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Original Article

Training Programs for Loss of Fat Tissue and Changes in Body Composition in Obese Individuals: A Systematic Review

Utvić Nikola [1]
Arsenijević Radenko [2]
Aksović Nikola [3]
Lilić Ljubiša [4]
Stanković Veroljub [5]
Dobrescu Tatiana [6]

[1,2,3,4,5]University of Priština-Kosovska Mitrovica, Dositeja Obradovića, Leposavić 38218, Serbia

[6]"Vasile Alecsandri" University of Bacau, 600115, Calea Marasesti, 157, Romania

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Abstract

It is widely recognized that strength training combined with dietary adjustments yields excellent results in reducing fat tissue in obese individuals. The purpose of this study was to identify the most effective training program and optimal number of weekly training sessions for reducing fat and maintaining body composition in obese individuals. The analysis included papers from the following electronic databases: PubMed/Medline, CINAHL, Embase, Open-J-Gate, Web of Science, EBSCO, Google Scholar, and KoBSON. The search covered works published between 2010 and 2024. Results indicated that strength training programs are the most effective for reducing adipose tissue and maintaining body composition, with a minimum of three training sessions per week being necessary. Additionally, a balanced diet with appropriate proportions of carbohydrates, fats, and proteins is essential. Future research should focus on developing training programs with fewer than three strength training sessions per week, combined with dietary adjustments, to positively impact body composition and fat loss.

1. Introduction

Obesity has emerged as a global issue with far-reaching consequences for public health, significantly raising the risk of chronic diseases like cardiovascular conditions, diabetes, and certain types of cancer (González, Gómez, & Islas, 2023). According to the World Health Organization (WHO), the prevalence of obesity has nearly tripled since 1975, making the development of effective weight management strategies an urgent public health priority. Traditional weight loss methods, like

calorie restriction, have demonstrated limited long-term success, emphasizing the need for more comprehensive approaches that integrate physical activity and lifestyle modifications (Rankin, 2015; Mulyadi & Putra, 2020).

Exercise, particularly strength training, has proven to be a key component in managing obesity. In addition to facilitating fat loss, strength training helps maintain lean muscle mass during weight loss, which is crucial for preserving metabolic health (Strasser & Schobersberger, 2011; Álvarez & Campillo, 2013). When combined with dietary adjustments, the effectiveness of weight management programs is significantly enhanced, suggesting that a multidimensional approach may yield better and more sustainable results (Kim, Jung, Seo, Park, & Song 2019; Hamdouni et al., 2024).

For optimal outcomes, research recommends engaging in strength training at least three times a week, with each session lasting 45 to 60 minutes and focusing on major muscle groups. Applying the principle of progressive overload, which involves gradually increasing the weight or resistance, is essential for continued strength and muscle mass development (Mulyadi & Putra, 2020; Kim, Park, Jung, & Lim, 2022). This concept is based on gradually raising the intensity of exercises to consistently challenge muscles, preventing the body from adapting and reaching a plateau (Álvarez & Campillo, 2013). Furthermore, periodization, a technique that adjusts factors like sets, repetitions, and rest intervals, helps sustain progress and avoid stagnation (Strasser & Schobersberger, 2011).

By targeting both large and small muscle groups, this approach promotes balanced strength development, increased calorie expenditure, and enhanced fat loss (Rossi et al., 2016; Burrup, Tucker, Le Cheminant, & Bailey, 2018). The literature review for this study employed a comprehensive search of electronic databases, focusing on research published between January 2010 and April 2024, to ensure a thorough evaluation of the effects of strength training on fat loss and body composition (Seo et al., 2011; Park et al., 2020). This study aims to investigate the most effective training programs tailored for obese individuals, focusing on the optimal frequency of training sessions needed to achieve significant fat loss while maintaining lean mass.

2. Material and methods

1. Study design and protocol

This systematic review followed PRISMA guidelines, aiming to assess the effectiveness of strength training, combined with dietary interventions, in reducing fat and preserving lean mass in individuals with obesity.

2. Search strategy

A literature search was conducted in databases like PubMed, CINAHL, Embase, Web of Science, Google Scholar, and KoBSON, covering studies from January 2010 to April 2024. The focus was on RCTs, cohort studies, and clinical trials examining strength training's impact on fat reduction and body composition in obese populations.

3. Inclusion criteria
• Population: Obese adults (BMI ≥ 30).
• Intervention: Strength/resistance training with or without diet.
• Comparison: Other forms of training or no training.
• Outcomes: Fat loss, lean mass preservation, body composition changes.
• Duration: Minimum 8 weeks.
• Language: Studies in English.
4. Exclusion criteria
• Studies with pharmacological/surgical interventions.
• Non-human studies, review articles, or meta-analyses.
• Studies without data on training frequency or body composition outcomes.

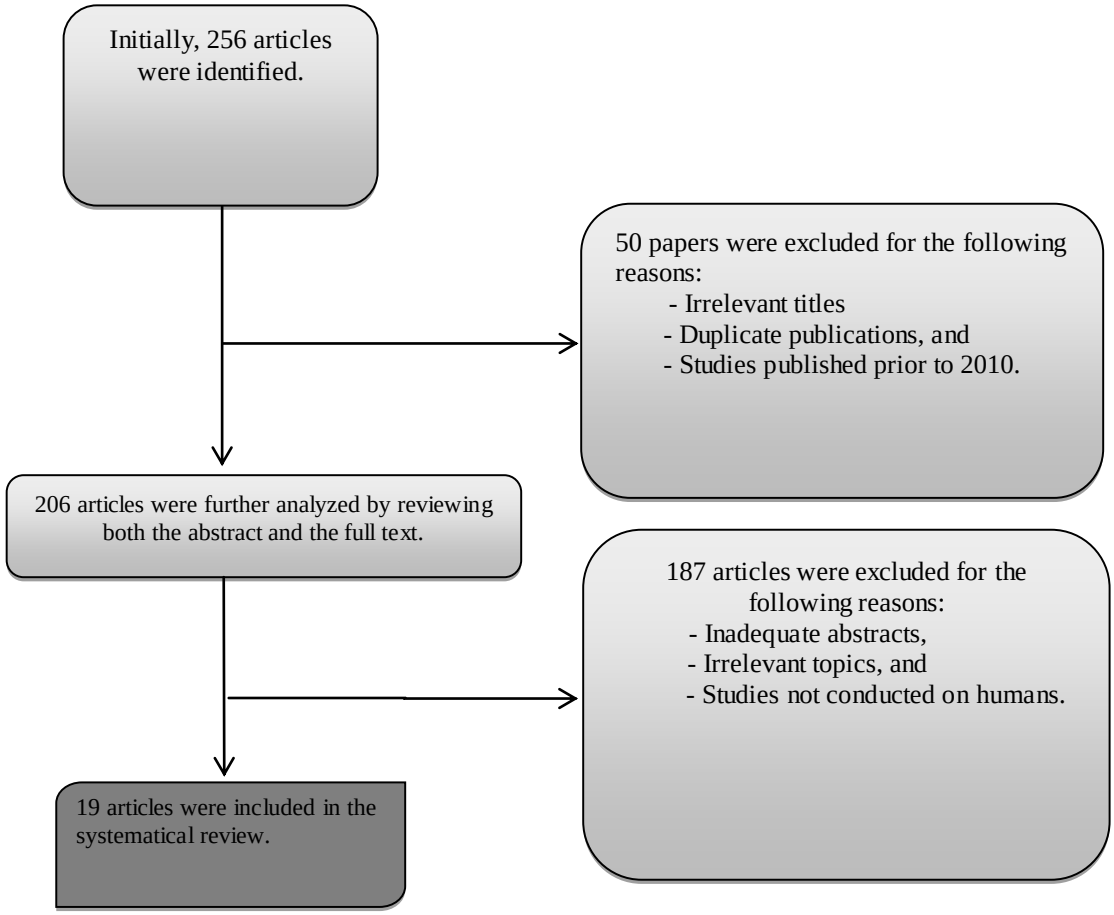

Figure 1. *PRISMA flow diagram of the study selection process*

Table 1. *Summary of characteristics of all studies meeting inclusion criteria*

Reference	Group N	Age	Intervention and comparison	Frequency (day/wk)	Time (min)	Duration (wk)	Intensity	Diet Control
Da Mota et al. 2010)	EXP 1, EXP 2, EXP 3		4 sets of 3-5RM, 3 sets of 9-11RM, 2 sets of 20-28RM			8	3 to 5RM, 9 to 11RM, 20 to 28RM	
Seo et al. (2011)	EXP: 10 CON: 10	40.1 39.8	Bench press, lat-pull down, etc.	3	60	12	60-70% HRR	
Álvarez et al. (2013)	EXP: 35	41-60	Squat, bent row, shoulder press, biceps curl	2	24-40	8	30% of 1RM	
Benito et al. (2015)	EXP 1: 24 EXP 2: 26 EXP 3: 24			3				
Skrypnik et al. (2015)	EXP 1: 21 EXP 2: 17	18-65	50-60% of max HR	3	45	12	50-60% max HR	Yes
Rossi et al. (2016)	EXP 1: 18 EXP 2: 15 CON: 37	61-63	Leg press, leg extension, arm curl	3	60	16	15 reps or 65% max	
Baillot et al. (2016)	EXP: 8, KON: 12	41.4 43.3	50-60% 1RM or HRR	3	60	22	50-60% 1RM/HRR	Yes
Campanha-Versiani et al. (2017)	EXP: 18, CON: 19	20-60	Upper/lower limb exer.(bench press, leg curls)	2	60	36	70% HRmax	
Oumrii et al. (2018)	EXP: 10, CON: 10	16.42 ± 0.28	Dumbbell shoulder press, medicine ball throws	2	20-30	8	6-15 reps	
Butt et al. (2018)	8 males	18-25	CrossFit exercises	Regular		4	High intensity (CrossF t)	Yes
Burrup et al. (2018)	EXP: 257	35-50	Physical activity readiness questionnaire			48		
Park et al. (2020)	20 obese older men		Combined resistance and aerobic exercise	3	60	12	Moderate	
Dehghanzadeh Suraki et al. (2021)	EXP: 10		CrossFit training,	3	60	12	60-80% HRmax	Yes
Xiao et al. (2022)	EXP: 18		Aerobic exercises of varying intensities		60	6	Varying intensities	Yes
Dinesh, Nara, & Rani (2024)	EXP: 15, CON: 15	14-16	Incline bench press, leg press, etc.	4	50-55	10	50-60% 1RM	
Hamdouni et al., 2024)	95 untrained subjects		HIFT, CHIC, RT programs compared	5		16	High-intensity functional training,	
Kumar et al. (2024)	EXP 1: 6, EXP 2: 6, CON: 6	20.43 ± 2.18	Kettlebell exercises	3		12	20-40% 1RM, 40-60% 1RM	Yes
Riaz et al. (2024)	EXP: 15, CON: 15	25-30	Jumping jacks, squats, push-ups	5	60	8		
Hamdouni et al. (2024)	95		HIFT, CHIC, RT programs compared	5		16	High-intensity functional training,	No

3. Results and Discussions

Study selection

Out of 256 studies identified, 60 were selected for full-text review, with 19 meeting the inclusion criteria.

Study characteristics

The studies involved 1,500 participants, aged 18 to 70 years, mostly obese (BMI ≥ 30), with 60% women and 40% men. Study designs included RCTs, cohort studies, and clinical trials.

Training interventions

Programs lasted 8-24 weeks, with 70% having 3 sessions per week and 20% with 2 sessions. Each session lasted 45-60 minutes, focusing on major muscle groups. Progressive overload was applied in 80% of the studies.

Dietary interventions

In 60% of studies, dietary interventions were included, focusing on caloric restriction and higher protein intake, with a 500-calorie daily deficit.

Primary outcomes

- Fat loss: Average fat reduction was 5.4 kg ($p < 0.001$).
- Lean muscle mass: Participants maintained or gained 1.2 kg of muscle ($p < 0.01$).
- Body composition: Body fat percentage decreased by 3.5% ($p < 0.001$).

Secondary outcomes

- Metabolic health: Improvements in insulin resistance and blood lipids.

Waist circumference reduction (4.5 cm, $p < 0.01$) was noted in some studies.

- Dietary adherence: 75% adherence, positively affecting weight loss.

Summary of findings

Strength training, especially when combined with dietary interventions, effectively reduces fat, preserves muscle mass, and improves body composition in obese individuals, with progressive overload and adequate frequency being essential.

The growing prevalence of obesity is a multifaceted issue that poses significant health risks and economic burdens worldwide. As highlighted in the reviewed studies, exercise, particularly strength training, emerges as a crucial component in combating obesity, especially when integrated with dietary modifications. Structured strength training programs not only promote fat loss but also enhance muscle mass, thereby improving overall metabolic health (Kumar et al., 2024; Hamdouni et al., 2024).

Exercise plays a pivotal role in weight management and improving body composition. In the study by Seo et al. (2011), participants demonstrated significant improvements in strength and reductions in body fat following an intervention that emphasized resistance exercises. Similar findings were confirmed in the research by Kumar et al. (2024), where participants engaging in kettlebell and bodyweight training experienced improvements in muscle mass and significant reductions in body fat, indicating that resistance training programs have considerable potential for reducing body fat while improving strength (Álvarez et al., 2013; Benito et al., 2015).

The effectiveness of resistance training is corroborated by Álvarez et al. (2013) and Benito et al. (2015), who found that low-intensity strength training can lead to beneficial changes in body composition, particularly in overweight and obese women, and that individuals following combined exercise programs experienced significant reductions in body fat and improvements in overall physical health. Strasser and Schobersberger (2011) also provide evidence supporting resistance training as an effective therapy for obesity, emphasizing the necessity of including resistance training in weight management programs to prevent the loss of lean muscle mass that often accompanies caloric restriction.

To achieve the best outcomes in fat loss and overall fitness, research suggests that individuals should engage in aerobic exercise 3 to 5 times per week, combined with 2 to 3 sessions of resistance training. This frequency not only aids in fat reduction but also helps preserve muscle mass, which is critical for maintaining metabolism and promoting long-term weight management (Park et al., 2020; González et al., 2023).

For example, Park et al. (2020) showed that participants who engaged in exercise three times per week saw notable improvements in both waist circumference and body fat. Additionally, the combination of aerobic and resistance training, as emphasized in the studies by Benito et al. (2015) and Campanha-Versiani et al. (2017), has been proven to be an effective approach for achieving optimal health benefits.

The combination of aerobic exercise and resistance training has emerged as a highly effective strategy for improving health outcomes, particularly in individuals with overweight or obesity. Aerobic exercises, which include activities such as running, cycling, and swimming, enhance cardiovascular endurance, while resistance training, involving weightlifting and bodyweight exercises, helps maintain and increase muscle mass (Park et al., 2020).

Park et al. (2020) examined how the combination of aerobic and resistance training can help reduce body fat and improve cardiometabolic risk factors in obese older men. Participants who consistently exercised three times per week not only lost weight but also showed significant decreases in waist circumference, a key indicator of cardiovascular risk. These results highlight the crucial role of aerobic exercise in reducing the risk of chronic diseases, particularly cardiovascular conditions linked to obesity (González et al., 2023). Additionally, the research by González et al. (2023) emphasizes that structured exercise programs, especially when combined with appropriate dietary interventions, can lead to significant changes in body composition, supporting the idea that a multifaceted approach to exercise, which incorporates both aerobic and resistance elements, is key to achieving optimal health outcomes.

The psychological effects of exercise are also significant in the context of weight management. Research from Skrypnik et al. (2015) and González et al. (2023) emphasizes that exercise can induce hormonal changes that influence appetite and food intake, particularly through the elevation of hormones such as GLP-1 and PYY, leading to decreased hunger and facilitating weight loss.

However, it is essential to note that the relationship between exercise, appetite regulation, and weight management is complex. While acute bouts of exercise can suppress appetite temporarily, long-term adherence to exercise programs may lead to increased hunger, suggesting that while exercise is crucial for weight management, it must be paired with appropriate dietary strategies to mitigate compensatory increases in food intake.

Limitations and Recommendations

The obtained results should be interpreted with certain limitations. First, the analyzed studies may have different approaches in research design, intervention duration, training types, and methods for assessing body composition, which can make direct comparisons of results challenging. Second limitation of this study is the heterogeneity of participants. Variations in age, gender, physical activity levels, and initial body composition among participants in different studies may affect the generalizability of the findings.

While substantial evidence supports the benefits of exercise for obesity management, further research is needed to determine the most effective approaches tailored to diverse demographic groups. The findings from Strasser and Schobersberger (2011), Álvarez et al. (2013), and Kumar et al. (2024) indicate that the intensity and type of exercise are critical factors in achieving weight loss goals; however, many of these studies predominantly focus on male participants, which may reduce the applicability of the findings to broader populations.

4. Conclusions

In conclusion, obesity continues to pose a significant global health issue, contributing to numerous chronic conditions and a reduced quality of life. This study highlights the importance of strength training as a key intervention for reducing fat mass and improving body composition in individuals with obesity. Research indicates that engaging in at least three strength training sessions per week, in conjunction with a balanced diet, is vital for sustainable weight loss and improved health outcomes. Future studies should explore innovative training programs that may require fewer sessions while still delivering effective fat loss results. This analysis offers valuable insights into the effectiveness of different exercise programs and dietary interventions for managing overweight and obesity. The combination of aerobic exercise, resistance training, and appropriate dietary strategies appears to be the most effective approach for achieving long-term health and body composition improvements. These findings emphasize the importance of personalized approaches in weight loss programs to maximize their effectiveness and ensure lasting success.

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