STANDING STRONG

By Michael E. Rogers, PhD, FACSM

Help older adults reduce their risk of falls with a strategically designed balance and strength training program.

According to the Federal Interagency Forum on Aging-Related Statistics (2004), the percentage of Americans over the age of 65 years has increased 12-fold, from 3 million to 36 million, during the past century and now accounts for more than 12% of the total population. As members of the Baby Boom generation reach retirement age in the near future, the older-adult population will double in size to over 70 million people by 2025, when it is expected that 1 in 5 Americans will be over the age of 65 years (Federal Interagency Forum on Aging-Related Statistics 2004). These demographic changes can be expected to have a major impact on fitness professionals as increasing numbers of older adults seek assistance in improving their fitness. >>

The Risk of Falls

Falls are the leading cause of injury-related deaths in older adults, as well as a significant cause of disability in this population (National Safety Council 2004). From 30% to 60% of community-dwelling elderly persons fall each year, and many of these individuals experience multiple falls (Rubenstein & Josephson 2002). With approximately 36 million older adults in the United States, this rate equates to more than 10 million falls each year! In 2000, 1.8 million falls among the elderly resulted in emergency room visits for head traumas, soft-tissue injuries, fractures and dislocations; and these injuries accounted for over $16 billion in direct medical expenses (Kochera 2002). Among fall-related injuries, hip fractures are the most devastating for this population. One in four older adults who fracture a hip die within 6 months of the injury, and more than 50% who survive the hip fracture are discharged to a nursing home (Coogler & Wolf 1999). In 2000 the number of hospital admissions for this injury totaled 340,000 (Kochera 2002).

Of course most falls do not result in severe physical injuries. But a fall, or even a near fall, often damages the older adult psychologically—instilling fear that can lead to a self-imposed decrease in activity, which, in turn, can contribute to a decline in health and an even greater risk of falling.

Falls among older adults are often viewed as unavoidable accidents, but the fact is that proper identification of the factors linked to falling and the use of appropriate interventions to correct these conditions may dramatically lessen the risk. Among the many factors that contribute to falls are the following (Tinetti, Speechley & Ginter 1988):

- physical environment
- muscular strength, balance and gait
- medications
- vestibular function
- vision
- cognition
- reaction time
- footwear

Many of these factors can be addressed through environmental modification and exercise intervention. What can you do as a fitness professional? Based on studies supporting the importance of strength and dynamic balance in avoiding falls, researchers recommend a program of postural muscle and dynamic balance training (Skelton & Dinan 1999).

Types of Balance

Although balance can sometimes be difficult to define and measure, it is basically the ability to maintain the body's position over its base of support, whether the base is stationary or moving (Rogers et al. 2003). There are two types of balance: **static balance**, which is the ability to maintain balance during quiet standing; and **dynamic balance**, the ability to anticipate and react to changes in balance as the body moves. Individuals with good dynamic balance can remain balanced while walking and stepping over or around objects.

Among older adults, static balance is maintained until significant functional declines occur, but losses in dynamic balance are evident much earlier (Hageman, Leibowitz & Blanke 1995).

Factors That Influence Balance

Many research studies have shown that resistance training can improve strength in older adults. However, although strength and balance are related, resistance training alone has only a modest effect on improving balance, probably because the ability to maintain balance requires the successful integration of multiple components. Among these components are the following **sensory systems**, which are not typically affected by resistance training:

- the visual system, which provides information about a person's position and movement through the environment and identifies objects to step around or over
- the vestibular system, located in the inner ear, which provides information about head movement and the body's position in space
- the somatosensory system, which monitors the body's position and contact with other objects (including the floor) through muscle receptors that detect limb and body movement, and skin receptors that relay information about touch and vibration

Based on input (afferent signals) from the sensory systems, the brain sends messages (efferent signals) to the muscles, which then make the necessary adjustments to maintain balance. If any of these systems is impaired, the body's ability to maintain balance decreases and the risk of falling increases. As the sensory systems are affected by increasing age, their ability to perform their vital role in maintaining balance diminishes, negatively affecting balance control (Era et al. 1996).

Muscle strength is another factor that plays a role in balance and mobility. For example, deficits in leg strength are related to diminished gait velocity, stride length and balance (Sandler et al. 1991). In addition, declines in hip extensor power significantly affect the ability to perform functional activities, such as rising from a chair, climbing stairs and walking (Bassey et al. 1992). Increasing strength may not only offset some of these deficits but also modify other factors—such as postural control, proprioceptive input, range of motion and confidence—and thereby reduce the risk of falls (Brown, Sinacore & Host 1995).

Fitness professionals who work with older adults should design safe, effective exercise programs that target all the systems that control balance—specifically the visual, vestibular, somatosensory and musculoskeletal systems—collectively known as the **sensory-motor system**.

Training Recommendations

A basic premise of exercise science is that in order to improve the function of a system, an exercise must stimulate that system (i.e., the principle of specificity) and challenge it beyond what it is used to (i.e., the principle of overload). Unfortunately, at this time, the optimal amount, frequency and duration of exercise needed to improve balance is not clear. However, experts recommend incorporating balance into everyday activities and performing a balance-specific exercise program 2–3 days each week.

Older adults can incorporate balance training into their daily activities with simple measures, such as standing on one foot while washing dishes or brushing their teeth (doing this several times a day for 15 seconds each time). Having a sturdy object,

such as a table or a counter, nearby is important in case exercisers lose their balance. **Caution: Someone with poor balance should never exercise alone.**

To fulfill the recommendation for a balance-specific program 2–3 days a week, older adults can perform 2–3 sets of 8–10 exercises for 15–30 seconds each. (To progress, they would first increase the time of each exercise to 30 seconds, then the number of sets from 2 to 3.) Once this phase of the program has been mastered, challenge can be added gradually by reducing or changing the base of support, performing dynamic movements that perturb the center of gravity, and reducing sensory input. This is exactly the type of progression provided by Standing Strong, a program developed by researchers at the Center for Physical Activity and Aging at Wichita State University.

The Advantages of the Standing Strong Program

The Standing Strong program combines strength training with balance-specific exercises to target the muscular system and the three major sensory control systems that affect balance. Essentially, the program employs 5-foot elastic resistance bands and 2-inch-thick foam pads measuring 16 by 9 inches. The bands are used to enhance strength and incorporate dynamic movements into the program; and the foam pads provide an unsteady surface that challenges the body to maintain balance.

Implemented in several senior centers in the United States and Japan, this program has been shown to significantly improve strength and balance. (See "Research Findings" on this page) There are several advantages to the program:

- Older adults find the exercises challenging but enjoyable. They are motivated by the fact that they can immediately see how the exercises relate to daily activities.
- Group-oriented programs can be conducted in community centers or wellness facilities, providing participants with an opportunity to socialize.
- The equipment is inexpensive, easy to store and portable, so older adults can exercise at home during bad weather or on the road while traveling.
- Individuals can exercise at a level suitable to their ability and can progress at their own rate, since both bands and foam pads are available in color-coded levels of resistance and firmness, respectively. For example, seniors with poor balance can perform the activities on a firm floor using light resistance, while seniors with better balance can perform the same exercises standing on the foam pads and using higher resistance. As participants improve in strength and balance, they can increase the intensity by advancing to the next level (color) of challenge.
- Participants can use a suitable level of challenge for a particular body part. For example, since the legs tend to be stronger than the arms, a band with higher resistance can be used for the leg press and one with lower resistance can be used for the arm curl. When using foam pads, participants may choose a less stable surface when standing in a semi-tandem position and a more stable surface when standing in a more difficult position.
- The color coding system helps participants easily identify the appropriate piece of equipment for each exercise and switch quickly from one piece to another.

RESEARCH FINDINGS

We recently evaluated the effects of a 12-week intervention using the Standing Strong program with older adults (Rogers et al. 2003; Shores, Taylor & Rogers 2001). During the intervention period, participants performed several balance-specific exercises—shifting their body weight from foot to foot, standing on one foot, and standing with the feet in a series of positions, including side by side and heel to toe. They also closed their eyes and/or moved their heads to target the visual and vestibular systems. To progressively increase the difficulty of the exercises and target the somatosensory system, they performed the exercises while standing on foam pads. To enhance muscular strength, they performed a series of resistance band exercises for the upper and lower body.

Using computerized force-platform posturography to assess limits of stability (how far one can lean in a given direction without stepping), we observed improvements in the right, left and back directions—the very directions that are most associated with falls that result in hip fractures (Greenspan et al. 1998). As a result of the intervention program, limits of stability improved by 28% and 23% in the right/back and left/back directions, respectively. In the backward direction, there was a 63% improvement. The number of times a person could stand from a chair in 30 seconds increased by 17% (from 10.5 times to 12.3 times). In addition, strength and balance improved by approximately 20%.

No changes were observed in any of the balance or strength variables for the control group.

Assessment Tools

Several valid assessment tools focus on balance. These tools are designed to provide objective measurements used for screening, assessing baseline status, checking changes over time and determining the effects of interventions.

Prior to engaging in an exercise program, each client should be tested so that you are aware of any deficits or risks. For adults who appear to be healthy, are active and do not have a history of falls, a simple assessment process may identify any unsteadiness. For example, you might observe a client rising from a chair without using the chair's arms; walking several steps; and returning to the chair (American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons 2001). But for individuals at higher risk, including those who fall frequently, you should perform additional assessments and modify the program based on the results—for example, by avoiding head movements for individuals with vestibular disorders.

Sophisticated assessment methods, such as computerized force-platform posturography, may be used. However, many fitness facilities do not have the equipment needed for such methods. In place of them, several tools are available to allow you to quickly and accurately identify risk factors in older-adult clients.

One-Leg Balance Test. The client stands unassisted on one leg. Balance is scored by the number of seconds she can keep

the foot raised—or until she loses balance. The task is rated on a point scale from 0 to 4. If the client is unable to perform the task or needs assistance to prevent a fall, the score is 0. If she can lift the leg and stand independently for more than 10 seconds, her score is 4 (Berg et al. 1992).

Timed "Up-and-Go" Test. This test evaluates physical mobility (gait speed and agility), as well as dynamic balance. The participant sits in a standard armchair (seat height of approximately 18.4 inches). He is allowed to push off the sides or arms of the chair when getting up and can use any walking aid (e.g., a cane or walker) during the test if he normally uses one. On the signal "Go," he stands up as quickly as possible, walks as fast as possible (without running) around a cone placed 10 feet in front of the chair, and returns to a seated position. The participant is told the test is timed, and a "practice walk" is allowed. A stopwatch is used to record the time from the signal "Go" until the client returns to a seated position. A client who takes longer than 30 seconds has a high risk of falls and requires assistance (Podsiadlo & Richardson 1991). Any apparent balance or gait problems should also be noted.

Tinetti Performance-Oriented Mobility Assessment Test. This test requires the client to perform a series of activities: standing up from a chair, stepping forward, standing with the feet as close together as possible while you nudge the client by pushing lightly on her sternum, standing with the eyes closed, turning 360 degrees (with the eyes open), walking 25 feet at a normal speed, turning and walking back to the chair at a faster speed, and sitting down. The test can be conducted in less than 3 minutes and is scored from 0 to 28, with balance and gait subscores. Scores of less than 20 are associated with a fivefold increase in risk for falls. Results are generally very reliable and provide valuable information for detecting gait and balance problems (Tinetti 1986).

Berg Balance Scale. This assessment contains 14 items that simulate tasks commonly performed in everyday life (Berg et al. 1992). The test evaluates the participant's ability to perform movements of increasing difficulty. The client progresses from a sitting position to a bilateral stance to a tandem stance and then to a single-leg stance. Each task is graded on a scale of 0 to 4, and a total score of 56 can be achieved.

Safety Measures

In a program aimed at reducing the risk of falls in older adults, the last thing you want is for a participant to fall while performing exercises. Take the following precautions to prevent accidents:

- When leading a group class, ensure that each participant has a chair or other sturdy object nearby as a stability aid before performing any activity in a standing position.
- Make sure exercises are performed on a nonskid floor that is dry and free of clutter. Inspect the room before the start of each exercise session, and keep a sharp eye out for potential hazards during the session.
- Advise participants to wear shoes with good traction. Although the exercises can be performed without shoes to eliminate the stabilizing components of footwear, older adults often find it cumbersome to remove their shoes.
- Closely observe each participant's technique.
- Frequently remind participants to progress gradually.
- Advise clients with poor balance that they should never exercise alone.

A Promising Program

Older adults who take part in the Standing Strong program can improve both their strength and their balance—two of the most important factors for reducing their risk of falling. Although further research is needed to establish the optimal amounts and combinations of exercise, the Standing Strong program provides a simple, effective and enjoyable opportunity for older adults to participate in exercises that are promising in terms of preventing falls and keeping seniors more active for a longer period of time.

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