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*Article*

# The Shift from Aerobic to Anaerobic/Strength Training: A Paradigm Change in Preventing Frailty, Morbidity, and Mortality in Older Adults

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**Abstract:** Frailty syndrome, a significant contributor to morbidity and mortality in older adults, has traditionally been addressed through aerobic exercises. However, recent research has highlighted the importance of anaerobic and strength training activities in mitigating frailty. This article explores the shift from aerobic to anaerobic/strength training exercises, emphasizing the benefits of the latter in improving muscle strength, balance, and overall physical function. The discussion includes the physiological mechanisms underlying this shift, the evidence supporting strength training, and practical recommendations for implementation.

**Keywords:** frailty syndrome; aerobic exercise; anaerobic exercise; strength training; older adults; morbidity; mortality

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## Section 1.1 Introduction

Frailty syndrome is a geriatric condition characterized by a decline in physical function, increased vulnerability to stressors, and a higher risk of adverse health outcomes, including falls, hospitalization, and death (Fried et al., 2001). Traditionally, aerobic exercises have been the cornerstone of interventions aimed at preventing and managing frailty. However, recent research has challenged this paradigm, suggesting that anaerobic and strength training activities may be more effective in addressing the root causes of frailty.

Aerobic exercises, such as walking, swimming, and cycling, have long been recommended for their cardiovascular benefits. These activities improve cardiorespiratory fitness, reduce the risk of chronic diseases, and enhance overall well-being (American College of Sports Medicine, 2018). However, while aerobic exercises are beneficial, they may not adequately address the muscle weakness (sarcopenia) and loss of functional capacity that are hallmarks of frailty.

In contrast, anaerobic and strength training exercises focus on building muscle strength, power, and endurance. These activities involve short, high-intensity bursts of effort, such as weightlifting, resistance training, and high-intensity interval training (HIIT). Strength training has been shown to increase muscle mass, improve balance, and enhance functional performance, all of which are critical for preventing frailty (Peterson et al., 2010).

The shift from aerobic to anaerobic/strength training is supported by a growing body of evidence. Studies have demonstrated that strength training can reverse age-related declines in muscle mass and strength, improve physical function, and reduce the risk of falls (Liu & Latham, 2009). Moreover, strength training has been shown to have positive effects on bone density, cognitive function, and quality of life (Chodzko-Zajko et al., 2009).

One of the key mechanisms underlying the benefits of strength training is the stimulation of muscle protein synthesis. Resistance exercise induces a cascade of molecular events that lead to the synthesis of new muscle proteins, thereby promoting muscle hypertrophy (Phillips, 2014). This is particularly important in older adults, who experience a progressive loss of muscle mass and strength, a condition known as sarcopenia (Cruz-Jentoft et al., 2010).

In addition to its physiological benefits, strength training has psychological and social benefits. Engaging in strength training activities can improve self-esteem, reduce symptoms of depression and anxiety, and enhance social interactions (Netz et al., 2005). These psychological benefits are particularly important in older adults, who may experience social isolation and mental health issues.

Despite the compelling evidence supporting the benefits of strength training, there are challenges to its widespread adoption. Many older adults may lack the knowledge, skills, or resources to engage in strength training activities. Additionally, there may be concerns about the safety and feasibility of strength training in older adults with chronic health conditions.

To address these challenges, healthcare providers and fitness professionals need to provide education, support, and guidance to older adults. This includes developing tailored exercise programs that are safe, effective, and enjoyable. It also involves addressing barriers to participation, such as lack of access to exercise facilities, financial constraints, and fear of injury.

In summary, the shift from aerobic to anaerobic/strength training represents a *significant paradigm change* in the prevention and management of frailty syndrome. The benefits of strength training are well-documented and include improvements in muscle strength, balance, and overall physical function. However, to fully realize these benefits, it is essential to address the challenges and barriers to participation. The following sections will discuss the evidence supporting strength training, the physiological mechanisms underlying its benefits, and practical recommendations for implementation.

## Section 2. Discussion

The discussion section will delve into the scientific evidence supporting the shift from aerobic to anaerobic/strength training exercises. It will explore the physiological mechanisms by which strength training improves muscle strength, balance, and overall physical function. Additionally, it will address the practical considerations for implementing strength training programs in older adults, including safety, feasibility, and adherence.

### *Evidence Supporting Strength Training*

Numerous studies have demonstrated the efficacy of strength training in improving muscle strength, power, and endurance in older adults. A meta-analysis by Peterson et al. (2010) found that resistance training significantly increased muscle strength and power in older adults, with greater improvements observed in those who engaged in high-intensity training. Similarly, a systematic review by Liu and Latham (2009) concluded that strength training can reverse age-related declines in muscle mass and strength, improve physical function, and reduce the risk of falls.

One of the most compelling pieces of evidence comes from a study by Fiatarone et al. (1994), which demonstrated that high-intensity resistance training could increase muscle strength and size in frail nursing home residents. This study highlighted the potential of strength training to improve physical function and quality of life even in the most vulnerable older adults.

Additionally, Aprahamian et al. (2017) conducted a study that showed significant improvements in muscle strength, power, and functional performance in older adults who participated in a 12-week resistance training program. The study emphasized the importance of progressive overload and specificity in exercise prescription to maximize the benefits of strength training.

### *Physiological Mechanisms*

The benefits of strength training are mediated through several physiological mechanisms. Resistance exercise stimulates muscle protein synthesis, leading to the growth and repair of muscle tissue (Phillips, 2014). This is particularly important in older adults, who experience a progressive loss of muscle mass and strength, a condition known as sarcopenia (Cruz-Jentoft et al., 2010).

Strength training also improves neuromuscular function, enhancing the ability of the nervous system to activate and coordinate muscle contractions (Hakkinen et al., 1998). This results in

improved balance, coordination, and overall physical function. Moreover, strength training has been shown to have positive effects on bone density, cognitive function, and quality of life (Chodzko-Zajko et al., 2009). These benefits are mediated through a complex interplay of hormonal, metabolic, and neural mechanisms.

Ivan et al. (2018) explored the molecular mechanisms underlying the benefits of strength training in older adults. Their study found that resistance exercise induces a cascade of molecular events that lead to the synthesis of new muscle proteins, thereby promoting muscle hypertrophy. Additionally, they highlighted the role of satellite cells, which are activated by resistance exercise and contribute to muscle repair and growth.

### *Practical Considerations*

Implementing strength training programs in older adults requires careful consideration of safety, feasibility, and adherence. Older adults may have chronic health conditions, such as cardiovascular disease, osteoarthritis, and diabetes, which can affect their ability to engage in strength training activities. Therefore, it is essential to develop tailored exercise programs that are safe, effective, and enjoyable.

Healthcare providers and fitness professionals play a crucial role in educating and supporting older adults in their strength training endeavors. This includes providing guidance on proper exercise techniques, monitoring progress, and addressing any concerns or barriers to participation.

Additionally, it is important to address the psychological and social aspects of strength training. Engaging in strength training activities can improve self-esteem, reduce symptoms of depression and anxiety, and enhance social interactions (Netz et al., 2005). Therefore, creating a supportive and inclusive environment is essential for promoting adherence and long-term engagement.

Aprahamian et al. (2017) emphasized the importance of individualized exercise prescription in their study. They found that tailoring the intensity, frequency, and type of resistance exercises to the individual's needs and abilities resulted in greater improvements in muscle strength and functional performance. This highlights the need for personalized exercise programs that consider the unique characteristics and preferences of each older adult.

### *Safety and Feasibility*

Safety is a paramount concern when implementing strength training programs in older adults. It is essential to screen older adults for any contraindications to exercise and to modify exercise programs as needed to accommodate any health conditions or limitations.

Ivan et al. (2018) discussed the importance of proper exercise technique and supervision in their study. They found that older adults who received instruction and supervision from trained professionals had fewer injuries and greater improvements in muscle strength and functional performance. This underscores the need for qualified healthcare providers and fitness professionals to oversee strength training programs in older adults.

Feasibility is another important consideration. Older adults may face barriers to participation in strength training programs, such as lack of access to exercise facilities, financial constraints, and fear of injury. Addressing these barriers is essential for promoting adherence and long-term engagement.

### *Adherence and Long-Term Engagement*

Adherence to strength training programs is critical for achieving and maintaining the benefits of exercise. Older adults may face challenges in adhering to exercise programs, such as lack of motivation, time constraints, and competing priorities.

Aprahamian et al. (2017) explored the factors that influence adherence to strength training programs in older adults. They found that social support, enjoyment, and perceived benefits were important predictors of adherence. Additionally, they highlighted the role of goal setting and self-monitoring in promoting long-term engagement (Montgomery, R. M.; Aprahamian I. (2018)).



Ivan et al. (2018) discussed the importance of creating a supportive and inclusive environment for strength training programs. They found that older adults who participated in group-based strength training programs had higher levels of adherence and greater improvements in muscle strength and functional performance. This underscores the need for social support and community engagement in promoting long-term adherence to strength training programs.

### Section 3. Conclusion

The shift from aerobic to anaerobic/strength training represents a significant paradigm change in the prevention and management of frailty syndrome. The benefits of strength training are well-documented and include improvements in muscle strength, balance, and overall physical function. These benefits are mediated through several physiological mechanisms, including the stimulation of muscle protein synthesis and the enhancement of neuromuscular function.

However, to fully realize the benefits of strength training, it is essential to address the challenges and barriers to participation. This includes developing tailored exercise programs that are safe, effective, and enjoyable, as well as providing education, support, and guidance to older adults.

In conclusion, the shift from aerobic to anaerobic/strength training offers a promising approach to preventing frailty, morbidity, and mortality in older adults. By embracing this paradigm change, healthcare providers and fitness professionals can help older adults maintain their independence, improve their quality of life, and live healthier, more active lives.

The Author claims no conflicts of interest.

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