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Letter to the Editor

New Strategies for the Concurrent Strength-, Power-, and Endurance-Training Prescription in Elderly Individuals

To the Editor:

Why Is It So Important to Combine Strength, Power, and Endurance Training in the Elderly?

Aging is associated with declines in muscle mass, strength performance, and cardiorespiratory fitness, resulting in an impaired capacity to perform daily activities and maintain independent functioning.^{1–4} Skeletal muscle power, however, decreases to a greater rate of muscle strength with advancing age,^{5,6} and is more strongly associated with functional test performance than muscle strength in elderly populations.⁷ To counteract this effect, a combination of strength and power, as well as endurance training, in elderly populations seems to be the most effective strategy to improve both neuromuscular and cardiorespiratory functions and consequently to maintain functional capacity during aging.^{8–12} The combination of strength/power and endurance training has been called *concurrent training*.^{9,11–14}

How to Simultaneously Optimize Neuromuscular and Cardiovascular Gains in the Elderly

The volume and frequency of training play a critical role in the concurrent-training–induced adaptations in elderly individuals.^{9,11,12} In a study by Izquierdo et al⁹ investigating the effects of 16 weeks of strength, endurance, and concurrent training among elderly men, the strength-training and endurance-training groups performed specific training twice a week, and the concurrent-training group performed strength exercises on one day and cycle ergometer on the other day. These authors demonstrated similar hypertrophy and strength gains between strength- and concurrent-training groups. In addition, similar cardiovascular gains were observed among endurance- and concurrent-training groups. These results suggest that a minimum weekly frequency of concurrent training (1 session per week of strength and 1 session per week of cycle endurance training) may be an optimal stimulus to promote neuromuscular and cardiovascular gains in previously untrained elderly individuals.⁹

Studies investigating training regimens with greater weekly volume reported that concurrent training induced similar strength adaptations using 2 sessions per week of each modality (ie, strength and endurance) on separated days when compared with strength training alone.^{12–14} However, 3 times a week of concurrent training can result in an interference effect in this population, because greater strength gains have been observed

in the strength-training group when compared with the concurrent-training group when this weekly frequency is performed.¹¹ However, the faster time course of strength development during a concurrent training performed 3 times a week justify the use of greater weekly frequency in elderly individuals.¹¹ Furthermore, recent evidence has shown that intrasession exercise sequence may also influence the magnitude of strength adaptations in the elderly, and performing strength training before endurance exercise may optimize the neuromuscular adaptations in this population.^{15,16} In addition, greater endurance improvements have been shown when strength training is performed before endurance training in each session.¹⁶ Possibly this effect is a consequence of the greater increases in the muscle strength achieved by performing strength training before endurance training, as strength gains have been associated with maximal and submaximal endurance gains³ and dynamic neuromuscular economy in the elderly.¹⁷

Why Include Power Training in Elderly Populations?

The inclusion of high-speed concentric contractions in strength training results in overall neuromuscular adaptations in the elderly, such as increases in the maximal concentric power, rate of force development, and rapid muscle activation.^{18–20} Moreover, some studies have shown that strength training using high velocity during concentric contractions results in greater improvements in functional capacity when compared with strength training using only slow velocity of contractions.^{7,21–23} In the study by Correa et al,²³ high-speed power training improved the performance on functional tests more than traditional strength training (ie, slow muscle contractions) in elderly women. Thus, muscle power seems to be an important predictor of functional performance in elderly adults. A concurrent-training regimen using typical explosive strength training was presented in a study by Karavirta et al,¹² who changed 20% of the knee extensor training volume by sets of 5 to 8 repetitions with 40% to 50% of 1 repetition maximum at maximal speed possible. Both strength-training and concurrent-training programs improved the maximal concentric power to the same extent, suggesting that the simultaneous performance of endurance and strength training did not compromise the power gains. Hence, the performance of strength training that combines high with slow velocity of contractions, may be included in the concurrent training prescription with no impairment on power gains magnitude.

How Should a Concurrent Training Approach Be Prescribed in Elderly Individuals?

The combination of strength and endurance training in the elderly is the best strategy to improve both neuromuscular and cardiorespiratory functions and, consequently, to maintain

functional capacity during aging. Based on recent evidence, strategies have been provided to optimize muscle strength, hypertrophy, and power output, and develop cardiovascular function, as follows:

- A minimum weekly frequency of concurrent training (1 session per week of strength training and 1 session per week of cycle endurance training) may be an efficient stimulus in elderly in early phases of training;
- For concurrent-training protocols in which both strength and endurance training are performed on the same day, the strength gains may be optimized with strength training before endurance intrasession exercise sequence;
- Endurance parameters also may be optimized when strength exercises are performed before endurance exercises in each session, because greater changes in the neuromuscular system result in enhanced endurance capacity.
- Concurrent strength- and endurance-training prescription should include high-speed muscle contractions in the strength-training program, as skeletal muscle power has been strongly associated with the functional capacity of this population.

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