

STRENGTH TRAINING FOR THOSE WHO NEED IT MOST

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Learning Objectives

- To recognize that more than 65% of American adults are overweight or obese and more than 95% of American adults perform too little physical activity.
- To understand that resistance exercise is a highly effective means for rebuilding muscle, recharging resting metabolism, and reducing fat in overweight and obese individuals.
- To realize that people with high body weight and low physical fitness are more likely to engage in low-volume and short-duration strength training programs.
- To design research-based resistance training protocols that are physiologically and psychologically appropriate for beginning exercisers.
- To evaluate similarities and differences in sex responses to resistance exercise.

Key words: Strength Training, Resistance Exercise, Physical Conditioning, Beginning Exercisers, Muscle Development

There are many reasons why adults of all ages should begin a regular program of resistance training. Research has shown that resistance training is effective for retaining muscle, recharging resting metabolism, reducing fat, rebuilding bone, reducing resting blood pressure, improving blood lipid profiles, increasing insulin sensitivity/glycemic control, facilitating physical function, enhancing self-concept, increasing cognitive abilities, and reversing cellular aging factors (29). These health-related benefits of resistance training reduce the risk of experiencing sarcopenia, osteopenia, obesity, diabetes, heart disease, stroke, metabolic syndrome, low-back pain, arthritis, falls, cognitive decline, depression, and premature all-cause mortality (29).

However, the largest category of adults who need to do resistance training is the 65% with a high body mass index (BMI). Based on BMI assessments, approximately one third of American adults are overweight, and approximately one third of American adults are obese (14). Because BMI is calculated from height and weight measures, it underestimates the percentage of our nation's population who have excessive body fat, especially among



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men and women older than 50 years. This is because of the fact that adults who do not perform resistance exercise lose between 3% and 8% of their muscle mass every decade before 50 years (13) and up to 10% of their muscle mass each decade after 50 years (20). Consequently, a 60-year-old man who weighs the same as he did at 20 years has an unchanged BMI, but he actually has approximately 20 lbs less muscle and approximately 20 lbs more fat, for a 40-lb undesirable difference in body composition.

Although research indicates that physical activity has a stronger association with desirable weight status than diet quality (21), far more men and women follow reduced-calorie nutrition plans than perform regular exercise. A Gallup poll found that at any given time, 52% of American adults attempt to lose weight through dieting (23). Although cutting calories is a successful means for short-term weight loss, more than 90% of dieters return to their original body weight within 1 year after completing their diet program (9). In their extensive review of diet research, Mann et al. (19) from the University of California at Los Angeles concluded that “dieters who manage to sustain a weight loss are the rare exception” (page 230).

Equally disconcerting, although research reveals that exercise is an effective intervention for sustained weight loss (15,19,25), less than 5% of Americans older than 20 years attain the minimum U.S. Centers for Disease Control/American College of Sports Medicine (ACSM) physical activity recommendations of 3 METs intensity, 30 minutes duration, 5 days/week frequency (26). For exercise science/fitness professionals, the obvious question is, why would most people prefer to *subtract* something good from their lives (food) than to *add* something good to their lives (exercise)?

The simple answer is that most people consider eating smaller meals a less aversive behavior than performing physical activity. Education, motivation, encouragement, and reinforcement are influential factors in exercise participation (27). Nevertheless, even under favorable conditions, 50% to 65% of new exercisers discontinue their physical activity program within 3 to 6 months (5,10).

With this in mind, let us examine typical exercise recommendations and perceived training barriers from the perspective of nonexercisers who have relatively high body weight and relatively low physical fitness. Generally, overweight individuals are advised to begin a walking or jogging program with progressively longer training durations. There are two problems with this common exercise prescription. First, most people who carry excess body fat do not perform particularly well in ambulatory activities. Second, most people who have low physical fitness levels do not find relatively long exercise sessions reinforcing.

A better physical activity recommendation for most overweight and underfit adults is a basic and brief program of resistance exercise. Unlike walking and jogging that involve transporting a fixed body weight, resistance training uses an external resistance that can be adjusted to low levels of muscular fitness. Equally important, rather than requiring relatively long periods of continuous aerobic activity, resistance training is performed with relatively brief exercise sets of 8 to 12 repetitions each.

Research with the U.S. Air Force supports this training approach (32). In this study, 83 male and female Air Force personnel who failed the physical fitness assessment (1.5-mile run, waist circumference, push-ups, and abdominal crunches) were assigned randomly to either the standard aerobic activity program (60 minutes, 4–5 d/wk) or a circuit strength training program (25 minutes, 3 d/wk). After 12 weeks of training, the circuit strength training participants attained significant improvements in every assessment component, whereas the aerobic activity participants did not improve significantly on any test measure.

Why was the circuit strength training program a more effective intervention than the aerobic activity program for improving these fitness parameters in poorly conditioned participants? From a process perspective, people who are overweight and out of shape are better suited to perform shorter-duration and less frequent workouts than longer-duration and more frequent workouts. From a product perspective, resistance training reverses the cascade of degenerative changes that are largely responsible for the progressive accumulation of body fat. There is strong evidence that muscle loss leads to metabolic decline and facilitates fat gain (17,40). Conversely, resistance exercise promotes muscle gain, metabolic increase, and fat loss (11,16,22). Resistance training programs have been shown to increase lean weight by approximately 1 lb per month (11,22,37), increase resting metabolic rate by approximately 7% (11,16,22), and decrease fat weight by approximately 1 lb per month (11,22,37).

Simple resistance training programs are psychologically acceptable and physiologically effective for overweight adults who need to regain muscle and reduce fat. For example, in a study with more than 1,600 beginning exercisers, a basic and brief program of combined strength and endurance training (40 minutes, 2 or 3 days a week) facilitated a 91% completion rate and produced significant body composition improvements (37). After 10 weeks of training, the study participants improved their fat percentage from 28% to 25% by increasing their lean weight by 3.1 lbs and decreasing their fat weight by 3.9 lbs.

The results of this research are consistent with the ACSM Position Stand on Appropriate Physical Activity Intervention





Strategies for Weight Loss and Prevention of Weight Regain for Adults (4) that states resistance training does not seem to be effective for weight reduction (page 466). The study participants lost less than 1 lb of body weight in 10 weeks. However, they averaged a 7-lb improvement in body composition (3.1 lbs more lean weight and 3.9 lbs less fat weight). The results of this study also support the ACSM Position Stand that states resistance training may increase loss of fat mass when combined with aerobic exercise (page 466). Resistance training enhances fat loss by increasing muscle mass (11,22,33) and raising resting metabolic rate (11,16,22) during the weight loss process, which are important factors for attaining and maintaining desirable body composition. Therefore, the combination of resistance training and aerobic activity is recommended for achieving sustainable weight loss and improving body composition, as well as for increasing muscular strength and cardiorespiratory fitness.

The resistance training protocol used in the aforementioned study corresponded to the ACSM resistance training recommendations at the time. These guidelines were 1 set of 8 to 10 exercises for the major muscle groups, using a resistance that could be performed for 8 to 12 controlled repetitions, 2 or 3 days a week (1) (page 158).

The current ACSM resistance training recommendations (3) for beginning exercisers are as follows (page 185):

Frequency: Each major muscle group should be trained 2 or 3 days a week.

Intensity: Each exercise should be performed with 60% to 70% of maximum resistance.

Repetitions: Each exercise should be performed for 10 to 15 repetitions (middle-aged and older beginning exercisers).

Sets: A single set of resistance exercise can be effective, especially among older and novice exercisers.

Based on our experience, these are excellent recommendations for adults and older adults who are beginning a resistance training program. Within the scope of these resistance training guidelines, the following suggestions are presented to foster compliance with the prescribed exercise protocol.

FREQUENCY

Research indicates that two or three weekly resistance training sessions produce similar results with respect to body composition changes (12,37). It is therefore suggested that overweight exercisers begin with two total-body resistance workouts a week, such as Wednesdays and Saturdays, to increase the likelihood of program adherence.

RESISTANCE AND REPETITIONS

Generally, training intensities of 60% to 70% of maximum resistance correspond to 10 to 15 repetitions (8) (page 23). A conservative recommendation for new exercisers is to start with a resistance that they can comfortably lift approximately 10 times. They should exercise with this workload until 15 repetitions can be completed, then increase the resistance by approximately 5% in what is referred to as a double progressive training protocol (34) (page 474).

SETS

The standard ACSM resistance training guideline for *most adults* is to perform two to four sets of resistance exercise for the major muscle groups (3) (page 185). This recommendation is consistent with two major meta-analyses of research on training sets (18,24). However, ACSM's acknowledgement that single-set strength training can be effective for novice exercisers is well-taken (3) (page 185). With respect to overweight and out-of-shape exercisers, shorter, single-set strength training sessions are beneficial psychologically and productive physiologically (5–7).

EXERCISES

Consistent with resistance training articles in *ACSM's Health & Fitness Journal*[®] (30) and *ACSM's Certified News* (31), the following resistance machine and free-weight exercises are recommended for beginning participants. Each program starts with six basic exercises, adds two exercises at month two, and two more exercises at month three. Table 1 presents the suggested machine exercises and Table 2 presents the suggested free-weight exercises as well as the major muscles involved in these exercises. It is recommended that beginning exercisers perform each resistance exercise at a controlled movement speed through a complete movement range (2) (page 172).

PRACTICAL APPLICATION

In 2004, a well-known and highly respected sports and fitness chain initiated a relatively brief resistance training program for new members as an alternative to more traditional, longer-duration strength training protocols (35). During the study period, potential fitness center members were offered a choice between a lower-volume XpressLine program (1 set of 8 resistance machine exercises) or various higher-volume protocols (2–3 sets of 8–16 exercises). More than 40 men and women joined the fitness center during the introductory period. Of these, 65% selected the XpressLine program, and 35% chose the traditional

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TABLE 1: Recommended Machine Exercises for Beginning Exercisers

Month	Exercise	Major Muscle Groups Addressed
1	Leg press	Quadriceps, hamstrings, gluteus maximus
	Chest press	Pectoralis major, triceps, anterior deltoids
	Seated row	Latissimus dorsi, biceps, teres major, rhomboids, middle trapezius, posterior deltoids
	Lateral raise	Middle deltoids, upper trapezius
	Abdominal	Rectus abdominis
	Low back	Erector spinae
2	Leg extension	Quadriceps
	Leg Curl	Hamstrings
3	Shoulder press	Middle deltoids, triceps, upper trapezius
	Pulldown	Latissimus dorsi, biceps, teres major, rhomboids, middle trapezius, posterior deltoids

protocols. After 8 weeks, 80% of those who selected the XpressLine program were still training, and 60% of those who chose the traditional protocols were still training.

Participants who completed the XpressLine program and participants who performed the traditional protocols attained similar improvements in body composition (lean weight gain and fat weight loss). Specifically, the XpressLine training group experienced a 2.5-point reduction in percent body fat, and the traditional training group experienced a 2.2-point reduction in percent body fat.

If the results of this study are reasonably representative of new fitness center members in general, they may be indicative of the following considerations:

Consideration 1: Beginning exercisers may be more likely to *enroll* in lower-volume, shorter-session resistance training programs than in higher-volume, longer-session resistance training programs.

Consideration 2: Beginning exercisers may be more likely to *complete* lower-volume, shorter-session resistance training programs than higher-volume, longer-session resistance training programs.

Consideration 3: Beginning exercisers may experience similar body composition changes (percent fat, fat weight, lean weight) with both lower-volume, shorter-session resistance training programs and higher-volume, longer-session resistance training programs.

RESISTANCE TRAINING RECOMMENDATIONS FOR WOMEN

Should women who are beginning a resistance training program follow a different exercise protocol than men? According to textbook authors Wilmore and Costill (39), “Women experience similar strength gains compared with men who participate in the same training program, but the women do not experience as much hypertrophy” (page 76). This statement indicates that a given program of resistance exercise is equally effective for stimulating strength development in men and women, but that men may attain greater muscle size than women. One reason why female strength trainers may experience less muscle hypertrophy than male strength trainers is because of lower levels of the anabolic hormone testosterone (39) (page 451). Because men typically have more muscle mass than women, they generally can lift heavier weight loads in a given exercise (39) (page 447). However, when strength comparisons are made relative to body weight, the differences decrease, and when strength comparisons are made relative to fat-free weight, the differences essentially disappear (39) (page 447).

As an example, data were collected on more than 900 men (average age, 43 years) and women (average age, 42 years)

TABLE 2: Recommended Free-Weight Exercises for Beginning Exercisers

Month	Exercise	Major Muscle Groups Addressed
1	Dumbbell squat	Quadriceps, hamstrings, gluteus maximus
	Dumbbell bench press	Pectoralis major, triceps, anterior deltoids
	Dumbbell bent row	Latissimus dorsi, biceps, teres major, rhomboids, middle trapezius, posterior deltoids
	Dumbbell lateral raise	Middle deltoids, upper trapezius
	Dumbbell curl	Biceps
	Dumbbell triceps extension	Triceps
2	Dumbbell stationary lunge	Quadriceps, hamstrings, gluteus maximus
	Dumbbell step-up	Quadriceps, hamstrings, gluteus maximus
3	Dumbbell shoulder press	Middle deltoids, triceps, upper trapezius
	Dumbbell pullover	Latissimus dorsi, triceps, teres major, posterior deltoids

(28). When compared for 10-repetition maximum (10RM) strength in the leg extension exercise, the men were approximately 50% stronger than the women (119 lbs vs. 79 lbs). However, relative to body weight, the average 10 RM weight loads were 62% of body weight for men and 55% of body weight for women. Furthermore, relative to fat-free weight, the 10 RM weight loads were just less than 75% of fat-free weight for both men and women. It would therefore seem that on a pound-for-pound and muscle-for-muscle basis, males and females have strength equity.

Research has revealed similar percentage increases in muscle strength for beginning men and women strength trainers performing identical programs of resistance exercise (38). However, the male exercisers experienced a greater increase in muscle mass during the same training period (38). Similarly, in a 10-week exercise program using the ACSM resistance training guidelines, the 386 male participants increased their lean weight by 3% (4.6 lbs.) whereas the 1,258 female participants increased their lean weight by 2% (2.6 lbs.) (36).

Based on the available evidence, the strength-building response to standard resistance exercise is similar for men and women, whereas the muscle-building response to standard resistance exercise is greater for men. However, the ACSM resistance training recommendations seem to be equally effective for both male and female exercisers, with no need for sex-specific protocols of resistance training.

SUMMARY

Resistance training programs for people who need it most should be designed for the 65% of Americans who have too much fat and too little muscle, as well as for the 95% of Americans who do not perform regular exercise. As effective as aerobic activities may be for burning calories and improving cardiorespiratory fitness, they may not represent the most appropriate initial exercise program for this population because aerobic activities, as generally performed, do not increase muscle mass and resting metabolism. As effective as advanced resistance training protocols may be for increasing muscle mass and strength, previously inactive individuals with high body weight and low muscle strength generally have poor compliance with high-volume, long-duration exercise programs.

Research indicates that beginning exercisers respond favorably, physiologically, and psychologically to basic and brief resistance training programs. The 2014 ACSM resistance training guidelines for new exercisers recommend a training frequency of 2 or 3 days a week, a training intensity of 60% to 70% of maximum resistance, a repetition range of 10 to 15 reps for middle-aged and older beginners, and a single set of each exercise for older beginners. Several practical resistance training studies with new participants support these recommendations for lower-volume and shorter-session exercise protocols during the first few months of musculoskeletal conditioning.

Research indicates that men and women have similar levels of muscle strength relative to their fat-free body mass. Studies

also show that men and women attain similar rates of strength gain from standard programs of resistance exercise. However, women generally experience slower rates of muscle development and less muscle hypertrophy than men, most likely because of lower levels of testosterone. It would seem that the ACSM resistance training guidelines for beginning exercisers apply equally well to men and women.

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BRIDGING THE GAP

Approximately 7 of 10 adults have too much fat, and 9 of 10 adults perform too little exercise. An underlying cause of both problems is the progressive muscle loss (up to 10% per decade) that accompanies inactive aging. Resistance training provides a productive stimulus for increasing muscle mass, bone mass, resting metabolism, and physical function, as well as for decreasing fat weight in overweight and underfit individuals. However, traditional high-volume and long-duration strength training protocols are not a good match psychologically or physiologically for this large percentage of the adult population. Beginning programs of resistance training that use the ACSM guidelines for new exercisers have been highly effective with respect to both training adherence and body composition improvement in previously sedentary men and women.