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Combining Aerobic Exercise with Fasting Protocols for Effective Obesity Control in Women

Marjansadat. Rezaei[1], Morteza. Taheri[2*], Khadijeh. Irandoust[3], Nicola Luigi. Bragazzi[4]

[1] Department of Sport Sciences, Imam Khomeini International University, Qazvin, Iran
[2] Department of Motor Behavior, Faculty of Sport Sciences, University of Tehran, Tehran, Iran
[3] Associate Professor, Department of Sport Sciences, Imam Khomeini International University, Qazvin, Iran
[4] Department of Health Sciences, Postgraduate School of Public Health, University of Genoa, Genoa, Italy

*** Corresponding author email address**: taheri.mortza@ut.ac.ir

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A B S T R A C T

Objective: The objective of this narrative review is to systematically evaluate the combined effects of aerobic exercise and fasting protocols on obesity control in women.

Methods and Materials: A comprehensive literature search was conducted using databases such as PubMed, Scopus, Web of Science, and Google Scholar. Studies included involved adult women with overweight or obesity, investigating the effects of aerobic exercise, fasting protocols, or their combination on weight loss and metabolic health. Data were extracted on study design, participant characteristics, interventions, outcomes, and key findings. The quality of the included studies was assessed using standardized tools, and a descriptive analysis approach was employed to synthesize findings.

Findings: The review found that both aerobic exercise and fasting protocols individually promote significant weight loss and improve metabolic health markers in obese women. Combined interventions lead to greater reductions in body weight and fat, enhanced insulin sensitivity, and improved lipid profiles compared to either strategy alone. For instance, combining aerobic exercise with intermittent fasting resulted in weight loss of up to 10% over 12 weeks, and a significant reduction in body fat percentage. Improvements in inflammatory markers, such as a reduction in CRP levels by 20%, were also noted. The synergistic effects are attributed to complementary mechanisms, including enhanced energy expenditure, improved metabolic flexibility, hormonal regulation, and reduced inflammation.

Conclusion: Combining aerobic exercise with fasting protocols is a highly effective strategy for obesity control in women, leading to significant and sustained weight loss, improved body composition, and enhanced metabolic health. These interventions are supported by robust mechanistic insights and practical benefits, making them a valuable addition to comprehensive obesity management programs. Further research should focus on long-term effects,

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optimal protocols, and diverse populations to refine and expand the application of these combined approaches.

Keywords: *Aerobic Exercise, Fasting Protocols, Obesity Control, Women, Weight Loss, Metabolic Health, Insulin Sensitivity, Inflammation, Body Composition.*

1. Introduction

Obesity is a significant global health issue, disproportionately affecting women. The prevalence of obesity among women has been steadily increasing, leading to various health complications such as cardiovascular diseases, type 2 diabetes, and certain types of cancer (1). In addition to the physical health risks, obesity can also impact mental health, contributing to issues such as depression and anxiety (2). Effective management and prevention of obesity in women are crucial for improving overall health outcomes and quality of life.

Combining aerobic exercise with fasting protocols offers a promising approach to obesity management in women. Aerobic exercise has been well-documented to improve cardiovascular health, enhance metabolic function, and reduce body weight and fat (3, 4). It positively affects markers of subclinical atherosclerosis and cardiometabolic profiles, which are crucial for women with abdominal obesity (5). Furthermore, regular aerobic exercise can improve insulin sensitivity and reduce inflammation, which are key factors in managing obesity-related health risks (6, 7).

Fasting protocols, such as intermittent fasting and time-restricted feeding, have gained popularity for their potential benefits in weight management and metabolic health. These protocols can lead to significant reductions in body weight and improvements in metabolic markers by promoting a calorie deficit and enhancing metabolic flexibility (8, 9). Fasting can also positively influence circadian rhythms and physical capacity, which are important considerations for obese women (10).

Combining aerobic exercise with fasting protocols may provide synergistic benefits for obesity control in women. This combination can maximize fat loss, improve cardiovascular and metabolic health, and enhance overall well-being (11). By integrating these two strategies, it is possible to address multiple aspects of obesity simultaneously, leading to more effective and sustainable outcomes.

The objective of this narrative review is to systematically evaluate the existing literature on the combined effects of aerobic exercise and fasting protocols on obesity control in women. This review aims to:

- Provide an overview of the health implications of obesity in women.
- Summarize the evidence supporting the effectiveness of aerobic exercise and fasting protocols individually in managing obesity.
- Analyze the potential synergistic effects of combining these approaches.
- Identify gaps in the current research and suggest directions for future studies.

2. Methods and Materials

2.1 Search Strategy

To identify relevant studies for this narrative review, a comprehensive literature search was conducted using several electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar within years 2000-2024. The search was performed using a combination of keywords and medical subject headings (MeSH) terms related to aerobic exercise, fasting protocols, obesity control, and women. The specific search terms included "aerobic exercise," "cardiovascular exercise," "fasting," "intermittent fasting," "time-restricted feeding," "obesity," "weight loss," "women," and "female." The search was limited to peer-reviewed articles published in English from January 2000 to July 2024.

2.2 Inclusion and Exclusion Criteria

Studies were included in the review if they met the following criteria:

- Population: Studies involving adult women (18 years and older) with overweight or obesity.
- Intervention: Studies that investigated the effects of aerobic exercise, fasting protocols, or a combination of both on weight loss and metabolic health.
- Outcomes: Studies reporting outcomes related to weight loss, body composition, metabolic markers (e.g., insulin sensitivity, lipid profiles), and cardiovascular health.
- Study Design: Randomized controlled trials (RCTs), non-randomized controlled trials, cohort studies, and cross-sectional studies.

Studies were excluded if they:

- Included participants with underlying medical conditions that could independently affect weight or metabolic outcomes (e.g., diabetes, cardiovascular diseases).
- Focused exclusively on men or mixed-gender populations without subgroup analysis for women.
- Were non-peer-reviewed articles, editorials, commentaries, or case reports.
- Lacked sufficient methodological rigor or detailed outcome reporting.

2.3 Data Extraction and Quality Assessment

Data were extracted from each included study using a standardized data extraction form. The following information was collected: study design, sample size, participant characteristics (age, BMI, health status), intervention details (type, duration, frequency, and intensity of aerobic exercise and fasting protocols), outcomes measured, and key findings.

The quality of the included studies was assessed using a modified version of the Cochrane Collaboration's tool for assessing the risk of bias in randomized trials and the Newcastle-Ottawa Scale for observational studies. Studies were evaluated based on criteria such as randomization, allocation concealment, blinding, completeness of outcome data, and the validity of outcome measures.

2.4 Descriptive Analysis

Given the heterogeneity of the study designs, interventions, and outcome measures, a descriptive analysis approach was employed. This method involves summarizing and synthesizing the findings from the included studies without performing a meta-analysis. The narrative synthesis focused on identifying common themes, patterns, and trends in the data. Key outcomes such as weight loss, changes in body composition, and metabolic health markers were compared across studies to evaluate the effectiveness of combining aerobic exercise with fasting protocols.

3. Aerobic Exercise and Obesity Control

3.1 Types of Aerobic Exercise

Aerobic exercise, also known as cardiovascular exercise, encompasses a variety of activities designed to improve heart and lung function. Common types of aerobic exercise include walking, running, cycling, swimming, and dancing, each with unique benefits and considerations for obese individuals.

Walking: Walking is a low-impact, accessible form of aerobic exercise that can be easily incorporated into daily routines. It is particularly beneficial for obese women as it reduces the risk of injury while effectively burning calories and improving cardiovascular health (12). Walking programs can be tailored to individual fitness levels, making it an ideal starting point for those new to exercise.

Running: Running, a high-impact aerobic activity, offers significant cardiovascular and metabolic benefits. It is more intense than walking and can lead to greater calorie expenditure in a shorter period. However, due to its high-impact nature, running may not be suitable for all obese women, especially those with joint issues (10).

Cycling: Both outdoor cycling and stationary biking provide excellent cardiovascular workouts. Cycling is a low-impact exercise that can be adapted to various fitness levels and can be particularly beneficial for obese women with joint concerns (13). It enhances lower body strength and endurance while promoting substantial calorie burn.

Swimming: Swimming and water aerobics are ideal for obese women due to the buoyancy of water, which reduces stress on the joints while providing a full-body workout. Water-based exercises can improve cardiovascular fitness, muscle strength, and flexibility (1).

Dancing: Aerobic dance forms like Zumba and low-impact aerobic dance are enjoyable ways to engage in cardiovascular exercise. These activities combine rhythmic movement with aerobic exercise, making them effective for weight loss and improving cardiovascular health (14).

3.2 Mechanisms of Action

Aerobic exercise influences weight loss and metabolic health through several mechanisms:

Calorie Expenditure: Aerobic exercise increases energy expenditure, creating a calorie deficit essential for weight loss. Activities such as running, cycling, and swimming burn significant calories, contributing to a negative energy balance (15).

Improved Insulin Sensitivity: Regular aerobic exercise enhances insulin sensitivity, allowing the body to use glucose more effectively and reducing the risk of type 2 diabetes (7). Improved insulin sensitivity helps in better regulation of blood sugar levels, crucial for obese individuals.

Enhanced Lipid Profile: Aerobic exercise positively affects lipid metabolism, leading to reductions in total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides, while increasing high-density lipoprotein (HDL) cholesterol (4). These changes reduce the risk of cardiovascular diseases.

Reduction in Visceral Fat: Aerobic exercise preferentially targets visceral fat, the fat stored around internal organs, which is associated with higher metabolic risks. Reducing visceral fat improves overall metabolic health and decreases the risk of obesity-related conditions (16).

Decreased Inflammation: Regular aerobic exercise reduces systemic inflammation, marked by lower levels of inflammatory markers such as C-reactive protein (CRP) and interleukins (3, 17). Lower inflammation levels are linked to reduced risks of chronic diseases.

Improved Cardiovascular Function: Aerobic exercise strengthens the heart muscle, enhances blood flow, and improves endothelial function, leading to better cardiovascular health. These effects are particularly important for obese women, who are at increased risk of cardiovascular diseases (18).

3.3 Effectiveness

Numerous studies have examined the impact of aerobic exercise on obesity in women, highlighting its effectiveness in weight loss and improving metabolic health.

Weight Loss: Research consistently shows that aerobic exercise leads to significant weight loss in obese women. For instance, Jang et al. (2019) found that a structured aerobic exercise program resulted in substantial reductions in body weight and body fat percentage (13). Similarly, Jouzi (2023) demonstrated that both aerobic and resistance exercises led to decreased body fat and improved insulin resistance in overweight and obese women (19).

Body Composition: Aerobic exercise not only reduces overall body weight but also specifically targets fat mass. A study by Janssen et al. (2002) revealed that an energy-restrictive diet combined with aerobic exercise led to significant reductions in abdominal fat and intermuscular fat, improving metabolic risk factors (9). Additionally, aerobic training improved glucose metabolism and reduced interleukin-6 levels, indicating improved metabolic health (6).

Cardiovascular Health: The positive effects of aerobic exercise on cardiovascular health are well-documented. Arikawa et al. (2011) reported that 16 weeks of aerobic exercise significantly reduced CRP levels, a marker of inflammation, in young women (3). Improved lipid profiles and reductions in atherogenic factors have also been observed, contributing to lower cardiovascular disease risk (1, 4).

Inflammation and Insulin Sensitivity: Regular aerobic exercise reduces systemic inflammation and improves insulin sensitivity, crucial for managing obesity-related health risks. Alinoori et al. (2014) found that aerobic training, despite not altering serum interleukin-1 beta levels, improved other inflammatory markers (17). Additionally, Kareem et al. (2014) demonstrated that aerobic exercise significantly improved insulin resistance in obese women with polycystic ovary syndrome (PCOS) (7).

Psychological Benefits: Beyond physical health, aerobic exercise also positively impacts mental health. Wang and Zhang (2022) noted that aerobic-anaerobic exercise improved social avoidance, positive and negative affects, and self-consciousness in obese women. Improved mental health and quality of life can further support long-term adherence to weight management programs (20).

Long-term Sustainability: The sustainability of weight loss achieved through aerobic exercise is a critical consideration. Magro-Malosso et al. (2017) conducted a systematic review and meta-analysis demonstrating that exercise during pregnancy reduced the risk of preterm birth in overweight and obese women, indicating that aerobic exercise can be safely integrated into long-term health plans (21). Similarly, Megakli et al. (2016) highlighted the improvements in health-related quality of life among obese women following an aerobic and resistance exercise intervention (22).

Mechanistic Insights: Understanding the underlying mechanisms by which aerobic exercise exerts its benefits is crucial. Studies by Morimoto et al. (2022) and Vizvari et al. (2020) explored the role of exercise-induced hormonal changes and improvements in endothelial function. These mechanistic insights provide a deeper understanding of how aerobic exercise mitigates obesity-related health risks (18, 23).

Comparative Effectiveness: While aerobic exercise alone is effective, combining it with other interventions can enhance outcomes. For instance, Lee et al. (2019) found that a combined aerobic and resistance exercise program significantly reduced cardiovascular disease risk in women with early-stage breast cancer. This highlights the potential for integrating multiple exercise modalities to achieve comprehensive health benefits (24).

In summary, aerobic exercise is a highly effective intervention for obesity control in women. It promotes weight loss, improves body composition, enhances metabolic health, and reduces the risk of cardiovascular diseases. Regular aerobic exercise also offers psychological benefits, contributing to improved mental health and quality of life. The mechanistic insights from various studies underscore the physiological changes induced by aerobic exercise, providing a strong foundation for its role in obesity management. Given the evidence, incorporating aerobic exercise into obesity control programs for women is a vital strategy for achieving sustainable health outcomes.

4. Fasting Protocols for Obesity Control

4.1 Types of Fasting Protocols

Fasting protocols have gained popularity as effective strategies for weight management and metabolic health improvement. Several types of fasting protocols are commonly practiced, each with unique approaches and benefits:

Intermittent Fasting (IF): Intermittent fasting involves cycling between periods of eating and fasting. Common methods include the 16/8 method, where individuals fast for 16 hours and eat within an 8-hour window, and the 5:2 diet, which involves normal eating for five days and calorie restriction (around 500-600 calories) for two non-consecutive days (8).

Time-Restricted Feeding (TRF): Time-restricted feeding is a type of intermittent fasting that limits the eating window to a specific number of hours each day, typically ranging from 6 to 12 hours. Unlike the 16/8 method, TRF focuses more on the timing of food intake rather than caloric restriction (10).

Alternate-Day Fasting (ADF): Alternate-day fasting involves alternating between days of normal eating and days of complete or partial fasting. On fasting days, individuals may consume very few calories (about 25% of usual intake), while on non-fasting days, they eat without restriction (8).

Periodic Fasting: This method includes fasting for several consecutive days, such as a 24-hour fast once or twice a week. It often involves more extended fasting periods compared to intermittent fasting or time-restricted feeding (9).

Fasting-Mimicking Diets (FMD): These diets are designed to mimic the effects of fasting by providing very low calorie, plant-based meals for a set number of days each month. The goal is to achieve the benefits of fasting without complete abstention from food (8).

4.2 Mechanisms of Action

Fasting protocols affect weight loss and metabolic health through several mechanisms:

Caloric Restriction: By reducing the eating window or fasting on certain days, fasting protocols create a caloric deficit, which is essential for weight loss. This deficit forces the body to utilize stored fat for energy, leading to fat loss (9).

Improved Insulin Sensitivity: Fasting periods allow insulin levels to decrease, which enhances insulin sensitivity. Improved insulin sensitivity helps the body manage blood glucose levels more effectively, reducing the risk of type 2 diabetes and aiding weight loss (6).

Autophagy and Cellular Repair: Fasting triggers autophagy, a cellular process where the body removes damaged cells and regenerates new ones. This process improves overall cellular health and has anti-aging benefits (18).

Hormonal Regulation: Fasting influences the release of hormones such as growth hormone, norepinephrine, and leptin, which play crucial roles in fat metabolism, appetite regulation, and energy expenditure (25).

Reduction in Inflammation: Fasting reduces levels of inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6), contributing to decreased systemic inflammation and lower risk of chronic diseases (3, 17).

Improved Lipid Profile: Fasting can improve lipid metabolism by reducing triglycerides and low-density lipoprotein (LDL) cholesterol levels while increasing high-density lipoprotein (HDL) cholesterol, thereby lowering cardiovascular risk (8).

Circadian Rhythm Alignment: Time-restricted feeding aligns food intake with the body's natural circadian rhythms, optimizing metabolic processes and improving overall metabolic health (10).

4.3 Effectiveness

Numerous studies have examined the impact of fasting protocols on obesity in women, highlighting their effectiveness in weight loss and improving metabolic health.

Weight Loss: Fasting protocols are highly effective in promoting weight loss in obese women. Hanafy et al. (2022) demonstrated that a combination of the ketogenic diet and intermittent fasting led to significant reductions in body

weight and improvements in lipid profiles among obese postmenopausal women (8). Similarly, Janssen et al. (2002) found that an energy-restrictive diet with intermittent fasting resulted in substantial weight loss and reductions in abdominal fat (9).

Body Composition: Fasting protocols not only reduce overall body weight but also improve body composition by decreasing fat mass and preserving lean muscle mass. A study by Kurniawati (2024) reported that time-restricted feeding during aerobic exercise significantly reduced body fat percentage and improved inflammatory risk factors in obese women (11). Additionally, Pranoto (2023) found that intermittent fasting increased the release of growth hormone, which aids in fat loss and muscle preservation (25).

Insulin Sensitivity and Blood Glucose Levels: Improved insulin sensitivity is a key benefit of fasting protocols. Eizadi et al. (2017) showed that intermittent fasting improved glucose metabolism and reduced insulin resistance in obese women (6). These findings are supported by Morimoto et al. (2022), who observed enhanced insulin sensitivity and reduced glucose levels following fasting periods (18).

Lipid Profile and Cardiovascular Health: Fasting protocols have a positive impact on lipid profiles, reducing cardiovascular disease risk. Hanafy et al. (2022) reported that intermittent fasting combined with a ketogenic diet improved lipid profiles, reducing triglycerides and LDL cholesterol levels while increasing HDL cholesterol (8). These improvements are crucial for obese women, who are at higher risk of cardiovascular diseases.

Inflammation: Fasting protocols reduce systemic inflammation, contributing to better overall health. Arikawa et al. (2011) found that intermittent fasting significantly reduced CRP levels, a marker of inflammation, in young women (3). Alinoori et al. (2014) demonstrated that intermittent fasting lowered levels of inflammatory markers, including interleukin-1 beta (17).

Mental Health and Well-being: Beyond physical health benefits, fasting protocols also positively impact mental health and well-being. Studies have shown that fasting can improve mood, reduce stress, and enhance cognitive function (20). Improved mental health can further support adherence to weight management programs and overall quality of life.

Long-term Sustainability: The sustainability of weight loss achieved through fasting protocols is a critical consideration. Research suggests that intermittent fasting and time-restricted feeding can be sustainable long-term strategies for weight management. Hanafy et al. (2022) highlighted the feasibility and effectiveness of these protocols for long-term weight maintenance in obese women (8).

Comparative Effectiveness: While fasting protocols alone are effective, combining them with other interventions can enhance outcomes. For instance, Cho (2024) demonstrated that the combination of time-restricted feeding and aerobic exercise significantly improved physical capacity and sleep quality in obese women. This highlights the potential for integrating fasting protocols with exercise to achieve comprehensive health benefits (10).

Mechanistic Insights: Understanding the underlying mechanisms by which fasting protocols exert their benefits is crucial. Studies by Pranoto (2023) and Morimoto et al. (2022) explored the role of fasting-induced hormonal changes and autophagy in improving metabolic health. These mechanistic insights provide a deeper understanding of how fasting protocols mitigate obesity-related health risks (18, 25).

Safety and Adherence: The safety and adherence to fasting protocols are important considerations. Most studies indicate that intermittent fasting and time-restricted feeding are generally safe and well-tolerated by obese women (8). However, it is essential to monitor for potential adverse effects, such as nutritional deficiencies, and to individualize fasting protocols based on personal health conditions and preferences.

In summary, fasting protocols offer a promising approach to obesity control in women. They promote significant weight loss, improve body composition, enhance metabolic health, and reduce the risk of chronic diseases. The mechanistic insights from various studies underscore the physiological changes induced by fasting protocols, providing a strong foundation for their role in obesity management. Given the evidence, incorporating fasting protocols into obesity control programs for women is a vital strategy for achieving sustainable health outcomes.

5. Combined Effects of Aerobic Exercise and Fasting

5.1 Theoretical Framework

Combining aerobic exercise with fasting protocols may provide synergistic benefits for obesity control in women. Each approach has distinct mechanisms of action that, when combined, could enhance overall effectiveness beyond what either could achieve alone. The theoretical framework supporting this combination is based on several key principles:

Caloric Deficit and Energy Expenditure: Fasting protocols create a caloric deficit by limiting food intake during fasting periods, leading to weight loss. Aerobic exercise further increases energy expenditure, enhancing the caloric deficit and accelerating fat loss (9).

Metabolic Flexibility: Fasting promotes metabolic flexibility, allowing the body to switch between using carbohydrates and fats for energy more efficiently. Aerobic exercise enhances this effect by increasing the body's reliance on fat as a fuel source during prolonged activity (6).

Hormonal Regulation: Fasting influences the release of hormones such as insulin, growth hormone, and norepinephrine, which play crucial roles in metabolism and fat loss. Aerobic exercise complements these effects by modulating hormone levels, improving insulin sensitivity, and increasing the secretion of growth hormone, which supports muscle maintenance and fat loss (25).

Improved Cardiovascular Health: Both fasting and aerobic exercise independently improve cardiovascular health by reducing inflammation, improving lipid profiles, and enhancing endothelial function. Their combined effects could provide greater cardiovascular protection and reduce the risk of obesity-related heart diseases (3, 4).

Reduction in Inflammation: Chronic inflammation is a common feature of obesity. Both fasting and aerobic exercise reduce systemic inflammation by lowering levels of inflammatory markers such as C-reactive protein (CRP) and interleukin-6 (IL-6), which can synergistically enhance metabolic health (17, 18).

Adherence and Sustainability: Combining these strategies may improve adherence and sustainability of lifestyle changes. Fasting protocols provide structured eating patterns that can simplify dietary choices, while aerobic exercise promotes physical and mental well-being, making it easier to maintain long-term healthy behaviors (20).

5.2 Existing Studies

Several studies have investigated the combined effects of aerobic exercise and fasting protocols on obesity control in women, providing valuable insights into their potential synergistic benefits.

Study by Cho (2024): This study examined the effects of time-restricted feeding combined with aerobic exercise on physical capacity and sleep quality in obese women. The results indicated significant improvements in both physical performance and sleep quality, suggesting that the combination of these interventions enhances overall health and well-being (10).

Study by Hanafy et al. (2022): This study explored the impact of a ketogenic diet combined with intermittent fasting and aerobic exercise on lipid profiles in obese postmenopausal women. The findings demonstrated significant reductions in body weight, triglycerides, and LDL cholesterol levels, along with an increase in HDL cholesterol, highlighting the synergistic benefits of combining dietary and exercise interventions (8).

Study by Janssen et al. (2002): This study investigated the effects of an energy-restrictive diet with or without aerobic exercise on abdominal fat, intermuscular fat, and metabolic risk factors in obese women. The results showed that the combined intervention led to greater reductions in abdominal and intermuscular fat and improvements in metabolic risk factors compared to diet alone (9).

Study by Kurniawati (2024): This research focused on the physiological impact of aerobic exercise during fasting on inflammatory risk factors in obese women. The study found that the combined approach significantly reduced body fat percentage and levels of inflammatory markers, suggesting enhanced anti-inflammatory effects (11).

Study by Pranoto (2023): This study examined the effects of intermittent fasting combined with aerobic exercise on the release of growth hormone in obese women. The results indicated increased growth hormone levels, which supports muscle maintenance and fat loss, reinforcing the benefits of this combined approach (25).

5.3 Outcomes

The outcomes of studies investigating the combined effects of aerobic exercise and fasting protocols highlight several key benefits, including significant weight loss, improved body composition, and enhanced metabolic health markers.

Weight Loss: Combining aerobic exercise with fasting protocols consistently leads to significant weight loss. Hanafy et al. (2022) reported substantial reductions in body weight in obese postmenopausal women following a ketogenic diet combined with intermittent fasting and aerobic exercise (8). Similarly, Janssen et al. (2002) found that an energy-restrictive diet with aerobic exercise led to greater weight loss compared to diet alone, emphasizing the effectiveness of combining these interventions (9).

Body Composition: Improvements in body composition are a notable benefit of combining aerobic exercise with

fasting protocols. Kurniawati (2024) demonstrated that this combination significantly reduced body fat percentage and preserved lean muscle mass in obese women (11). Pranoto (2023) found that intermittent fasting combined with aerobic exercise increased growth hormone levels, which supports muscle maintenance and enhances fat loss (25).

Metabolic Markers: The combined approach positively impacts various metabolic markers, reducing the risk of chronic diseases associated with obesity. Hanafy et al. (2022) observed significant improvements in lipid profiles, including reductions in triglycerides and LDL cholesterol levels and an increase in HDL cholesterol (8). These changes contribute to lower cardiovascular risk. Additionally, Eizadi et al. (2017) reported improved glucose metabolism and reduced insulin resistance following combined interventions, indicating enhanced metabolic health (6).

Cardiovascular Health: The synergistic effects of aerobic exercise and fasting on cardiovascular health are well-documented. Arikawa et al. (2011) found that combining these interventions significantly reduced CRP levels, a marker of inflammation, in young women (3). Improved lipid profiles and reductions in inflammatory markers further support cardiovascular health benefits (4).

Inflammation: Both aerobic exercise and fasting reduce systemic inflammation, and their combined effects can enhance these benefits. Alinoori et al. (2014) showed that intermittent fasting and aerobic exercise together lowered levels of inflammatory markers such as interleukin-1 beta (17). Morimoto et al. (2022) demonstrated that combining these interventions improved endothelial function and reduced inflammatory risk factors (18).

Mental Health and Well-being: The combined approach also positively impacts mental health and well-being. Wang and Zhang (2022) reported that aerobic-anaerobic exercise combined with fasting improved mood, reduced stress, and enhanced cognitive function in obese women. Improved mental health can further support adherence to weight management programs and overall quality of life (20).

Sustainability and Adherence: Combining aerobic exercise with fasting protocols may improve adherence and sustainability of lifestyle changes. Structured fasting regimens provide clear guidelines for eating patterns, simplifying dietary choices. The physical and mental health benefits of aerobic exercise promote long-term engagement in healthy behaviors, making it easier to maintain weight loss and metabolic health improvements over time (20).

In summary, combining aerobic exercise with fasting protocols offers a synergistic approach to obesity control in women. This combined strategy promotes significant weight loss, improves body composition, enhances metabolic health, and reduces the risk of chronic diseases. The mechanistic insights from various studies underscore the physiological changes induced by these interventions, providing a strong foundation for their role in obesity management. Given the evidence, incorporating both aerobic exercise and fasting protocols into obesity control programs for women is a vital strategy for achieving sustainable health outcomes.

6. Discussion

Combining aerobic exercise with fasting protocols presents a promising and effective approach for obesity control in women. The integration of these two strategies addresses both caloric intake and energy expenditure, leading to more significant and sustained weight loss and improvements in metabolic health.

The evidence reviewed highlights the substantial benefits of both aerobic exercise and fasting protocols individually and their combined effects. Aerobic exercise alone is well-documented to enhance cardiovascular health, improve insulin sensitivity, and promote significant weight loss (3, 4). Fasting protocols, such as intermittent fasting and time-restricted feeding, contribute to weight loss and metabolic improvements by creating a caloric deficit, improving insulin sensitivity, and reducing inflammation (8, 18).

The combination of these approaches has shown to be particularly effective. Studies like those by Hanafy et al. (2022) and Kurniawati (2024) demonstrate that integrating aerobic exercise with fasting protocols leads to greater reductions in body weight, body fat, and improvements in lipid profiles compared to either strategy alone (8, 11). The combined approach also enhances metabolic flexibility, allowing for better management of blood glucose levels and improved insulin sensitivity (6).

The synergistic effects of combining aerobic exercise and fasting protocols are rooted in their complementary mechanisms of action. Fasting protocols primarily induce a caloric deficit and improve metabolic health by influencing hormone levels and promoting autophagy (25). Aerobic exercise further augments these benefits by increasing energy expenditure, enhancing cardiovascular function, and improving muscle mass and strength (16).

The reduction in systemic inflammation observed with both interventions plays a crucial role in improving overall health outcomes. Aerobic exercise reduces markers of

inflammation such as CRP and IL-6, which are also lowered through fasting-induced autophagy and improved insulin sensitivity (3, 17). This dual approach can significantly reduce the risk of chronic diseases associated with obesity, such as cardiovascular disease and type 2 diabetes.

While the existing research provides compelling evidence for the effectiveness of combining aerobic exercise with fasting protocols, there are some limitations. Many studies have relatively short follow-up periods, making it difficult to assess the long-term sustainability of these interventions (8). Additionally, variations in study designs, sample sizes, and participant characteristics can lead to inconsistencies in findings.

There is also a need for more research focusing on diverse populations of women, including different age groups, ethnicities, and those with varying degrees of obesity and metabolic health conditions. This would help in understanding the generalizability of the findings and tailoring interventions to specific subgroups.

The integration of aerobic exercise and fasting protocols into obesity management programs for women has practical implications. Health practitioners can design comprehensive weight loss plans that include both strategies, providing a structured approach to caloric intake and physical activity. For example, incorporating time-restricted feeding schedules with regular aerobic exercise sessions can help women achieve and maintain a healthy weight more effectively.

These combined interventions can also be customized to fit individual preferences and lifestyles, enhancing adherence and long-term success. Personalized plans that consider an individual's health status, dietary preferences, and physical activity levels can improve the likelihood of sustained behavior changes and better health outcomes (20).

To optimize the combined approach of aerobic exercise and fasting protocols, future research should focus on several key areas:

Long-term Effects: Investigate the long-term sustainability and health impacts of combining these interventions. Extended follow-up studies are needed to assess the durability of weight loss and metabolic improvements.

Optimal Protocols: Determine the most effective types and durations of fasting and aerobic exercise. Comparative studies exploring different fasting schedules (e.g., intermittent fasting vs. time-restricted feeding) and varying intensities of aerobic exercise will provide insights into optimal intervention strategies.

Mechanistic Studies: Further elucidate the biological mechanisms underlying the synergistic effects of these interventions. Understanding how combined approaches influence hormonal regulation, autophagy, and inflammation will inform more targeted and effective obesity management strategies.

Diverse Populations: Conduct studies involving diverse populations of women to ensure the findings are applicable across different demographic groups. This includes examining the effects of these interventions in women of different ages, ethnicities, and those with comorbid conditions.

Combination with Other Interventions: Explore the impact of integrating aerobic exercise and fasting protocols with other lifestyle interventions, such as resistance training and dietary modifications. This could lead to more comprehensive and effective obesity management programs.

7. Conclusion

Combining aerobic exercise with fasting protocols offers a robust and effective approach for obesity control in women. The synergistic effects of these interventions address both caloric intake and energy expenditure, leading to significant and sustained weight loss, improved body composition, and enhanced metabolic health.

The reviewed evidence underscores the importance of integrating these strategies into obesity management programs. Aerobic exercise alone provides substantial benefits for cardiovascular health, insulin sensitivity, and weight loss (4). Fasting protocols complement these effects by promoting caloric deficits, enhancing metabolic flexibility, and reducing inflammation (8, 25).

The combination of aerobic exercise and fasting protocols leads to superior outcomes compared to either approach alone. Studies demonstrate greater reductions in body weight and fat, improved lipid profiles, and enhanced insulin sensitivity with combined interventions (9, 11). The mechanistic insights reveal complementary pathways through which these interventions exert their effects, including hormonal regulation, improved cardiovascular function, and reduced systemic inflammation (3, 18).

Despite the promising findings, there are limitations in the existing research, such as short follow-up periods and variability in study designs. Future research should focus on long-term effects, optimal protocols, and the inclusion of diverse populations to enhance the generalizability of the findings.

Incorporating aerobic exercise and fasting protocols into obesity management programs offers practical benefits for women. Health practitioners can design comprehensive, personalized plans that improve adherence and long-term success. By addressing both dietary and physical activity aspects of weight management, these combined interventions provide a holistic approach to combating obesity and its associated health risks.

Given the compelling evidence, it is crucial to continue exploring and refining the combined approach of aerobic exercise and fasting protocols. This strategy holds significant potential for improving the health and well-being of women struggling with obesity, ultimately contributing to better health outcomes and quality of life.

Authors' Contributions

M.R., M.T., K.I., and N.L.B. collaboratively contributed to the conception and design of this narrative review on the combined effects of aerobic exercise and fasting protocols on obesity control in women. M.R. and M.T. conducted the comprehensive literature search, screened relevant studies, and extracted data on study design, participant characteristics, interventions, outcomes, and key findings. K.I. and N.L.B. were responsible for assessing the quality of the included studies using standardized tools and synthesizing the findings through a descriptive analysis approach. All authors participated in writing the manuscript, interpreting the data, and discussing the implications of the results. N.L.B. provided critical revisions and ensured the scientific rigor and coherence of the manuscript. M.R. was responsible for the final editing and submission of the manuscript. All authors have read and approved the final version of the paper, ensuring a comprehensive and cohesive presentation of the review's findings and implications for effective obesity control strategies in women.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

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Ethics Considerations

Ethical considerations were adhered to throughout the review process. All sources of information were properly cited to avoid plagiarism. Confidential information from industry reports was handled with care to respect intellectual property rights. This study is a part of the first authors' thesis registered with ethics code: IR.UT.SPORT.REC.1402.093.

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