

Balancing on One Leg Reveals Important Clues About Your Neuromuscular Health

Analysis by [Dr. Joseph Mercola](#)

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STORY AT-A-GLANCE

- › A study conducted at the Mayo Clinic showed that balancing on one leg (unipedal stance) is a strong indicator of neuromuscular aging, with unipedal stance time declining more rapidly than gait or muscle strength as people age
- › The study emphasizes the importance of balance in maintaining independence, noting that gait parameters are not significantly affected by age, while strength declines are more pronounced in grip than knee strength
- › Balance is linked to a reduced risk of falls and improved quality of life, suggesting balance training as a preventive measure for age-related decline, and poor balance may indicate underlying health issues
- › While men have higher baseline strength than women, both genders experience similar rates of strength decline with age; grip strength decreased by 3.7% per decade, while knee strength decreased by 1.4%
- › Strategies to preserve mobility, maintain balance and combat muscle weakness as you age are included below

Aging doesn't just mean gaining years; it also affects both mental and physical abilities, especially neuromuscular functions like balance. Balance plays a pivotal role in daily life. It is not just about standing upright; it involves a complex interplay of sensory inputs and neuromuscular control.

Good balance allows you to perform everyday tasks with ease, from walking and climbing stairs to carrying groceries. As balance deteriorates with age, even simple movements will become challenging, leading to a decreased quality of life. It also increases your risk of falls, which leads to severe injuries.

In a comprehensive study conducted at the Mayo Clinic,¹ researchers examined how aging affects walking patterns, balance and muscle strength in individuals over the age of 50. They discovered that the ability to stand on one leg, known as unipedal stance, serves as an important indicator of neuromuscular aging and offers valuable insights for developing interventions to support older adults' mobility, independence and overall well-being.

Assessing Balance Is Key to Understanding Neuromuscular Health in Older Adults

Traditional methods for evaluating neuromuscular aging often include gait analysis and strength measurements. Gait analysis examines walking patterns, while strength tests measure muscle power. However, these methods might not fully capture the subtle changes in balance that indicate early signs of neuromuscular decline.

In contrast, unipedal stance time emerges as a simple yet effective test for assessing neuromuscular health.² The ability to stand on one leg demands the coordination of multiple sensory systems, including vision, the vestibular system and proprioception. These systems work together to maintain stability and adjust to any shifts in body position.

As individuals age, the efficiency of these sensory inputs and the neuromuscular control required for balance diminishes, leading to shorter durations of unipedal stance. Interestingly, the decline in unipedal stance time is shown to be more pronounced compared to changes in walking patterns or muscle strength. While gait speed and grip strength did decrease with age, they did so at a slower rate than balancing on one leg.

This indicates that unipedal stance time is a more sensitive and reliable indicator of neuromuscular aging. Moreover, unlike gait analysis or strength measurements, which require specialized equipment and trained personnel, balancing on one leg is easily performed anywhere without the need for advanced technology. This accessibility allows for frequent monitoring and early detection of neuromuscular decline.

Reduced Unipedal Stance Duration Linked to Age-Related Neuromuscular Changes

Published in the journal PLOS One,³ the featured study involved participants over the age of 50, who were asked to perform a series of balance tests, including standing on one leg for as long as possible with eyes open. This task was performed on both the dominant and non-dominant leg to capture any asymmetry in balance. During these tests, the researchers recorded unipedal stance duration, which was significantly influenced by age.

According to the results, participants' unipedal stance time declined by approximately 2.2 seconds per decade on their non-dominant leg and 1.7 seconds on their dominant leg. This rapid reduction highlights how neuromuscular function deteriorates as you grow older. The study also found that the decline in unipedal stance time was consistent across both men and women, despite inherent differences in muscle strength between the sexes. The authors concluded:⁴

"Unipedal stance time is a valid measure of frailty, independence and fall status, and proves to be a useful tool in identifying patients with peripheral neuropathy.

... The importance of balance, especially in unipedal stance, arises from the fact that it requires multiple sensory inputs and neuromuscular control, in addition to adequate muscle strength. This is why balance on one leg, as demonstrated in our study, undergoes the fastest decline in our healthy cohort, reflecting age-related declines in muscle strength ... and in the rapid coordination and integration of data by the central nervous system."

Moreover, while unipedal stance was the primary measure of neuromuscular aging in this study,⁵ researchers also examined bipedal stance to provide additional context on age-related stability changes.

During bipedal stance, participants were observed for shifts in their center of pressure (CoP), which increased with age. This increase in CoP movement indicates that even in a more stable two-legged stance, older adults must make more subtle adjustments to maintain their balance.

Poor balance could indicate underlying health problems that require attention. Conditions such as cardiovascular issues, neurological disorders or the side effects of certain medications can impair balance. Recognizing a decline in balance allows for early detection and treatment of these health concerns.

Understanding Age-Related Changes in Muscle Strength

While unipedal stance time showed no significant gender differences, the study⁶ did reveal differences in strength measures between men and women. Men showed significantly higher grip and knee strength compared to women across all age groups.

However, the rate of age-related strength decline was similar for both sexes, with grip strength decreasing by about 3.7% per decade, while knee strength decreased by about 1.4%.

These findings show that aging affects muscle strength regardless of gender, even though men start with greater baseline strength. This gradual loss of muscle strength impacts daily activities and overall mobility. According to the authors:⁷

“Muscle strength serves as an additional indicator of muscle quality and a predictor of various health concerns, such as disability and mortality. Unlike level walking or balance tests, maximal muscle strength evaluates the greatest capacity of the muscle, which declines with age. The grip strength test, a simple and reliable measurement has been recognized as a powerful predictor of disability, mortality, and morbidity.

The current study observed a significant decline in grip strength, which decreased at a faster rate than knee strength. This trend aligns with findings from a longitudinal study, where grip strength was reported to decline more rapidly than hip or knee strength. Hence, grip strength serves as a better predictor of musculoskeletal aging than other strength measures.”

Strategies to Maintain Balance and Mobility as You Age

The researchers stress the need for proactive measures to support aging populations.⁸ One strategy is to incorporate balance exercises into daily workout routines. Activities like yoga, tai chi and specific balance training strengthen the muscles and improve coordination.⁹ These exercises help maintain the efficiency of your neuromuscular system, making it easier to stay steady on your feet.

Regular balance training also effectively mitigates age-related neuromuscular decline.¹⁰ Consistent practice not only improves your brain’s ability to coordinate movements but also enhances muscle strength. This dual benefit means that balance training slows down the natural aging process of the neuromuscular system.

Simple activities also make a big difference when you incorporate them into your daily habits. Try standing on one foot while brushing your teeth, walking heel-to-toe like on a tightrope or practicing standing from a chair without using your hands. These quick activities are easy to integrate into daily routines, significantly improving your balance and supporting your ability to move confidently and independently as you age. Other balancing exercises to try include:

- 1. Stability ball exercises** — Sitting or kneeling on a stability ball challenges your core muscles and balance systems.
- 2. Ankle strengthening** — Strong ankles are crucial for stability. Try writing the alphabet with your foot while seated, or practice rising up on your toes while standing.

- 3. Dynamic balance exercises** – Try walking in different patterns – sideways, backward, or in a figure-eight – to challenge your dynamic balance.
- 4. Frog stand (Advanced)** – This balance exercise involves crouching down and placing your knees on your upper arms while leaning forward to lift your feet off the ground. This position strengthens your core, improves balance and coordination, and enhances overall body awareness. It's the one I do every day.

Additional Tips to Combat Age-Related Muscle Weakness

In addition to maintaining balance, preserving muscle mass and strength is essential for overall health and independence. Here are four effective strategies to help you maintain and even build muscle as you grow older:

- 1. Incorporate strength training into your routine** – Perform strength training exercises for 20 minutes twice a week on non-consecutive days or 40 minutes once a week. Focus on major muscle groups using weights or resistance bands. Consistent strength training helps reduce the risk of muscle atrophy, enhances your ability to perform daily activities and boosts your metabolism.¹¹
- 2. Prioritize proper posture** – Maintain a straight back, keep your lumbar area relatively flat and slightly protrude your buttocks. Good posture reduces the strain on your muscles and joints, decreases the risk of back pain and promotes better overall muscle function.
- 3. Stay active throughout the day** – Avoid prolonged periods of sitting by standing up and moving around every 15 minutes. Simple actions like walking, stretching or doing light exercises significantly improve your muscle health and reduce the risk of muscle loss.
- 4. Focus on functional movements** – Perform exercises that mimic real-life movements like squats, lunges and lifting. Functional movements build strength in ways that support daily activities. By practicing these types of exercises, you

strengthen not only isolated muscles but also improve coordination, stability, and balance, making everyday tasks easier and safer.

- 5. Optimize your protein intake** – This macronutrient is important for muscle maintenance and building muscles. For most adults, the ideal protein intake is 15% of daily calories. Make sure one-third of your total protein intake is collagen to ensure you're getting a healthy amino acid ratio.

Sources and References

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