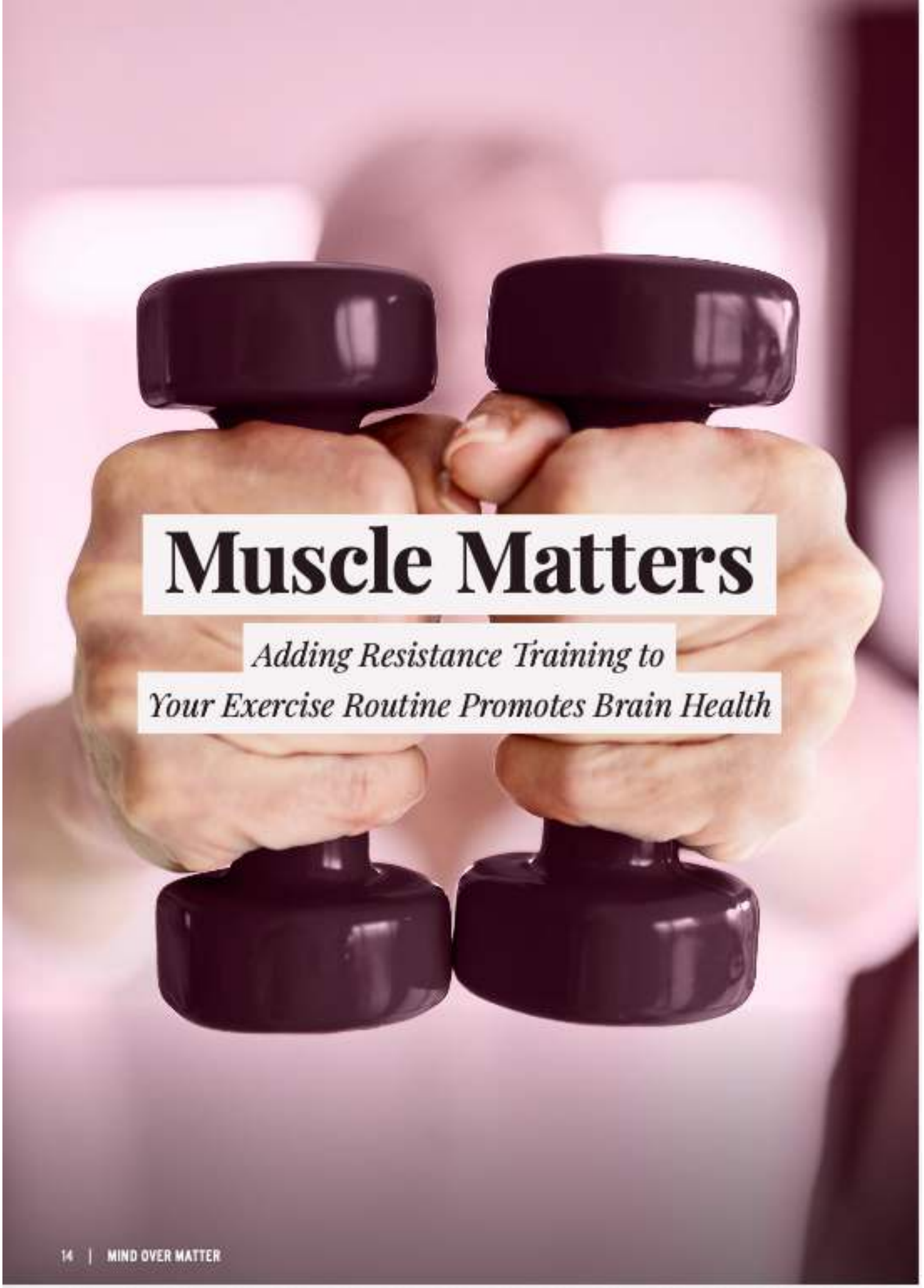


# Muscle Matters

*Adding Resistance Training to Your Exercise Routine Promotes Brain Health*

As part of her recent re-election campaign for Mayor of Toronto, 69-year-old Olivia Chow shared a "Day in the Life" video on Instagram, showing that she begins her day with cardiovascular exercise and resistance training. Staying fit helps her keep up with her busy work schedule and participate in activities like skiing and boxing with her grandkids.

***Exercise provides many brain health benefits. New research has revealed that the frequency and intensity of exercise sessions matter more than duration for brain benefits, and that women benefit more than men from frequent, brisk sessions.***

Studies on the brain health benefits of exercise typically include aerobic exercise and resistance training together, as physical activity guidelines recommend both. However, emerging research suggests that resistance training may be as important as, or even more impactful than, aerobic exercise in certain contexts, and that women may reap greater benefits than men.

## EXERCISE IS GOOD FOR THE BRAIN

Exercise improves cognitive function, functional connectivity, and brain volume, especially in the hippocampus. It is associated with a 30% to 60% lower risk of dementia and a consistent positive influence on executive function in longitudinal study.

Moderate-intensity exercise, the kind of activity that makes you breathe faster and break a sweat yet you can still talk, is significantly associated with improved executive function, memory, and working memory in adults over 50, according to a 2018 systematic review published in the *British Journal of Sports Medicine*.

But does frequency, intensity, or the length of exercise sessions matter more for brain health? Research led by Dr. Kaitlin Casaletto, an associate professor and researcher at the University of California, San Francisco, Weill Institute for Neurosciences and a clinical neuropsychologist at the UCSF Edward and Pearl Fein Memory and Aging Center, and colleagues, provided some interesting insights.

The study participants were healthy adults aged 40 and older without dementia. They underwent MRI scans and were monitored with Fitbits for 30 days while doing their usual fitness routines or following their typical non-exercise lifestyles.

Among 279 participants, 56% were women and 44% were men. The researchers defined an exercise session as at least 10 continuous minutes of any brisk activity, including aerobic exercise, resistance training, or purposeful walking. Of the results, Dr. Casaletto noted:

> **"OVERALL, PEOPLE WHO PERFORMED AT LEAST ONE EXERCISE SESSION WEEKLY HAD HEALTHIER WHITE MATTER IN THEIR BRAINS THAN NON-EXERCISERS. THE STRONGEST PREDICTORS OF BETTER BRAIN HEALTH WERE THE NUMBER OF WEEKLY EXERCISE SESSIONS AND HOW BRISKLY PEOPLE MOVED. THESE TWO FACTORS MATTERED MORE THAN TOTAL DAILY STEP COUNT OR SESSION LENGTH.**

Notably, women benefitted more from frequent, brisk exercise sessions, showing higher memory scores and greater improvements in white matter health than men did. The study was published in *Alzheimer's Research & Therapy* in March 2026.

"These findings aligned with our previous work: older people who regularly engaged in physical activity showed less brain inflammation and better synaptic signalling on post-mortem imaging, which are both related to a lower risk of Alzheimer's disease," Dr. Casaletto said.

## AEROBIC EXERCISE & RESISTANCE TRAINING

Dr. Laura Middleton, the Schlegel Research Chair in Dementia and Active Living, associate professor of kinesiology and health sciences at the University of Waterloo, and member of Women's Brain Health Initiative's expert panel, conducts studies that combine aerobic exercise and resistance training with other lifestyle interventions, such as healthy eating or cognitive training.

For example, in the SYNERGIC trial, she and her collaborators investigated the additive effects of 20 weeks of aerobic and resistance training combined with cognitive training and vitamin D supplementation on cognitive function in older adults with mild cognitive impairment (MCI). A little more than half of the 161 participants were women.

Dr. Manuel Montero-Odasso, professor in the Departments of Medicine and Epidemiology and Biostatistics at Western University and Director of the Gait and Brain Lab at Parkwood Institute at St. Joseph's Health Care London, ⊕

## DIFFERENT TRAINING TYPES

According to the National Academy of Sports Medicine, resistance training is a form of exercise that increases muscle strength and endurance by exercising it against external resistance, such as your body weight or equipment like bands or dumbbells.

**When resistance training is challenging and progressive over time, your muscles benefit in various ways:**

- **improved stability** around joints and ability to move with a healthy range of motion;
- **better endurance in producing force** over long periods;
- **increased muscle size,** called hypertrophy;
- **improved strength,** the ability to overcome an external force; and
- **better power,** the ability to produce the greatest force possible in the shortest amount of time.

led the SYNERGIC trial. Dr. Middleton and Dr. Teresa Liu-Ambrose at the University of British Columbia were co-principal investigators. The study results were published in *Age and Ageing* in September 2025.

> **EVERYONE IN THE EXERCISE GROUP TOOK PART IN AEROBIC AND RESISTANCE TRAINING. COGNITIVE BENEFITS WERE GREATER WHEN EXERCISE WAS COMBINED WITH COGNITIVE TRAINING THAN EITHER ALONE. SURPRISINGLY, ADDING VITAMIN D HAD A NEGATIVE EFFECT ON GAIT, RAISING A QUESTION ABOUT ITS VALUE IN IMPROVING MOBILITY AND PREVENTING FALLS IN OLDER ADULTS WITH MCI.**

In another trial, the Lifestyle, Exercise, and Diet (LEAD 2.0) study, Dr. Middleton and her team are assessing the feasibility of delivering a six-month program of aerobic exercise and resistance training, together with instruction in healthy eating choices, in a virtual format.

The study includes 140 adults over 65 with no objective cognitive impairment on standard tests such as the Montreal Cognitive Assessment, but who have subjective cognitive decline (SCD). SCD involves noticing memory or thinking becoming worse and causing worry. It is associated with a two-times greater risk of future dementia.

The researchers are randomly assigning participants to four hours of aerobic and resistance training or to stretching and toning, plus either diet counselling or brain health education, once weekly for six months.

If this study finds that the virtual format works well in terms of recruiting and engaging participants, the research team will pursue fielding a larger trial that will assess whether this training model can provide brain health benefits for people with SCD. Longer-term, the virtual program could be scaled up quickly, making it accessible to a broad range of people at risk of dementia.

## RESISTANCE TRAINING – BOTH SEXES

High-intensity, progressive resistance training resulted in significant improvements in cognitive function, muscle strength, and aerobic capacity in older adults with MCI, according to a randomized controlled trial from Australia that was published in the *Journal of the American Geriatrics Society* in 2017.

The study included 68 women and 32 men aged 55 and older with MCI. They were randomly assigned to participate in resistance and cognitive training or sham interventions, two to three days per week for six months.

The improvements in cognition were causally related to gains in muscle strength, suggesting that building muscle strength is essential for protecting brain health. Interestingly, gains in aerobic capacity were not associated with cognitive benefits in this study.

Unfortunately, the researchers did not report results separately for women versus men.

## RESISTANCE TRAINING BENEFITS FOR WOMEN

In 2010, Dr. Teresa Liu-Ambrose published the first trial that investigated the impact of resistance training on cognitive and brain outcomes exclusively in cognitively healthy older women aged 65 to 75. The results were published in the *Archives of Internal Medicine*.

Dr. Liu-Ambrose is a physical therapist, Professor, Tier I Canada Research Chair in Healthy Aging and Director of the Aging, Mobility, and Cognitive Health Laboratory at

the University of British Columbia. She is also Director of the Vancouver General Hospital Falls Prevention Clinic and Co-Director of Aging SMART at Vancouver Coastal Health. She noted that:

> ***Resistance training performed once or twice weekly had some robust positive effects on executive function. Additionally, twice weekly resistance training slowed the progression of cerebral small vessel disease that we found in imaging in a small subset of asymptomatic women.***

Most recently, Dr. Liu-Ambrose and colleagues replicated these findings in another randomized controlled trial, this time in women and men with MCI due to cerebral small vessel disease, known as subcortical vascular cognitive impairment (SCVI).

"Most people with AD also have an additional pathology and that's often in the form of cerebral small vessel disease that we can see on brain imaging," said Dr. Liu-Ambrose.

In the study, 89 people with SCVI over the age of 55 (average age 75) were randomly assigned to participate in progressive resistance training or a balance-and-toning exercise program twice weekly for 12 months. There were 30 women and 14 men in the resistance training group, and 28 women and 17 men in the balance and toning group.

The trial results, as published in *Alzheimer's & Dementia* in March 2026, showed that resistance training improved cognitive assessment scores, and that women with SCVI seemed to benefit more than their male counterparts.

"While a lot more research is needed to explain why women benefited more than men, the answer may lie in differences in vascular and muscle health," said Dr. Liu-Ambrose.

> **BEFORE MID-LIFE, MEN HAVE HIGHER CARDIOVASCULAR RISK FACTORS THAN WOMEN, BUT WOMEN'S CARDIOVASCULAR ADVANTAGE DISAPPEARS AFTER MENOPAUSE, AND THEIR RISK RISES SIGNIFICANTLY WITH THE LOSS OF ESTROGEN. ALSO, BECAUSE WOMEN TEND TO HAVE A LOWER MUSCLE MASS, THEY MAY POSSESS A GREATER CAPACITY TO RESPOND TO RESISTANCE TRAINING THAN MEN.**

## SEX DIFFERENCES IN MUSCLE LOSS WITH AGING

The amount of lean muscle mass has a direct impact on survival in healthy adults and in those with chronic conditions.

With aging, a gradual, progressive loss of muscle mass, strength, and function may result in a condition called **sarcopenia**.

**Sarcopenia** differs between sexes due to differences in muscle composition. Generally, women have less muscle mass and more slow-twitch fibres than men. (Slow-twitch fibres are specialized, fatigue-resistant cells designed for endurance.) Conversely, men have a higher total muscle mass and more fast-twitch fibres.

As a result of these biological differences, age-related sarcopenia affects women and men differently: Men tend to lose more muscle mass than women, whereas women tend to lose more strength and quality of movement, leading to higher risks of frailty and falls compared to men.

In both sexes, sarcopenia can be slowed or reversed by resistance training in combination with a nutrition plan that includes increasing protein intake.

**Myosteatosis**, another age-related muscle condition, involves an increase in fat infiltration. "Muscle quality also matters as we age. As fatty infiltration increases over time, it promotes inflammation, leads to insulin resistance, and likely reduces the ability of muscles to send beneficial signals to the brain," said Dr. Liu-Ambrose. "Resistance training is excellent for slowing myosteatosis."

A separate study, led by researchers at the Latin American Brain Health Institute in Santiago, Chile, recently found that moderate and heavy resistance training significantly reduced brain age by about 1.5 to 2.3 years in older adults compared to non-exercisers. The benefits were seen across the whole brain, according to resting-state functional magnetic resonance imaging (fMRI). Women represented about 60% of the study's participants. The results were published in *GeroScience* in February 2026.

## MUSCLE-BRAIN CROSSTALK

Your brain sends messages to your muscles that result in movement. But your muscles also actively communicate with your brain.

In a review of "muscle-brain crosstalk," published in *GeroScience* in August 2025, Dr. Liu-Ambrose and co-authors explained that muscles release two chemical messengers that cross the blood-brain barrier:

- **Myokines** are proteins released by muscles, especially during exercise. Several types of myokines are linked to brain health, including irisin, which may help protect the brain from AD-related processes; cathepsin B, which promotes the growth of new brain cells and may help clear amyloid; and brain-derived neurotropic factor, which supports memory and brain cell survival.

- **Extracellular vesicles** (EVs) are little packets that carry substances from muscles to the body and brain. Animal studies have found that young, healthy EVs play a role in muscle regeneration and brain function, and that their beneficial cargo decreases with aging.

## TIPS FOR GETTING STARTED WITH RESISTANCE TRAINING

"Multiple meta-analyses show that resistance training must be challenging and progressive over time to have an impact. When it's performed correctly, resistance training is safe for older adults, including those with osteoporosis, because it improves bone health and reduces the risk of falls," said Dr. Liu-Ambrose.

"Studies show that people in their 90s can benefit from resistance training, even if those benefits are not as plentiful or as quick as for women in their 20s," said Dr. Middleton. "Consult with your physician if you are considering adding resistance training to your fitness regimen. After that, a simple way to start is with five basic functional exercises: a squat, a lunge, a push, a pull, and a carry exercise."

Dr. Liu-Ambrose recommended adding a sixth starting exercise: a sit-to-stand and sit back down again.

Dr. Middleton advised a good place to start is ParticipACTION's online resource at **www.participaction.com/blog/workout/functional-training-exercises**. If you are concerned about technique, she suggested scheduling an appointment with a personal trainer.

For those who prefer cardio to resistance training when pushed for time, Dr. Middleton offers this advice:

> ***"Resistance training can produce a 'feel-good' rush in the brain like cardio. For me, resistance training has the quickest impact on my well-being because my posture changes immediately and improves how I move through my day. Initial muscle soreness when you first add resistance training to your fitness regimen subsides within a few weeks."***

The experts agree: It's never too late to get started with resistance training. Keeping your muscles healthy is one of the best things you can do for your brain, not just your body.

BrainFit – Free Habit Tracker®, our free mobile app, can help you stay fit and prolong your cognitive vitality. It guides you to set goals based on the Six Pillars of Brain Health – exercise, nutrition, sleep, mental stimulation, social activity, and stress management – and allow you to track your progress. The app includes personal challenges, hundreds of tips, and articles on the latest scientific evidence. BrainFit® is available for both iOS and Android devices. Visit **BrainFit.org** for more information.