

SARCOPENIA AS MUSCLE ATROPHY BY AGING

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ABSTRACT

Sarcopenia is a loss of muscle mass and function in the elderly that reduces mobility, diminishes quality of life, and can lead to fall-related injuries, which require costly hospitalization and extended rehabilitation. It is the decline of skeletal muscle tissue with age, is one of the most important causes of functional decline and loss of independence in older adults. It represents a loss of muscle strength and mass in older individuals and is a major determinant of fall risk and impaired ability to perform activities of daily living, often leading to disability, loss of independence and death. It affects your musculoskeletal system and is a major factor in increased frailty, falls and fractures. These conditions can lead to hospitalizations and surgeries, which increase the risk of complications including death. Focusing on muscle strength as the key component of sarcopenia, the aim of this overview was to evaluate its links to nutrition, both to variation in habitual diets in older populations, as well as considering supplementation effects in trials.

KEYWORDS: Leucine, Ursolic acid, Vitamin D, Vitamin E, Omega-3 fatty acid, DHEA.

Overview: Sarcopenia is the age-related progressive loss of muscle mass and strength. The main symptom of the condition is muscle weakness. Sarcopenia is a type of muscle atrophy primarily caused by the natural aging process. Scientists believe being physically inactive and eating an unhealthy diet can contribute to the disease. The primary treatment for sarcopenia is exercise, specifically resistance training or strength training. These activities increase muscle strength and endurance using weights or resistance bands. Resistance training can help your neuromuscular system, hormones.^[1-5]

Muscle Weakness.
Slow Walking Speed.
Self-Reported Muscle Wasting.
Difficulty Performing Normal Daily Activities.

Types of exercises

Push-ups on a counter.
Seated chair push-ups.
Squats with chair touch.
Step ups.
Standing shoulder rows with anchored resistance.

Symptoms

Falling.

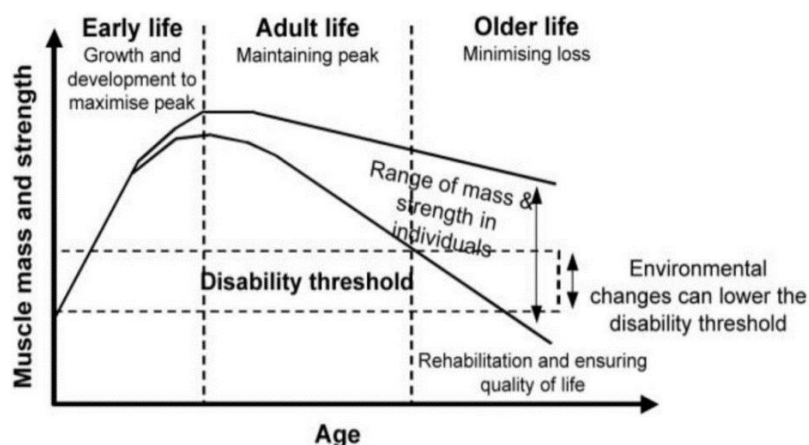


Figure-1: Sarcopenia graph.

Sarcopenia is defined as generalized and progressive age-related loss of skeletal muscle mass, muscle strength and physical performance below a defined threshold. In sarcopenia skeletal muscle mass - the largest body organ - is failing in its function and the term "muscle failure" was suggested.^[6-10]

Sarcopenia is a type of muscle loss (muscle atrophy) that occurs with aging and/or immobility. It is characterized by the degenerative loss of skeletal muscle mass, quality, and strength. The rate of muscle loss is dependent on exercise level, co-morbidities, nutrition and other factors. The muscle loss is related to changes in muscle synthesis signaling pathways. It is distinct from cachexia, in which muscle is degraded through cytokine-mediated degradation, although both conditions may co-exist. Cachexia is a complicated metabolic syndrome related to underlying illness and characterized by muscle mass loss with or without fat mass loss that is often associated with

anorexia, an inflammatory process, insulin resistance, and increased protein turnover.^[11-16] Sarcopenia is considered a component of frailty syndrome. It can lead to reduced quality of life, falls, fracture, and disability. This is a factor in changing body composition associated with aging populations; and certain muscle regions are expected to be affected first, specifically the anterior thigh and abdominal muscles. In population studies, body mass index (BMI) is seen to decrease in aging populations while bioelectrical impedance analysis (BIA) shows body fat proportion rising. To minimize the risk of sarcopenia, females should keep their BMI over 18.5 kg/m², as well as BF% [body fat] between 26.0% and 34.6%. In males, higher BMI and BF% less than 23.9% were recommended. The term sarcopenia is from Greek: sarx [flesh, body, the soft tissue of a creature, often in contrast to bone, ligament, or sinew] and penia [poverty].^[17-20]



Figure-2: Sarcopenia inventor.

This was first proposed by Rosenberg in 1989, who wrote that "there may be no single feature of age-related decline that could more dramatically affect ambulation, mobility, calorie intake, and overall nutrient intake and status, independence, breathing, etc." Clinical rehabilitation impact: Increasing the number of steps walked per day may reduce the risk of developing sarcopenia in older people. The sarcopenia index (SI)—(serum creatinine value/cysteine C value) × 100—is a novel blood test to approximate muscle mass. We sought to validate SI among lung transplant patients. The significant effect of sarcopenia prevention was found in BMI 25–29.5 group in male (p = 0.02), and BMI ≥ 30 in female (p = 0.001). BMI <18.5 increased the risk of sarcopenia in female (p = 0.05). Vitamin D status acts as a useful biomarker for predicting total mortality, hip fractures, early death, and the development of sarcopenia.^[21-24]

Dr. Irwin Rosenberg [Born: January 6, 1935 in Madison, Wisconsin, United States] is University Professor of Nutrition and Medicine at Tufts University's USDA Human Nutrition Research Center on Aging (HNRCA) and the Friedman School of Nutrition Science and Policy. A lot of studies showed that a Mediterranean dietary pattern or a diet with a predominant intake of vegetables, fruits, protein from legumes and omega-3

fatty acids might have the potential to reduce the risk of sarcopenia among older adults. Studies show sarcopenia can be reversed, and muscle loss decreased. A healthy diet and reasonable exercise can reverse sarcopenia, which increases lifespan and improve quality of life. Vitamin D may be protective for muscle loss; a more alkalinogenic diet and diets higher in the anti-oxidant nutrients vitamin C and vitamin E may also prevent muscle loss. Vitamin D [CAS: 67-97-0; IUPAC: (3S,5Z,7E)-9,10-secocholesta-5,7,10(19)-trien-3-ol], Vitamin E [CAS: 59-02-9; IUPAC: (2R)-2,5,7,8-Tetramethyl-2-[(4R,8R)-4,8,12-trimethyltridecyl]-3,4-dihydro-2H-1-benzopyran-6-ol] and leucine-rich whey protein enhances lean body mass and muscle function in sarcopenic older adults. Ursolic acid [CAS: 77-52-1; IUPAC: 3β-Hydroxyurs-12-en-28-oic acid] is a phytochemical abundant in apple and has been reported to enhance muscle mass and function in various muscle atrophy animal models. Pea protein is another promising option. One study found it to be nearly equivalent to whey protein. Leucine [CAS: 61-90-5; IUPAC: 2-Amino-4-methylpentanoic acid] supplementation can significantly increase muscle mass in the elderly and works particularly well in people with sarcopenia.^[25-28]

Natural Sarcopenia Treatment

Exercise. The adoption of a more sedentary lifestyle is the worst choice to make when it comes to warding off sarcopenia.

Increase Overall Dietary Protein.

Choose Protein Wisely.

Omega-3s.

Hormone Balance.

Vitamin D.

Increase Anti-Inflammatory Foods.

Decrease Pro-Inflammatory Foods.

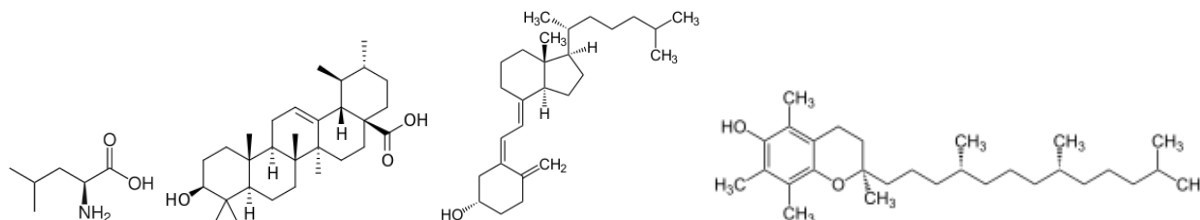


Figure-3: Leucine, Ursolic acid, Vitamin D, Vitamin E.

Exercise: The adoption of a more sedentary lifestyle is the worst choice to make when it comes to warding off sarcopenia. “Without question, exercise is the most powerful intervention to address muscle loss, whether it occurs in the context of advancing age or debilitating chronic or acute diseases”. When it comes to sarcopenia, exercise has been shown to increase strength, aerobic capacity and muscle protein synthesis, as well as to increase muscle mitochondrial enzyme activity in both young and older people.^[29-32] Resistance exercise, in particular, has been shown to decrease frailty and improve muscle strength in very elderly adults. Exercise is recommended on most days of the week, but a minimum of three times per week is recommended to slow muscle loss and prevent sarcopenia, which is one of the biggest benefits of exercise as we age.

Increase Overall Dietary Protein: Protein is the most valuable food for repairing and building muscle fibers. Studies show that 12 percent of men and 24 percent of women over age 70 eat significantly less than the recommended 0.8 gram of protein per kilogram of their body weight each day. Currently, the recommended dietary allowance for protein is generally 50 grams of protein per day or 0.8 gram per kilogram (g/kg) of body weight a day for men and women 19 years of age and older. However, recent research shows that higher levels of dietary protein are needed for adults 65 years and older. For healthy adults, between one and 1.2 g/kg is a good target for daily protein intake. For those with sarcopenia, protein needs are even higher at 1.2 to 1.5 g/kg a day.^[33-35]

To figure out how much protein you need, take your body weight in pounds and multiply it by 0.45. This gives you your body weight in kilograms. Next, multiply that number by 1.2 to reach the recommended grams of protein per day. For example, a person who weighs 150 pounds or 67.5 kilograms should aim for about 81 grams of protein per day. Most meat, poultry and fish have about 7 grams of protein in an ounce. One cup of milk or

one egg has about 8 grams of protein. You can add high-protein snacks to your diet as well.

Choose Protein Wisely: When it comes to positively impacting sarcopenia, it’s not just how much protein you eat, but also what type of protein you consume. Not all protein is created equal, and the type of protein you eat also seems to play a role in preventing muscle loss. Dietary protein is made up many types of amino acids. The body can make some amino acids on its own, but the rest it must obtain from protein-rich foods. Of the 20 total amino acids there are, certain ones are considered “essential” because these are the specific kinds we aren’t capable of making ourselves. Others are “nonessential” because the body can create them by synthesizing other amino acids.

The amino acid leucine has been shown to preserve body muscle. Leucine is an essential amino acid, which means our bodies cannot produce it, so we must get it from dietary sources. A 2010 study showed that the ingestion of leucine-enriched essential amino acids stimulates muscle protein synthesis to a similar extent in both young and elderly individuals. Leucine is found in higher amounts in animal foods, including beef, lamb, poultry, fish, eggs, milk and products made with milk. It’s also found in soybeans and, to a lesser extent, other beans, nuts and seeds. The best protein foods to include in your diet are the following:

- Grass-fed beef
- Whey protein (organic, ideally from raw goat milk)
- Lentils
- Wild-caught fish (salmon, mackerel, tuna, etc.)
- Organic chicken
- Black beans (or other beans)
- Natto
- Raw milk
- Kefir or yogurt
- Free-range eggs
- Raw cheese



Figure-4: Protein source.

Eating enough protein is necessary to build and maintain healthy muscle mass, while also supporting tendons, ligaments and other body tissue. When your diet lacks amino acids, “muscle wasting” (or muscle atrophy) can take place when your muscle fibers are broken down to support your body’s energy needs. Protein is especially important after exercise, since physical activity like strength training purposefully damages muscle tissues so they can repair and grow back stronger. For the process to happen effectively, you need some extra protein to help repair the damage. While protein alone won’t enhance athletic performance, research shows that eating protein before and after exercise helps increase muscle recovery, promotes muscle synthesis and serves as effective muscle ache treatment.^[36]

Omega-3s: Omega-3 fatty acids have been found to influence muscle protein metabolism and mitochondrial physiology in the context of human aging. A 2011 randomized and controlled study’s objective was to evaluate the effect of omega-3 fatty acid supplementation on the rate of muscle protein synthesis in older adults. Supplementation of omega-3 fatty acids versus corn oil were compared. The study found that dietary omega-3 fatty acid supplementation increases the rate of muscle protein synthesis in older adults. The omega-3 fatty acid EPA has been found to preserve muscle mass under various physiological conditions. Like EPA, the omega-3 fatty acid DHA has anti-inflammatory effects, which scientists believe may be of value in managing sarcopenia.

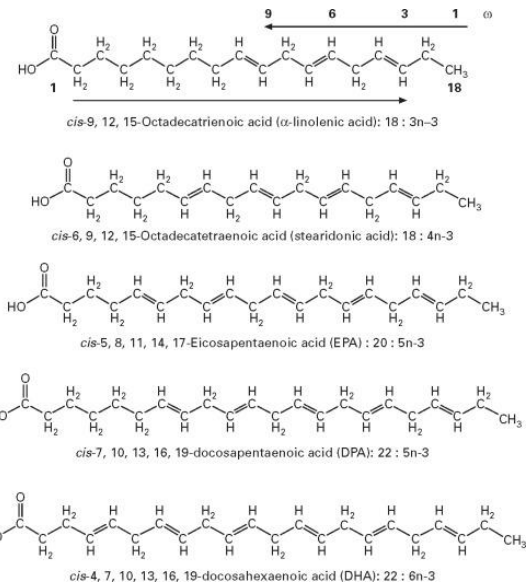


Figure-5: Omega-3 fatty acids.

Fish oil-derived omega-3 fatty acid supplementation slowed the normal decline in muscle mass and function in older adults and should be considered a therapeutic approach for preventing sarcopenia and maintaining physical independence in older adults. You can consider supplementing with fish oil or flaxseed oil to increase your omega-3 acid intake.

Hormone Balance: Hormonal factors can significantly affect muscle mass. If you’re 40 years of age or older, you can have annual blood work done to track your hormone levels. If necessary, deficiencies of essential hormones, such as growth hormone, DHEA (Dehydroepiandrosterone) [CAS: 53-43-0; IUPAC: 3β-Hydroxyandrost-5-en-17-one] and testosterone [CAS: 58-22-0; IUPAC: 17β-Hydroxyandrost-4-en-3-one], can be addressed using natural supplementation under a doctor’s supervision. There are also many ways to balance hormones naturally, which is important to prevent muscle loss.

For women in particular, hormonal balance can have a direct effect on sarcopenia. Menopause is linked to reduced concentrations of a hormone called estradiol in middle-aged and older women. There appears to be impaired muscle performance during the postmenopausal period when ovarian hormone production has decreased. It’s believed that hormonal changes and balance may play a role in sarcopenia in older women.

Vitamin D: Many studies have shown that low blood levels of vitamin D are associated with lower muscle strength, increased body instability, falls and disability in older subjects. Vitamin D deficiency is the most common nutritional deficiency for older adults regardless of race or ethnicity. Up to 90 percent of adults in the U.S. are believed to have a vitamin D deficiency. Low vitamin D levels have been associated with sarcopenia. Supplementation of vitamin D in individuals with low levels can help improve muscle function and muscle mass.^[37]

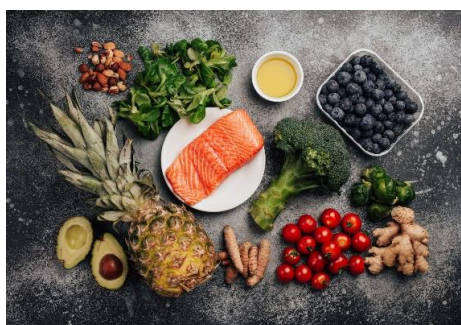


Figure-6: Anti-inflammatory and Pro-inflammatory food with Food Pyramid.

Increase Anti-Inflammatory Foods: Chronic inflammation has received attention as a potential contributor to sarcopenia. To move toward an anti-inflammatory diet and anti-inflammatory foods, we must

primarily move away from the abundance of overly processed, unbalanced diets of the West and toward the ancient eating patterns of the Mediterranean diet. For the sake of improving sarcopenia as well as your overall

health, you should increase your intake of anti-inflammatory foods like green leafy vegetables, blueberries, pineapple, walnuts and salmon, to name a few.^[38]

Decrease Pro-Inflammatory Foods: With lots of anti-inflammatory foods filling your diet, you'll naturally begin to eliminate pro-inflammatory foods and substances. Two pro-inflammatory suspects you definitely want to avoid are high fructose corn syrup and trans fats. Found in processed foods, these bad guys cause inflammation that contributes to sarcopenia. Processed foods are also likely to be higher in omega-6 fatty acids, which are necessary but only to an extent. In excess and without the balance of omega-3s, omega-6 fats actually create inflammation in the body. The typical American diet tends to contain 14–25 times more omega-6 fatty acids than omega-3 fatty acids. Simple, refined sugars and carbohydrates are more inflammation-causing culprits. Limiting refined grains is another important component of an anti-inflammatory diet.^[39]

Watch Alcohol Intake: Drinking too much alcohol over time can weaken the muscles, which is a good reason for all adults to consider their alcohol consumption. If you know you already have sarcopenia, then you want to consider your alcohol consumption even more seriously. Alcohol abuse appears to affect skeletal muscle severely, promoting its damage and wasting. Alcohol misusers also frequently suffer from low muscle mass and strength, muscle pain, cramps, difficulties in gait, and falls. Most alcoholic beverages aren't just empty calories, but they can also remove critical nutrients from your body. Alcohol, especially in excess, can also contribute to inflammation. With sarcopenia, you want to increase your nutrient intake significantly and decrease bodily inflammation. By reducing your alcohol intake or avoiding alcohol all together, it's easier to reach your goal of increasing beneficial nutrients and decreasing pro-inflammatory substances.

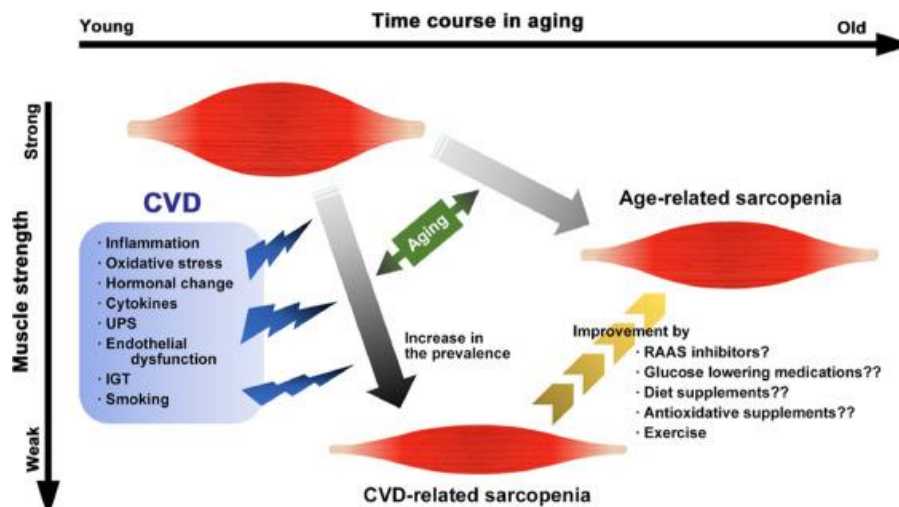


Figure-7: Muscle strength with sarcopenia.

Quit Smoking: If you smoke, here is just another item on the laundry list of reasons why you want to quit stat. Cigarette smoking is associated with poor lifestyle habits, such as low levels of physical activity and impaired nutrition. In addition, smoking itself is another lifestyle habit that has been found to be associated with sarcopenia. Studies have found that men and women who were smokers were more likely to have sarcopenia. It's also been reported that smokers had lower relative appendicular skeletal muscle mass than subjects who never smoked and that men with sarcopenia smoked significantly more. Tobacco smoking is definitely a risk factor for sarcopenia that you can and should avoid, and that include electronic cigarettes.^[40]

CONCLUSION

Sarcopenia is emerging as a major public health concern given the increased longevity of industrialized populations and growing geriatric population. Sarcopenia is a predictor of many adverse outcomes including

increased disability, falls and mortality. Immobility or bed rest in populations predisposed to sarcopenia can cause dramatic impact on functional outcomes. In the elderly, this often leads to decreased biological reserve and increased vulnerability to stressors known as the "frailty syndrome". Loss of lean body mass is also associated with increased risk of infection, decreased immunity, and poor wound healing. The weakness that accompanies muscle atrophy leads to higher risk of falls, fractures, physical disability, need for institutional care, reduced quality of life, increased mortality, and increased healthcare costs. This represents a significant personal and societal burden and its public health impact is increasingly recognized. Intake of calories and protein are important stimuli for muscle protein synthesis. Older adults may not utilize protein so efficiently as younger people and may require higher amounts to prevent muscle atrophy. A number of expert groups have proposed an increase in dietary protein recommendations for older age groups to 1.0-1.2 g/kg body weight per day.

Ensuring adequate nutrition in older adults is of interest in the prevention of sarcopenia and frailty, since it is a simple, low-cost treatment approach without major side effects. Exercise remains the intervention of choice for sarcopenia, but translation of research findings into clinical practice is challenging. The type, duration and intensity of exercise are variable between studies, preventing a standardized exercise prescription for sarcopenia. Lack of exercise is a significant risk factor for sarcopenia and exercise can dramatically slow the rate of muscle loss. Exercise can be an effective intervention because aging skeletal muscle retains the ability to synthesize proteins in response to short-term resistance exercise. Progressive resistance training in older adults can improve physical performance (gait speed) and muscular strength. Increased exercise can produce greater numbers of cellular mitochondria, increase capillary density, and increase the mass and strength of connective tissue.

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