

LE Magazine January 2007

REPORT

Preventing Sarcopenia

Maintain Healthy Muscle Mass As You Age

By Will Brink



One of the greatest long-term threats to our ability to remain healthy and function independently with advancing age is a steady loss of lean muscle mass, a condition known as sarcopenia.

While doctors have long warned about the loss of bone mass (osteoporosis) that accompanies aging, scant attention has been paid to the equally debilitating loss of muscle mass commonly seen in older people.

Today, however, sarcopenia is increasingly recognized as a serious health problem that afflicts millions of aging adults and places an ever-greater strain on our health care system.¹ Age-related loss of muscle mass and strength not only robs elderly people of the ability to perform even the most basic tasks of daily living, but also vastly heightens their risk of suffering devastating injuries and even death from sudden falls and other accidents. The good news is, all health-conscious

adults can take immediate steps to implement a program that will greatly lessen their risk for sarcopenia.

In this article, we will review the nature of sarcopenia, its causes, and ways to both prevent and manage this condition. Since sarcopenia has no single cause, its prevention and treatment require an integrated approach that incorporates dietary strategies, hormone replacement, nutritional supplementation, and exercise.

UNDERSTANDING SARCOPENIA

Sarcopenia is the age-related loss of muscle mass, strength, and functionality. It generally appears after the age of 40 and accelerates after the age of approximately 75. Although most often seen in physically inactive people, sarcopenia is also common in those who remain physically active throughout their lives. Therefore, while engaging in regular physical activity is essential to avoiding sarcopenia, inactivity is not the only contributing factor to this condition. Like osteoporosis, sarcopenia is a multifactorial disease process that may result from sub-optimal hormone levels, inadequate dietary protein, other nutritional imbalances, lack of exercise, oxidative stress, and inflammation.^{2,3}



Sarcopenia and osteoporosis are related conditions, and one often accompanies or follows the other. Muscles generate the mechanical stress required to keep our bones healthy. When this muscle activity is reduced, it increases our susceptibility to a loss of bone mass, often initiating a vicious circle of declining health and functionality.

Moreover, this loss of muscle mass can have additional far-ranging effects beyond an obvious loss of strength and functionality. Muscle acts as a metabolic reservoir.⁴ After a traumatic event, for example, muscle produces proteins and metabolites required for survival and recovery. In practical terms, this suggests that frail elderly people with decreased muscle mass may have poorer outcomes after major surgery or traumatic accidents, since they lack the metabolic reservoir of muscle mass to support the immune system and other bodily systems during the recovery process.

PROTEIN AND OTHER DIETARY FACTORS

Major dietary factors that contribute to sarcopenia are inadequate protein intake, insufficient calorie intake, and chronic, low-level metabolic acidosis (or an abnormally increased acidity in the body's fluids). Although it is generally believed that the average American consumes more protein than needed, inadequate protein in the diets of older adults is common. Further compounding this problem may be a diminished capacity to digest and absorb protein in the elderly. Several studies suggest that protein requirements for older adults are higher than for younger people, and should be higher than is often recommended.⁵⁻⁷ In short, many older adults may not consume enough high-quality protein to support and preserve their lean body mass.

While consuming an adequate amount of protein is important for older adults, consuming too much protein can result in a low-level, diet-induced metabolic acidosis, or abnormally increased acidity in the body. The typical American diet—which is high in animal proteins and cereal grains, and low in fruits and vegetables—can cause a low-grade metabolic acidosis that contributes to the decline in muscle and bone mass found in aging adults.⁸ One study found that adding a buffering agent (potassium bicarbonate) to the diet of postmenopausal women prevented the muscle-wasting effects of a “normal” diet.⁹ This led the researchers to conclude that the buffering agent may prevent continuing age-related loss of muscle mass and help restore lost muscle mass.

Therefore, older adults should strive to ensure an adequate intake of high-quality protein from a variety of sources, accompanied by an increase in fruits and vegetables, and a reduced intake of cereal grain foods. Buffering agents such as potassium bicarbonate can be incorporated in a supplement regimen, though they should not take the place of potassium-rich fruits and vegetables in the diet.

IMPORTANCE OF OPTIMAL HORMONE LEVELS

Aging is accompanied by declining levels of many essential hormones in the body, particularly tissue-building (anabolic) hormones such as growth hormone, DHEA (dehydroepiandrosterone), and testosterone.²

For example, circulating growth hormone levels in older adults are just one third of those in teenagers.³ Researchers have recently focused on insulin-like growth factor 1 (IGF-1) and mechano growth factor as critical hormones in maintaining muscle and bone mass.¹⁰ Without adequate levels of these hormones, it may be impossible for anyone to maintain lean body mass, regardless of how they eat or exercise.

Aging adults have a reduced output of mechano growth factor, a hormone that helps build muscle in response to exercise.¹¹ This could help explain why older adults have a much more difficult time building muscle compared to their younger counterparts. However, when older people were given growth hormone before engaging in resistance exercise, their mechano growth factor response improved markedly, as did their muscle mass.¹¹



Testosterone is also critical to maintaining lean body mass. Especially when given to testosterone-deficient men, this essential hormone can have a broad range of positive effects. One study noted that in healthy older men with low-normal to mildly decreased testosterone levels, testosterone supplementation increased lean body mass and decreased fat mass. Additionally, testosterone improved upper and lower body strength, functional performance, sexual function, and mood in some individuals.¹² Although women produce less of this hormone than men do, adequate testosterone is just as essential to their health and well-being.

Because hormonal factors can significantly affect muscle mass, all adults over the age of 40 should undergo annual blood testing to track their hormone levels. If necessary, hormone deficiencies can be addressed using bioidentical hormone replacement therapy. Since hormone replacement therapy requires regular monitoring and is contraindicated in some individuals, you should consult a medical professional about your specific hormone replacement needs.

REPORT

Preventing Sarcopenia

Maintain Healthy Muscle Mass As You Age

By Will Brink

NUTRITIONAL STRATEGIES FOR OPTIMIZING MUSCLE MASS

Several nutrients, including creatine, vitamin D, and whey protein, have shown great promise in combating sarcopenia.

Creatine. The muscle atrophy commonly seen in older adults comes mainly from a loss of fast-twitch (Type II) muscle fibers that are recruited during high-intensity movements, such as weight lifting and sprinting. These are the fibers most profoundly affected by the dietary supplement creatine. Various studies have found that when creatine is given to older adults who are participating in resistance exercise training, it helps increase strength and lean body mass.¹³⁻¹⁵ According to one research group, creatine supplementation in older adults may help attenuate age-related loss of muscle strength as well as improve one's ability to perform functional living tasks.¹⁴

Vitamin D. While scientists have long known that vitamin D plays an important role in bone health, recent studies suggest that it is also essential for maintaining muscle mass in aging people. Vitamin D helps preserve the Type II muscle fibers that are prone to atrophy in the elderly. Scientists recently noted that vitamin D helps support both muscle and bone tissue, and that low vitamin D levels seen in older adults may be associated with poor bone formation and muscle function. Thus, ensuring adequate vitamin D intake may help reduce the incidence of both osteoporosis and sarcopenia in aging people.¹⁶

Whey protein. Many older adults find it difficult to obtain enough high-quality protein from dietary sources. Whey protein, which is derived from dairy products, may help aging adults to optimize their protein intake and protect against muscle loss. Whey has an exceptionally high biological value—that is, it contains amino acids in proportions that are similar to those required by humans. Proteins with higher biological value generally are superior to lower-quality proteins in maintaining muscle mass. One study found whey protein to be especially effective in preserving lean body mass in older adults.¹⁷

SARCOPENIA: WHAT YOU NEED TO KNOW

- Sarcopenia, the age-related loss of lean muscle mass, strength, and functionality, can prevent elderly people from performing the most basic tasks of daily living, and greatly increases their risk of suffering falls and other serious accidents.
- Sarcopenia is a multifactorial disease process that may result from sub-optimal hormone levels, inadequate dietary protein, other nutritional imbalances, lack of exercise, oxidative stress, and inflammation.
- Preventing and treating sarcopenia requires an integrated approach that incorporates dietary strategies, hormone replacement, nutritional supplementation, and exercise.
- Older adults should strive to ensure an adequate intake of high-quality protein, abundant consumption of fruits and vegetables, and a reduced intake of cereal grain foods.
- Because hormonal factors can significantly affect muscle mass, all adults over 40 should undergo annual blood testing to track their hormone levels. If necessary, deficiencies of essential hormones such as growth hormone, DHEA, and testosterone can be addressed using bioidentical hormone replacement therapy.
- Several nutrients, including creatine, vitamin D, and whey protein, have shown great promise in combating sarcopenia. Other nutrients such as omega-3 fatty acids, carnitine compounds, and the amino acid glutamine have biological effects that may be beneficial in promoting healthy muscle mass.
- Regular exercise, particularly weight training, is essential for preserving and increasing muscle mass. In addition to building muscle, strength training promotes mobility, enhances fitness, and improves bone health.

ADDITIONAL NUTRIENTS OF INTEREST

When developing a comprehensive supplement regimen to prevent or treat sarcopenia, several other nutrients deserve consideration. These include omega-3 fatty acids, carnitine compounds, and the amino acid glutamine. Although scientists have yet to study their specific effects in relation to sarcopenia, these nutrients have biological activities and mechanisms of action that suggest a potentially beneficial role in promoting healthy muscle mass.

For example, the omega-3 fatty acid EPA (eicosapentaenoic acid) has been found to preserve muscle mass under various physiological conditions.¹⁸ Like EPA, the omega-3 fatty acid DHA (docosahexaenoic acid) has anti-inflammatory effects, which scientists believe may be of value in managing sarcopenia.^{19,20}

Carnitine formulations are known to help enhance athletic performance and may help promote healthy muscle mass in older adults who are prone to sarcopenia.²¹ Glutamine is the most abundant amino acid in the body; in combination with resistance training, it has been reported to help increase muscle mass.²²



CRITICAL IMPORTANCE OF EXERCISE

Exercise is critically important in preventing and managing sarcopenia. Exercise stimulates the release of hormones that promote healthy muscle mass. These include growth hormone, which acts throughout the body, as well as local growth factors, such as mechano growth factor.^{3,23} Exercise helps combat the loss of essential muscle and bone seen with aging,²⁴ and may enhance the effects of other interventions, such as hormone replacement therapy.

Although any exercise is better than no exercise, not all forms of exercise are equal. Aerobic exercise is great for the cardiovascular system and for keeping body fat levels low, but is only mildly effective in preserving the lean body mass you already have. When athletes want to increase lean mass, they use resistance training as their preferred method. Thus, engaging in some form of resistance training (using weights, machines, bands, or other devices) is essential for those seeking to preserve or increase their muscle mass. The federal Centers for Disease Control and Prevention has issued guidelines for resistance exercise for older adults, noting that in addition to building muscle, strength training can promote mobility, improve health-related fitness, and improve bone health.²⁵

CONCLUSION



Millions of people will become weak and frail as they age due to severe loss of muscle mass. The good news is, you do not have to be one of them.

By adopting a regimen that includes dietary modifications, hormone replacement therapy as indicated, nutritional supplements, and exercise, it is possible to dramatically improve lean muscle mass at virtually any age. Optimizing muscle mass helps improve strength, functionality, and overall health and well-being, even into advanced age. Since it is far easier to prevent or slow the progression of muscle loss than it is to treat it later in life, it makes sense to begin your sarcopenia-prevention program today.

References

1. Lynch GS. Emerging drugs for sarcopenia: age-related muscle wasting. *Expert Opin Emerg Drugs*. 2004 Nov;9(2):345-61.
2. Leifke E, Gorenai V, Wichers C, et al. Age-related changes of serum sex hormones, insulin-like growth factor-1 and sex-hormone binding globulin levels in men: cross-sectional data from a healthy male cohort. *Clin Endocrinol (Oxf)*. 2000 Dec;53(6):689-95.
3. Goldspink G. Mechanical signals, IGF-I gene splicing, and muscle adaptation. *Physiology (Bethesda)*. 2005 Aug;20:232-8.
4. Karakelides H, Sreekumaran NK. Sarcopenia of aging and its metabolic impact. *Curr Top Dev Biol*. 2005;68:123-48.
5. Campbell WW, Crim MC, Dallal GE, Young VR, Evans WJ. Increased protein requirements in elderly people: new data and retrospective reassessments. *Am J Clin Nutr*. 1994 Oct;60(4):501-9.
6. Young VR. Amino acids and proteins in relation to the nutrition of elderly people. *Age Ageing*. 1990 Jul;19(4):S10-S24.
7. Campbell WW, Evans WJ. Protein requirements of elderly people. *Eur J Clin Nutr*. 1996 Feb;50 Suppl 1S180-3.
8. Frassetto L, Morris RC, Jr., Sellmeyer DE, Todd K, Sebastian A. Diet, evolution and aging—the pathophysiologic effects of the post-agricultural inversion of the potassium-to-sodium and base-to-chloride ratios in the human diet. *Eur J Nutr*. 2001 Oct;40

(5):200-13.

9. Frassetto L, Morris RC, Jr., Sebastian A. Potassium bicarbonate reduces urinary nitrogen excretion in postmenopausal women. *J Clin Endocrinol Metab.* 1997 Jan;82(1):254-9.
10. Hameed M, Orrell RW, Cobbold M, Goldspink G, Harridge SD. Expression of IGF-I splice variants in young and old human skeletal muscle after high resistance exercise. *J Physiol.* 2003 Feb 15;547(Pt 1):247-54.
11. Hameed M, Lange KH, Andersen JL, et al. The effect of recombinant human growth hormone and resistance training on IGF-I mRNA expression in the muscles of elderly men. *J Physiol.* 2004 Feb 15;555(Pt 1):231-40.
12. Gruenewald DA, Matsumoto AM. Testosterone supplementation therapy for older men: potential benefits and risks. *J Am Geriatr Soc.* 2003 Jan;51(1):101-15.
13. Brose A, Parise G, Tarnopolsky MA. Creatine supplementation enhances isometric strength and body composition improvements following strength exercise training in older adults. *J Gerontol A Biol Sci Med Sci.* 2003 Jan;58(1):11-9.
14. Gotshalk LA, Volek JS, Staron RS, et al. Creatine supplementation improves muscular performance in older men. *Med Sci Sports Exerc.* 2002 Mar;34(3):537-43.
15. Chrusch MJ, Chillbeck PD, Chad KE, Davison KS, Burke DG. Creatine supplementation combined with resistance training in older men. *Med Sci Sports Exerc.* 2001 Dec;33(12):2111-7.
16. Montero-Odasso M, Duque G. Vitamin D in the aging musculoskeletal system: an authentic strength preserving hormone. *Mol Aspects Med.* 2005 Jun;26(3):203-19.
17. Dangin M, Boirie Y, Guillet C, Beaufriere B. Influence of the protein digestion rate on protein turnover in young and elderly subjects. *J Nutr.* 2002 Oct;132(10):3228S-33S.
18. Tisdale MJ. Clinical anticachexia treatments. *Nutr Clin Pract.* 2006 Apr;21(2):168-74.
19. Roubenoff R. Catabolism of aging: is it an inflammatory process? *Curr Opin Clin Nutr Metab Care.* 2003 May;6(3):295-9.
20. Fritsche K. Fatty acids as modulators of the immune response. *Annu Rev Nutr.* 2006;26:45-73.
21. Gomes MR, Tirapegui J. Relation of some nutritional supplements and physical performance. *Arch Latinoam Nutr.* 2000 Dec;50(4):317-29.
22. Kreider RB. Dietary supplements and the promotion of muscle growth with resistance exercise. *Sports Med.* 1999 Feb;27(2):97-110.
23. Mastorakos G, Pavlatou M, amanti-Kandarakis E, Chrousos GP. Exercise and the stress system. *Hormones (Athens).* 2005 Apr;4(2):73-89.
24. Bass SL, Eser P, Daly R. The effect of exercise and nutrition on the mechanostat. *J Musculoskelet Neuronal Interact.* 2005 Jul;5(3):239-54.
25. Available at: http://www.cdc.gov/nccdphp/dnpa/physical/growing_stronger/spotlight.htm. Accessed August 15, 2006.

All Contents Copyright © 1995-2009 Life Extension Foundation All rights reserved.

LifeExtension[®]

These statements have not been evaluated by the FDA. These products are not intended to diagnose, treat, cure or prevent any disease. The information provided on this site is for informational purposes only and is not intended as a substitute for advice from your physician or other health care professional or any information contained on or in any product label or packaging. You should not use the information on this site for diagnosis or treatment of any health problem or for prescription of any medication or other treatment. You should consult with a healthcare professional before starting any diet, exercise or supplementation program, before taking any medication, or if you have or suspect you might have a health problem. You should not stop taking any medication without first consulting your physician.