Impact of Strength and Resistance Training on Cardiovascular Disease Risk Factors and Outcomes in Older Adults

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• Strength • Cardiovascular disease risk factors • Older adults
• Resistance training • Resistance exercise prescription

In older persons with and without cardiovascular disease, muscular strength and endurance significantly contribute to improved functional independence and quality of life,[1,2] while reducing disability. Unfortunately, muscle atrophy results from aging and inactivity, leading to a loss of strength and power,[3,4] the latter being a function of both force and the speed of the movement. This article reviews the physiologic response to resistance training in older adults and discusses the impact of resistance exercise training on cardiovascular disease risk factors, particularly obesity and diabetes.

RESISTANCE EXERCISE TRAINING RESPONSES IN OLDER ADULTS

Regardless of age, skeletal muscle responds to progressive overload through resistance training. Strength improves through neuromuscular adaptation, muscle fiber hypertrophy, and muscle strength. In older adults, muscle strength and the ability to move quickly appear to have an inverse relationship with risk for falls.[5] In particular,

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low- to moderate-intensity resistance training incorporating increased movement velocity (ie, power) has been shown to improve performance of activities of daily living and balance.[6–10]

Resistance training appears to increase muscle oxidative capacity and the capacity for aerobic endurance exercise.[11] The most likely reason for this is that resistance training programs in older adults are usually a mix of strength development and aerobic exercise resulting from the circuit training format using moderate-intensity resistance (**Fig. 1**).[12] This approach has been demonstrated to maintain or increase capillary density, mitochondrial content, and oxidative capacity.

Benefits of Resistance Exercise Training in Older Persons

Improved physical function results from substantial increases in upper- and lower-body muscle strength and endurance.[9,13,14] In both older men and women, resistance training improves several components of function, including walking endurance, walking speed, and dynamic balance.[9,13–19] Even in the oldest persons (nursing home residents; mean age, 87 years), Fiatarone and colleagues[17] demonstrated that 10 weeks of resistance training significantly improved strength, gait velocity, and stair-climbing power in association with an increase in thigh muscle cross-sectional area. Nakamura and colleagues[20] showed that training frequencies ranging from 1 to 3 days per week, which included both aerobic and resistance types of exercise, produced similar increases in strength, but that 3 days per week was superior for muscle endurance, coordination, balance, and cardiovascular endurance. With regard to increasing strength, modest- to high-intensity resistance programs have demonstrated similar improvements in strength in some studies,[11,21,22] while other studies found that high-intensity effort produced the greatest benefit in strength in older adults.[23–26]

In older women with cardiovascular disease and at least moderate mobility limitation, Brochu and colleagues[27] and Ades and colleagues[28] showed that, compared

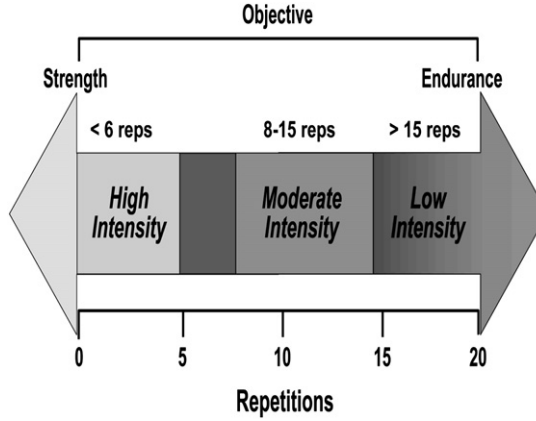

Fig. 1. Classification of weight training intensity (resistance). A lower repetition range with a heavier weight may better optimize strength and power, whereas a higher repetition range with a lighter weight may better enhance muscular endurance. Using weight loads that permit 8 to 15 repetitions (reps) will generally facilitate improvements in muscular strength and endurance. (*Reprinted from* Williams MA, Haskell WL, Ades PA, et al. Resistance exercise in individuals with and without cardiovascular disease: 2007 update. Circulation 2007;116:579; with permission.)