



ACSM Information On...

## Eccentric Resistance Exercise for Health and Fitness

Muscle contractions involve shortening and lengthening while the muscle is still producing force. The phase of contraction that occurs when the muscle shortens is concentric, whereas the phase of contraction that occurs as the muscle lengthens is eccentric.

### A COMPLETE PHYSICAL ACTIVITY PROGRAM

A well-rounded physical activity program includes aerobic exercise and strength training exercise, but not necessarily in the same session. This blend helps maintain or improve cardiorespiratory and muscular fitness and overall health and function. Regular physical activity will provide more health benefits than sporadic, high intensity workouts, so choose exercises you are likely to enjoy and that you can incorporate into your schedule.

ACSM's physical activity recommendations for healthy adults, updated in 2011, recommend at least 30 minutes of moderate-intensity physical activity (working hard enough to break a sweat, but still able to carry on a conversation) five days per week, or 20 minutes of more vigorous activity three days per week. Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation.

Examples of typical aerobic exercises are:

- Walking
- Running
- Stair climbing
- Cycling
- Rowing
- Cross-country skiing
- Swimming.

In addition, strength training should be performed a minimum of two days each week, with 8-12 repetitions of 8-10 different exercises that target all major muscle groups. This type of training can be accomplished using body weight, resistance bands, free weights, medicine balls or weight machines.

During everyday activities, concentric actions start movements while eccentric actions slow activity down. For example, during running, the quadricep muscles will propel the runner forward with concentric actions, while the hamstrings can brake running by slowing down the forward motion. To maintain sport performance and prevent injury throughout the whole range of motion, strengthening both phases of muscle contraction is important. Resistance exercise programs are therefore recommended for muscle health and strength across the age span. Eccentric strength is especially important for balance, mobility and physical functions such as walking down stairs or lowering objects to the ground.

Eccentric actions have been referred to as 'negatives' or 'eccentrics.' Traditional resistance training programs ranging from 2-6 months are designed to overload muscle and help muscle increase strength, power and size. Most programs focus on overloading the muscle during the concentric phase, as in bicep curls or leg extension. Recent development of equipment and training programs has emphasized the eccentric phase of muscle

actions. Examples of eccentric actions include lowering a dumbbell, performing a Nordic hamstring curl or a calf press off of a stair ledge. Because a person can lower more weight than lift, products or programs are being designed to take advantage of this fact. Individuals may feel that they are exercising at a lower level of muscle effort during eccentric exercise compared to during concentric exercise. Traditional strength training eccentric programs typically involve lifting a weight in the concentric phase for 2 seconds and lower a weight in the eccentric phase for ~4-6 seconds to maximize strength gain. In sport-specific exercises or dynamic exercise (such as drop jumping or throwing), eccentric exercise is performed at higher speeds. The eccentric exercises can be tailored to meet the goals and needs of the individual. Because the muscle forces that are generated during slow eccentric overloading are high compared to traditional concentric resistance exercise, 3-5 days of rest should be provided between days of exercise. This recovery time allows the muscle to repair, adapt and prepare for the next exercise session.

## ECENTRIC RESISTANCE EXERCISE PRODUCTS OR PROGRAMS CURRENTLY INCLUDE:

- Web-based exercise plans using free weights
- Weight machines that control weight during different phases of muscle contraction
- Modification of existing machines to create eccentric loading
- Video or online promotions
- Eccentric exercise ergometers that pedal backwards
- Using kettle bells or small medicine balls during sport specific motions

Samples of eccentric exercise machines include the reverse pedalling ergometer and the new eccentric focused resistance exercise machines.

If machines are not available, training programs can also provide direction for eccentric loading using body weight, hand-held weights, kettle balls and small medicine balls. The intensity of these programs can be modified based on the individual's fitness level and characteristics. Healthy, younger, fit individuals may start programs that involve body weight and free weights. Older adults may have low strength or joint pain and may need to start an eccentric program with body weight alone before adding any resistance.

When performed correctly and safely, eccentric exercise may have several benefits including:

- Improved muscle coordination
- Improved balance
- Less cardiovascular stress than intensive concentric actions
- Increased strength in the entire range of motion of each joint
- Increased strength across a variety of movement speeds
- Increased muscle power and sport performance
- Recovery from tendon related injuries



## PRECAUTIONS FOR THE USE OF ECCENTRICS

There are several considerations when starting eccentric focused resistance exercise:

- Warm up for 5-10 minutes before starting exercise
- Muscle soreness is common 24-48 hours after eccentric exercise
- Be sure that exercise form is correct before increasing the weight to be lifted
- Begin slowly (fewer repetitions at the start of training to prevent severe soreness)
- May increase lactate levels more than concentric exercises
- For heavier free weight exercises, have a spotter to help you
- Use maximal eccentric exercise sparingly (1 X week)
- For adults with current joint pain like osteoarthritis, eccentrics may worsen pain symptoms in the affected joint
- If an individual is recovering from injury, a physician should be consulted before using eccentrics
- Older adults may use eccentrics, but should consider supported machines such as an eccentric flywheel ergometer or machines that permit small incremental changes in resistance

## STAYING ACTIVE PAYS OFF!

Those who are physically active tend to live longer, healthier lives. Research shows that moderate physical activity – such as 30 minutes a day of brisk walking – significantly contributes to longevity. Even a person with risk factors like high blood pressure, diabetes or even a smoking habit can gain real benefits from incorporating regular physical activity into their daily life.

As many dieters have found, exercise can help you stay on a diet and lose weight. What's more – regular exercise can help lower blood pressure, control blood sugar, improve cholesterol levels and build stronger, denser bones.

## THE FIRST STEP

Before you begin an exercise program, take a fitness test, or substantially increase your level of activity, make sure to answer the following questions. This physical activity readiness questionnaire (PAR-Q) will help determine if you're ready to begin an exercise routine or program.

- Has your doctor ever said that you have a heart condition or that you should participate in physical activity only as recommended by a doctor?
- Do you feel pain in your chest during physical activity?
- In the past month, have you had chest pain when you were not doing physical activity?
- Do you lose your balance from dizziness? Do you ever lose consciousness?
- Do you have a bone or joint problem that could be made worse by a change in your physical activity?
- Is your doctor currently prescribing drugs for your blood pressure or a heart condition?
- Do you know of any reason you should not participate in physical activity?

If you answered yes to one or more questions, if you are over 40 years of age and have recently been inactive, or if you are concerned about your health, consult a physician before taking a fitness test or substantially increasing your physical activity. If you answered no to each question, then it's likely that you can safely begin exercising.

## PRIOR TO EXERCISE

Prior to beginning any exercise program, including the activities depicted in this brochure, individuals should seek medical evaluation and clearance to engage in activity. Not all exercise programs are suitable for everyone, and some programs may result in injury. Activities should be carried out at a pace that is comfortable for the user. Users should discontinue participation in any exercise activity that causes pain or discomfort. In such event, medical consultation should be immediately obtained.



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