



# Strength Training for Seniors

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## **Importance of Resistance Training**

Men and women who do not perform regular resistance exercise experience progressive muscle atrophy throughout the aging process. Research indicates that inactive adults lose about one-half pound of muscle per year during their 30's and 40's (5, 8). The rate of muscle loss may double to one-pound per year in people past 50 years of age (13). Unfortunately, the higher rate of fat gain masks the muscle loss. As illustrated in Figure 1, adults typically lose about 5 pounds of muscle and add about 15 pounds of fat each decade during the midlife years.

Based on bodyweight the average adult changes approximately 10 pounds per decade, but based on body composition the average adult changes approximately 20 pounds per decade (5 pounds less muscle and 15 pounds more fat). As presented in Figure 1, a woman in her 50's may have 15 pounds less muscle and 45 pounds more fat than she had in her 20's. This represents an unhealthy 60-pound change in her body composition, which increases her risk for a variety of devastating degenerative problems such as cardiovascular disease, many types of cancer, type II diabetes, and low back pain.

While the focus is typically on fat loss (one out of two American adults is presently on a weight reduction diet plan), more emphasis should be placed on muscle gain. This is due to the fact that the 5-pound per decade loss of muscle is largely responsible for up to a 5 percent per decade reduction in resting metabolic rate (5, 12). A slower resting metabolism means that some calories previously used by high-energy muscle tissue are no longer needed, and are therefore stored as fat. Because a pound of muscle requires between 35 to 50 calories a day for tissue maintenance, a 10-pound muscle loss may reduce resting

metabolism by 350 to 500 calories daily (4, 14). Think of cutting your daily food intake by 20 to 25 percent, and you will better appreciate the importance of muscle and metabolism.

Although eating fewer calories can prevent weight gain, it cannot reduce the rate of muscle loss or metabolic slowdown. It is obviously more desirable to maintain both muscle and metabolism, as well as the functional capacity to perform physical activities. Progressive resistance exercise can build muscle tissue that facilitates physical performance and enhances energy utilization throughout the senior years. In fact, strength training is the only type of exercise that can maintain muscle and metabolism as we age, and should therefore be the essential component of every senior fitness program.

Fortunately, older adults can rather quickly rebuild muscles that have atrophied from years of sedentary living. Research has repeatedly shown significant increases in muscle mass (3, 7, 9, 10, 13, 18) and resting metabolic rate (4, 15) in seniors who do regular resistance exercise. Senior research subjects at Tufts University (4) and the University of Maryland (15) added 3.0 to 3.5 pounds of muscle and increased their resting metabolism by 6.8 to 7.7 percent after 3 to 4 months of standard strength training.

We recently conducted a large-scale strength training study with 1,132 men and women between 20 and 80 years of age (18). As presented in Table 1, the younger adults (21-40 years), middle-aged adults (41-60 years) and older adults (61-80 years) made similar improvements in bodyweight, percent fat, fat weight and lean (muscle) weight after 8 weeks of basic resistance exercise.

It is interesting to note that adult and senior men add about 3 to 4 pounds of lean (muscle) weight after 2 to 3 months of strength exercise (15, 17, 18), whereas adult and senior women gain about 2 to 3 pounds of lean (muscle) weight over the same training period (3, 18). Although the rate of improvement is almost the same, men typically replace more muscle than women during a given time period because they generally have greater body mass.

On average, previously sedentary seniors can replace approximately 3 pounds of muscle after about 3 months of regular resistance exercise. Further, 3 pounds more muscle tissue increases resting metabolic rate by approximately 7 percent in older adults. Additionally the senior exercisers in these studies averaged about 50 percent greater muscle strength after completing their training program. Research clearly

confirms the importance of resistance training for effectively reversing the muscle loss, metabolic slowdown, and strength decrement associated with the aging process.

There are many more health-related reasons why seniors should perform regular resistance exercise. As presented in the March 2002 issue of *Fitness Management YMCA Quarterly*, strength training can reduce the risk of cardiovascular disease, colon cancer, diabetes, osteoporosis, low back pain and depression (19).

## **Principles of Strength Training**

Generally speaking, the guidelines for healthy senior strength exercisers are essentially the same as those for younger adults and youth. Basically, a well-designed strength training program for any age group consists of several exercises that address all of the major muscle groups. Studies with older adults have used as few as 5 exercises and as many as 15 exercises. For example, a landmark study with older women (13) incorporated only the leg press, leg extension, pulldown, back extension and abdominal curl exercises, whereas a classic study with senior golfers (17) included the leg extension, leg curl, hip adduction, hip abduction, leg press, chest cross, chest press, pullover, lateral raise, biceps curl, triceps extension, low back extension, abdominal curl, neck flexion, and neck extension exercises.

## **Sets**

Most senior strength training studies have used a one, two or three set training protocol. Typically, programs with fewer exercises perform multiple sets, and programs with more exercises perform single sets. For example, participants in the older women study (13) performed 3 sets each of the 5 resistance exercises, whereas participants in the senior golfers study (17) performed one set each of the 15 resistance exercises. Participants in both programs completed 15 exercise sets per session, which represents a reasonable recommendation for most senior strength training protocols.

In a recent meta-analysis of several strength training studies, all but one showed no significant difference between performing single or multiple sets of resistance exercise (6). The researchers therefore concluded that training with one, two or three sets per exercise is equally effective for strength development and largely a matter of personal preference.

Based on the research protocols used with senior subjects and the comparative studies on exercise sets, a standard strength training session for older adults may include 8 to 24 sets of exercise. The following guidelines represent a sensible approach for training sets based on the number of exercises performed:

- 4 to 8 exercises..... 2 to 3 sets each
- 8 to 12 exercises..... 1 to 2 sets each
- 12 to 16 exercises..... 1 set each

Generally speaking, older adults should take at least two minutes recovery time between successive sets of exercise. This time period permits almost full replenishment of the anaerobic energy source used during strength training.

## **Resistance and Repetitions**

There is an inverse relationship between the amount of resistance used and the number of repetitions performed. The productive resistance range for strength development is generally considered 60 to 90 percent of maximum resistance, with a standard recommendation of approximately 75 percent of maximum resistance (2, 16). Research indicates that most adults can complete between 8 and 12 repetitions with 75 percent of their maximum resistance, and the majority of senior strength training studies have incorporated this exercise protocol (4, 7, 9, 13, 17, 18).

Although 8 to 12 repetitions with 75 percent of maximum resistance has proven to be a safe and productive strength training protocol for men and women between 50 and 90 years of age, the American College of Sports Medicine recommends that seniors perform 10 to 15 repetitions per set with slightly less resistance (1). This more conservative training approach is most appropriate for beginning exercisers. However, as higher levels of strength fitness are attained, most seniors can safely progress to lower repetition exercise protocols. The textbook, *Strength Training for Seniors*, recommends the following training progressions for seniors who prefer to use heavier resistance (16).

- Beginner Exercisers                      12 to 16 repetitions with about 65 percent of maximum resistance.
- Intermediate Exercisers                  8 to 12 repetitions with about 75 percent of maximum resistance.
- Advanced Exercisers                      4 to 8 repetitions with about 85 percent of maximum resistance, periodically.

## **Progression**

The key factor in strength development is progressive resistance. For continued progress, seniors must gradually increase the training load as the muscles become stronger. A safe approach to more challenging training sessions is known as the double progressive program, in which clients increase the number of repetitions before they increase the exercise resistance. For example, seniors following an 8 to 12 repetition protocol should use the same resistance until they can complete 12 good repetitions, at which point they should increase the resistance by 5 percent or less.

## **Technique**

The two major factors in exercise technique are movement speed and movement range. Although research has not revealed an optimal speed for strength training, studies with senior subjects have incorporated relatively slow movement speeds, typically averaging about 6 seconds per repetition (13, 18). At about 6 seconds per repetition, a set of 10 repetitions requires approximately one-minute of continuous muscle action/tension, which provides a productive stimulus for strength development (16). Because slower movement speeds involve less momentum they provide more controlled and consistent stress to the musculoskeletal system, thereby reducing the risk of injury.

Seniors should develop strength throughout the full-range of every joint action, if they can do so without discomfort. Research indicates that full-range strength requires full-range repetitions, as strength gains are specific to the exercise movement patterns (11). Consequently, most strength exercises should be performed throughout the full-range of pain-free movement to maximize muscle development and maintain joint integrity.

## **Frequency**

Strength training is recommended on non-consecutive days, as the muscle microtrauma that results from resistance exercise generally requires about two recovery days for tissue remodeling and strength building (1). Research with more than 1,100 adults and seniors showed more muscle development from three-day-per-week training than from two -day-per-week training (18). However, the difference was relatively small (about 10%), indicating that twice-a-week strength training is highly effective.

Based on the available research, two or three strength training sessions per week are recommended for senior exercisers, dependent upon lifestyle factors and personal preferences. Ideally, the weekly strength workouts should be as evenly spaced as possible. For example, seniors who train three times a week may follow a Monday-Wednesday-Friday schedule, whereas those who train twice a week may exercise on Mondays and Thursdays.

## **Breathing**

Seniors must make sure to breathe continuously when performing resistance exercise. For best results, they should exhale during each lifting movement and inhale during each lowering movement. If you notice them holding their breath, reduce the weightload so that they breathe continuously throughout every repetition.