

## Nutritional and Physiological Insights into Muscle Health in Older Adults

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### DESCRIPTION

Muscle weakness, or sarcopenia, is a prevalent condition in older adults characterized by the progressive loss of muscle mass, strength, and function. It contributes significantly to falls, fractures, and reduced quality of life. Addressing muscle weakness requires a multifaceted approach that integrates dietary strategies, physical activity, and an understanding of physiological changes associated with aging. Nutrition and physiological factors play a pivotal role in mitigating these effects

### Understanding muscle weakness in aging

Aging is associated with several physiological changes that contribute to muscle weakness:

**Muscle protein synthesis decline:** Aging reduces the efficiency of muscle protein synthesis, even in response to dietary protein intake, a phenomenon termed anabolic resistance.

**Hormonal changes:** Decreases in anabolic hormones like testosterone, growth hormone, and Insulin-Like Growth Factor-1 (IGF-1) impair muscle maintenance.

**Chronic inflammation:** Low-grade chronic inflammation, or "inflammaging," accelerates muscle degradation through the upregulation of proteolytic pathways.

**Mitochondrial dysfunction:** Reduced mitochondrial efficiency leads to decreased energy production and increased oxidative stress, exacerbating muscle loss.

### Therapeutic dietary interventions

Dietary strategies are key to improving muscle health and overall well-being in aging.

**Optimal protein intake:** Adequate protein intake is fundamental for preserving muscle mass. Older adults are recommended to consume 1.2 g–2.0 g of protein per kg of body weight per day, with a focus on high-quality protein sources. Foods rich in leucine, an essential amino acid, such as dairy, eggs, and lean meats, stimulate muscle protein synthesis more effectively.

**Vitamin D:** Vitamin D plays a important role in muscle function and strength. Deficiency is common in older adults and is

associated with reduced muscle performance. Foods like fatty fish, fortified dairy, and eggs, along with supplementation if necessary, can help maintain optimal levels.

**Omega-3 fatty acids:** Found in fish like salmon, walnuts, and flaxseeds, omega-3 fatty acids exhibit anti-inflammatory properties that may reduce muscle breakdown and improve anabolic sensitivity.

**Antioxidants:** Oxidative stress contributes to muscle degradation in aging. Foods rich in antioxidants, such as berries, green tea, and dark leafy greens, combat oxidative damage and support mitochondrial health.

**Creatine:** Creatine supplementation enhances muscle energy metabolism and may improve strength and function in older adults. Natural dietary sources include animal-based foods like meat and fish.

**Resistance training:** Regular resistance training is one of the most effective interventions for combating muscle weakness. It enhances muscle protein synthesis, counteracts anabolic resistance, and improves mitochondrial function. Combining resistance training with adequate protein intake maximizes benefits.

**Hormonal modulation:** Addressing hormonal imbalances through medical interventions, such as testosterone replacement therapy, should be considered under medical supervision. Lifestyle factors like resistance training and sufficient sleep also influence hormonal health.

**Reducing inflammation:** Anti-inflammatory dietary patterns, such as the Mediterranean diet, rich in fruits, vegetables, whole grains, and healthy fats, help mitigate chronic inflammation and support muscle health.

### The role of functional foods and nutraceuticals

Functional foods and nutraceuticals potential as therapeutic targets for muscle weakness. Examples include:

**Branched-Chain Amino Acids (BCAAs):** Essential for muscle repair and growth.

**Polyphenols:** Found in foods like green tea and turmeric, polyphenols have antioxidant and anti-inflammatory properties.

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**Probiotics:** Emerging evidence suggests that gut microbiota health influences muscle function, making fermented foods like yogurt and kefir potential modulators.

Combating muscle weakness in older adults requires a holistic approach that integrates nutritional strategies, physical activity, and an understanding of aging-related physiological changes. Adequate protein intake, vitamin D, omega-3 fatty acids, and

antioxidant-rich foods, combined with regular resistance training, form the cornerstone of therapeutic interventions. Functional foods and targeted supplementation further enhance muscle health. By addressing the complex interplay of diet and physiology, it is possible to improve muscle strength and quality of life in older adults.