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The Importance of Muscle in Healthy Aging

Analysis by Dr. Joseph Mercola ✔ Fact Checked | November 23, 2022

STORY AT-A-GLANCE

- The older you get, the more important your muscle mass becomes. Not only are strong muscles a requirement for mobility, balance and the ability to live independently, but having reserve muscle mass will also increase your chances of survival during illness and hospitalization
- Age-related loss of muscle mass is known as sarcopenia, and if you don't do anything to stop it you can expect to lose about 15% of your muscle mass between your 30s and your 80s
- While declines in muscle mass and strength are relatively well-synchronized in the 35- to 40-year-old group, strength dramatically drops off as you get into the 75-year-old and over groups, with 85-year-olds seeing dramatic declines in strength and function relative to the decline in muscles size
- Research shows the strongest one-third of the population over 60 have a 50% lower death rate than the weakest
- Research shows aerobic exercise in isolation reduces your all-cause mortality by 16% and strength training-only reduces it by 21%, whereas if you do both, you reduce your all-cause mortality by 29%

The older you get, the more important your muscle mass becomes. Not only are strong muscles a requirement for mobility, balance and the ability to live independently, but having reserve muscle mass will also increase your chances of survival[1] when sick or hospitalized.

Muscle is lost far more easily and quicker than it's built, so finding ways to continuously promote and maintain your muscle mass is really crucial, especially as you get older.

Age-related loss of muscle mass is known as sarcopenia, and if you don't do anything to stop it you can expect to lose about 15% of your muscle mass between your 30s and your 80s.[2] An estimated 10% to 25% of seniors under the age of 70 have sarcopenia and as many as half those over the age of 80 are impaired with it.[3]

In the lecture above, Brendan Egan, Ph.D., associate professor of sport and exercise physiology at the School of Health and Human Performance and the National Institute for Cellular Biotechnology at Dublin City University in Ireland, reviews the latest research on exercise training for aging adults, which places a significant focus on building and maintaining muscle, and the nutritional components that can help optimize training results.

Muscle Strength and Function in Relation to Muscle Size

While it's true that larger muscle is indicative of stronger, more functional muscle, it's not a true 1-to-1 relationship. As noted by Egan, "you can have situations where you can gain back function without necessarily gaining muscle size." To illustrate this point, Egan presents data from the Baltimore Longitudinal Study of Aging, which looked at leg strength and lean muscle mass.

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Speed as a Measure of Functional Muscle Capacity

One way to measure functional capacity in older adults is gait (walking) speed, which is a strong predictor of life expectancy. Data suggest that if you have a walking speed of

1.6 meters (about 5.2 feet) per second (approximately 3.5 mph) at the age of 65, your life expectancy is another 32 years, meaning you may live into your late 90s.

Having a walking speed at or below the cutoff for sarcopenia, which is 0.8 meters (about 2.6 feet) per second, your life expectancy would be another 15 years, which means you'd be predicted to live to 80. At this speed, you would not be able to make it safely across a typical pedestrian crossing before the light changes to red.

Strength as a Predictor of Survival

Strength can also tell us a lot about an individual's chances of survival. Egan presents data from a study in which people's chest and leg press strength were measured to arrive at a composite score of whole body strength. The pattern is quite revealing, showing the strongest one-third of the population over 60 had a 50% lower death rate than the weakest.

Exercise guidelines recommend getting 150 minutes of aerobics exercise and two strength training sessions per week. As noted by Egan, you need both. It's not just one or the other.

Research shows aerobic exercise in isolation reduces your all-cause mortality by 16% and strength training-only reduces it by 21%, whereas if you do both, you reduce your all-cause mortality by 29%.[4] Disturbingly, U.K. data suggest only 36.2% of adults over the age of 30 meet aerobic guidelines, and a minuscule 3.4% meet strength training guidelines.

Part of the problem may be that many don't want to go to the gym. But there's little difference between doing gym-based strength training and doing bodyweight resistance training at home.

The Danger of Bedrest and Disuse Atrophy

As noted by Egan, enforced bedrest, such as acute hospitalization, can have a dramatic impact on your muscle mass. For example, a 2015 review[5] in Extreme Physiology & Medicine notes you can lose 2.5% of your muscle mass in the first two weeks of bedrest. By Day 23, you can have lost up to 10% of your quadriceps muscle mass. As explained in this review:[6]

> *"Skeletal muscle mass is regulated by a balance between MPS [muscle protein synthesis] and MPB [muscle protein breakdown]. In a 70-kg human, approximately 280 g of protein is synthesized and degraded each day.*
>
> *The two processes are linked … as facilitative or adaptive processes, whereby MPS facilitates (allows modulation of muscle mass) and MPB adapts (limiting said modulation).*
>
> *When exposed to an anabolic stimulus, MPS rises. MPB rises too, but to a lesser amount, resulting in a net synthetic balance. In response to an anti-anabolic stimulus, MPS decreases and MPB decreases to a lesser degree, resulting in a net breakdown.*
>
> *The interaction between critical illness and bed rest may result in greater muscle loss compared to bed rest alone. The musculoskeletal system is a highly plastic and adaptive system, responding quickly to changing demands. Relatively short periods of immobilization decrease MPS, with no effect on MPB.*
>
> *Furthermore, this altered balance is relatively resistant to high dose amino acid delivery … Immobilization has significant effects on peripheral muscle aerobic capacity, contractility, insulin resistance and architecture.*
>
> *Microvascular dysfunction occurring in severe sepsis is associated with immobilization and may have an additive effect on reducing MPS. In critically ill patients, MPS is reduced even with nutritional delivery, with increased MPB seen, leading to a net catabolic state and thus muscle wasting."*

Research[7] has shown even healthy young subjects in their 20s can lose 3.1 pounds of muscle mass in a single week of bedrest. This is why it is so important to have a reserve in case you wind up in the hospital and lose this much muscle mass. It may take you the better part of a year to regain that muscle, as gaining muscle mass is hard work and many elderly fail to do so.

The loss of muscle mass also significantly decreases your insulin sensitivity. One of the reasons for this has to do with the fact that muscle tissue is a significant reservoir for the disposal of glucose. Your muscle tissue also produces cytokines and anti-inflammatory myokines that play an important role in health.

Concurrent Exercise Training

While three to five sessions of aerobic exercise and two or more strength sessions per week may sound like a lot, for many, the lack of time is a restricting factor. However, some of these sessions can be done together. "That's called concurrent exercise training," Egan says.

He goes on to cite research looking at time matched concurrent exercise in the elderly, 65 and older, where an aerobic training group and a strength training group were compared to a group that spent half of their session doing aerobic exercise and the other half doing resistance training. All groups spent the same overall time exercising (30 minutes, three times a week for 12 weeks).

In terms of leg strength, the concurrent training group had better responses to training than aerobic or strength training alone. There was little difference in lean body mass, meaning they didn't necessarily bulk up, but they had a 50% increase in strength nonetheless. They also lost more body fat around the trunk area. In short, concurrent training appears to give you more bang for your buck.

Blood Flow Restriction Training

One of the reasons I'm so passionate about blood flow restriction (BFR) training is because it has the ability to prevent and widely treat sarcopenia like no other type of training.

There are several reasons why BFR is far superior to conventional types of resistance training in the elderly. Importantly, it allows you to use very light weights, which makes it suitable for the elderly and those who are already frail or recovering from an injury. And, since you're using very light weights, you don't damage the muscle and therefore don't need to recover as long.

While most elderly cannot engage in high-intensity exercise or heavy weightlifting, even extraordinarily fit individuals in their 60s, 70s and 80s who can do conventional training will be limited in terms of the benefits they can achieve, thanks to decreased microcirculation. This is because your microcirculation tends to decrease with age.

With age, your capillary growth diminishes, and capillary blood flow is essential to supply blood to your muscle stem cells, specifically the fast twitch Type II muscle fiber stem cells. If they don't have enough blood flow — even though they're getting the signal from the conventional strength training — they're not going to grow and you're not going to get muscle hypertrophy and strength.

BFR, because of the local hypoxia that is created, stimulates hypoxia-inducible factor-1 alpha (HIF1a) and, secondarily, vascular endothelial growth factor (VEGF), which acts as "fertilizer" for your blood vessels. VEGF allows your stem cells to function the way they were designed to when they were younger.

What's more, the hypoxia also triggers vascular endothelial growth factor, which enhances the capillarization of the muscle and likely the veins in the arteries as well. Building muscle and improving blood vessel function are related, which is why BFR offers such powerful stimulus for reversing sarcopenia.

In short, BFR has a systemic or crossover training effect. While you're only restricting blood flow to your extremities, once you release the bands, the metabolic variables

created by the hypoxia flow into your blood — lactate and VEGF being two of them — thereby spreading this "metabolic magic" throughout your entire system.

Nutrition for Muscle Maintenance

It should come as no surprise that there is an important synergy between nutrition and exercise. When it comes to muscle building and maintenance, amino acids, the building blocks of protein, are of particular importance.

In the podcast above, Megan Hall, scientific director at Nourish Balance Thrive delves into this topic at greater depth and reviews the current recommended daily allowances of protein compared to the optimal levels needed to support muscle mass and strength in at various life stages.[8]

Research[9] looking at post-prandial protein handling and amino acid absorption shows 55.3% of the dietary protein of a given meal is in circulation within five hours after eating, which significantly increases muscle protein synthesis.

Research[10] suggests healthy young adult men "max out the protein synthesis signal from a given meal" at a dose of 0.24 grams of protein per kilogram of total bodyweight, or 0.25 grams of protein per kilogram of lean body mass.

The current U.S.-Canadian recommended dietary protein allowance is 0.8 g/kg/d (0,36/grams/pound/day), but healthy older adults may actually require about 1.20 g/kg/d or .55 grams/pound/day. According to this study:[11]

> *"Our data suggest that healthy older men are less sensitive to low protein intakes and require a greater relative protein intake, in a single meal, than young men to maximally stimulate postprandial rates of MPS [myofibrillar protein synthesis].*
>
> *These results should be considered when developing nutritional solutions to maximize MPS for the maintenance or enhancement of muscle mass with advancing age."*

Amino acids also act as signaling molecules that trigger muscle growth. **Leucine** is a particularly potent signaling agent, although all of the amino acids are required to actually build the muscle. The richest source of leucine (which helps regulate the turnover of protein in your muscle), by far, is whey protein. In fact, it can be difficult to obtain sufficient amounts of leucine from other sources.

The typical requirement for leucine to maintain body protein is 1 to 3 grams daily. However, to optimize its anabolic pathway, research shows you need somewhere between 8 and 16 grams of leucine per day, in divided doses.[12,13]

To reach the 8-gram minimum, you'd have to eat nearly 15 eggs.[14] Eighty grams of whey, on the other hand, will give you 8 grams of leucine.[15]

Time-Restricted Eating Adds Benefits

One of the problems with Egan is that he's not very literate on time-restricted eating. During the question and answer portion, an audience member asks him about it and he admits he hasn't studied it.

This is important because restricting your eating window to six to eight hours, which means you're fasting 14 to 18 hours each day, would make it far easier for each of the meals to be over the leucine threshold. It will also activate autophagy, which is another factor essential for optimal muscle growth.

Autophagy is a self-cleaning process in which your body digests damaged cells, which in turn encourages the proliferation of new, healthy cells. The harder your workout, the more autophagy you will activate.

So, I recommend fasting for as long as you can before your morning workout, and then, shortly thereafter, have your largest meal of the day with plenty of high-quality protein, making sure you get several grams of leucine and arginine, both of which are potent mTOR stimulators.

The mTOR pathway is an important key for protein synthesis and muscle building. As explained in David Sabatini's excellent review paper "mTOR at the Nexus of Nutrition, Growth, Ageing and Disease," published in Nature Reviews Molecular Cell Biology:[16]

> *"Over the past two and a half decades, mapping of the mTOR signaling landscape has revealed that mTOR controls biomass accumulation and metabolism by modulating key cellular processes, including protein synthesis and autophagy.*
>
> *Given the pathway's central role in maintaining cellular and physiological homeostasis, dysregulation of mTOR signaling has been implicated in metabolic disorders, neurodegeneration, cancer and ageing."*

In summary, fasting activates autophagy, allowing your body to clean out damaged subcellular parts. Exercising while fasted maximizes autophagy even further. In fact, exercising while you are fasting for more than 14 to 18 hours likely activates as much autophagy as if you were fasting for two to three days. It does this by increasing AMPK, increasing NAD+ and inhibiting mTOR.

Refeeding with protein after your fasted workout then activates mTOR, thus shutting down autophagy and starting the rebuilding process. These two processes need to be cyclically activated to optimize your health and avoid problems.

Muscle Health Is Central to an Active Lifestyle

As noted by Egan, "Hopefully I've convinced you that muscle health is central to active lifestyles. There's been this increased awareness of muscle size, but I think we need to emphasize the idea about strength and function. These are the things that are easiest to change with the right type of training."

In short, if you want to increase muscle size and strength, then there's no getting around resistance training. It simply must be part of your exercise prescription, and concurrent training, where you're combining aerobic and strength training in a given session is a time-efficient model.

BFR is also a particularly excellent way to ensure you're getting effective strength training without the risks of conventional strength training using heavy weights, and is easy to combine with exercises such as walking and swimming. You simply wear the BFR bands while walking or exercising as normal.

Defy Aging by Improving Your Muscle Mass

In my February 2020 interview with Ben Greenfield, author of "Boundless: Upgrade Your Brain, Optimize Your Body & Defy Aging," we discuss the importance of strength training and getting the appropriate amount of protein to build and maintain your muscle mass and optimize mitochondrial density and biogenesis.

In summary, Greenfield recommends a fitness program that includes the following types of exercise in order to target the main pathways involved in health and aging:

- **High-intensity interval training once a week to boost mitochondrial density and biogenesis —** Brief spurts of exercise followed by longer rest periods. Greenfield recommends a 3-to-1 or 4-to-1 rest-to-work ratio.
- **Muscle endurance training two to three times a week to improve lactic acid tolerance —** An example is the classic Tabata set, which has a 2-to-1 work-to-rest ratio.
- **Longer training sessions twice a week to improve your VO2 max —** To target and improve your VO2 max, you'll want your training sessions to be longer, about four to six minutes in duration with four to six minutes of recovery in between, for a 1-to-1 work-to-rest ratio.

  Examples include The New York Times' seven-minute workout[17] and bodyweight training done in a fast explosive manner or with a very light medicine ball, sandbag or kettle bells.
- **Long walk once a week to improve your stamina —** Greenfield recommends taking a 1.5- to three-hourlong walk, bike ride or paddle session — anything where your body

is engaged in chronic repetitive motion for a long period of time — preferably in a fasted state. Alternatively, do 20 to 30 minutes of fasted cardio followed by a cold shower.

- **Super-slow weight training once or twice a week to improve muscle strength —** Alternatives include elastic band training systems and blood flow restriction (BFR) training. You can also combine BFR with super-slow training.

Sources and References

- [1] Curr Opin Clin Nutr Metab Care. 2012 Jan; 15(1): 7–11
- [2] J Gerontol A Biol Sci Med Sci. 1995 Nov;50 Spec No:5-8
- [3] Journal of Gerontology: Series A October 2003; 58(10): M911-M916
- [4] Youtube, Brendan Egan, Muscling in on Aging2, 10:25 minutes
- [5, 6] Extreme Physiology & Medicine 2015; 4: 16
- [7] Diabetes 2016 Oct;65(10):2862-75
- [8] Nourish Balance Thrive February 21, 2020
- [9] PLOS ONE November 10, 2015 DOI: 10.1371/journal.pone.0141582
- [10, 11] J Gerontol A Biol Sci Med Sci. 2015 Jan;70(1):57-62
- [12] American Journal of Clinical Nutrition, July 2017 Media Alert (PDF)
- [13] American Journal of Clinical Nutrition July 2017;106(1):12-13
- [14, 15] Sports Dietitians Australia
- [16] Nat Rev Mol Cell Biol January 14, 2020 DOI: 10.1038/s41580-019-0199-y
- [17] The New York Times 7-minute workout