

## Special Article – Proteins

# Proper Protein Intake is a Strategy in the Treatment of Sarcopenia in the Elderly to Increase Muscle Mass Changes

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As the world's population ages, sarcopenia has become the focus of global attention. Risk factors for sarcopenia include age, malnutrition, physical inactivity and others. Among, nutrition is a modifiable factor affecting the quality of life and independence of older people. Due to inadequate nutrient intake in the diet, the elderly are prone to sarcopenia, age-related loss of muscle mass and function. To date, adequate protein intake is the most promising intervention to prevent and/or delay muscle mass and function decline. This review not only outlines the current definition of sarcopenia, but also outlines how to properly drink a protein-rich diet to prevent sarcopenia in old age. It also emphasizes the importance of a reasonable diet of protein to maintain the structure and function of skeletal muscle in the elderly.

**Keywords:** Sarcopenia; Proteins; Dietary protein; Diet; Aging; Skeletal muscle

**Introduction**

Sarcopenia is a degenerative disease of skeletal muscle mass loss and dysfunction that occurs with age, so it is also known as age-related sarcopenia. Aging is accompanied by a gradual decline in the quality, which has a negative impact on muscle strength and body function, leading to clinical problems [1]. According to statistics, the incidence of sarcopenia in the elderly aged 60-70 years is 5%-13%; in the elderly over 80 years old, the incidence rate is as high as 11%-50% [2]. As the population ages, the social and economic problems caused by aging diseases are also increasing, which seriously affects the quality of life of the elderly and exposes the society to great economic pressure.

However, the specific pathogenesis and causes of sarcopenia are unclear, and Castaneda et al currently consider it to be primarily related to the following reasons. (1) Gender and age [3,4]; (2) malnutrition [5,6]; (3) skeletal muscle loss [7,8]; (4) endocrine function changes [9,10]; (5) chronic wasting disease and systemic inflammatory response [11-14], etc. The lack of protein intake is the most important reason. Among them, in a study by Wilson et al. [6], it was demonstrated that loss of appetite and malnutrition lead to insufficient protein synthesis, resulting in increased protein consumption in the body and a decrease in muscle mass. Increased protein intake can increase muscle mass in elderly hospitalized patients with malnutrition [15]. Muscle Protein Synthesis (MPS) is a major factor in reducing the onset of senile sarcopenia, so a proper dietary protein diet is essential for maintaining skeletal muscle mass. The Recommended Daily Allowance (RDA) of protein compared to young people is 0.8g protein/kg/day, which is not sufficient to prevent sarcopenia in the elderly. Therefore, it is recommended that the dietary protein intake of the elderly should be between 1.0g protein/kg/day to 1.5g protein/kg/day [16-19].

This review focuses on the digestion and absorption of protein

in the elderly and the effects of dietary protein intake on sarcopenia. At the same time, research based on dietary protein intake is very important for older people, so establishing an interactive and friendly information system can also change the dietary quality of a hospital or nursing home's catering menu. Proper high-quality protein can also help older people increase/maintain muscle mass, thereby preventing and relieving the onset of sarcopenia.

**Dietary patterns**

A reasonable way to check the relationship between diet and diseases such as sarcopenia is through a food survey that provides a dietary pattern associated with the risk of muscle loss and decreased muscle function. Dietary patterns include the interaction between food and different nutrients and their health effects [20]. The main food groups in the dietary pattern include bread, other grains and potatoes; fruits and vegetables; meat, fish and substitutes; milk and dairy products; and fat and sugary foods [21].

Along with aging, the physical, psychological and social relationships of older people can influence their dietary choices. This has led to an inadequate intake of energy and protein for many older people, as malnutrition causes other acute and chronic diseases to occur [22]. It has been found that a diet characterized by high fruit and vegetable consumption and low meat and processed food consumption is beneficial to the health and quality of life of the elderly [23,24]. Therefore, dietary patterns can serve as a guide for educating older people and inducing changes in eating behavior.

**Malnutrition in the elderly can affect skeletal muscle health**

Malnutrition is an under nutrition caused by inadequate intake, malabsorption or excessive loss of nutrients, but may also include over nutrition due to overeating or excessive intake of specific nutrients. Malnutrition can lead to health-related problems such as

immune dysfunction, decreased bone health, cardiovascular disease, metabolic syndrome, decreased cognitive function, impaired muscle function; increased risk of injury, poor wound healing, and increased mortality [25-29].

In recent years, people have become more aware of sarcopenia associated with skeletal muscle ageing. Skeletal muscle mass and strength usually peak between 20-35 years old [30]. Thereafter, 3% to 8% of muscle mass may be lost every 10 years, and this loss is usually accelerated after the age of 60 [31-34]. It is thought to affect 30% of individuals over the age of 60 and more than 80% of individuals over the age of 80 [3]. In recent years, there has been a lot of evidence that lean body mass is positively correlated with bone mass, leading to a reduced risk of fracture. Genetic, endocrine and mechanical factors affect muscles and bones. In contrast to the links from muscle to bone, the effect of bones on the muscles may exist [35]. Factors affecting skeletal muscle aging include changes in hormones, growth factors, and cytokines. Glucocorticoids are involved in the development of age-related muscular atrophy, which interferes with the effects of other synthetic hormones such as insulin or insulin-like growth factor-1 (IGF-1) [36,37]. During the aging process, the synthesis of growth factors such as IGF-1 is significantly reduced. Some cytokines, such as IL-1, TNF, IL-15 and CNTF, have a strong influence on MPS and Muscle Protein Breakdown (MPB) [38].

Common in malnutrition is insufficient protein intake, which is an important cause of skeletal muscle aging. A multinational pooled analysis of data for the elderly population showed that 28% of men and 21% of women were malnourished, while 49% of women and 46% of men were at risk of malnutrition [39]. A study by Chorong Oh et al. [40] found that men were much more affected by food than women were. In addition, these data on the relationship between food frequency and body composition may help prevent chronic diseases.

### **Maintain muscle function and quality: Increase protein intake**

Protein intake plays an extremely important role in delaying skeletal muscle aging and increasing muscle protein synthesis. The skeletal muscle mass is equivalent to about 40% of body weight. For example, in a 70kg male, the total mass of protein in the skeletal muscle is 5kg [41]. In contrast, in bone, the total amount of protein present in the form of collagen is about 2% kg, skeletal muscle is the body's protein pool, and 50% of body protein is stored in skeletal muscle in various forms [42-44], so increasing protein intake is the main nutritional intervention to delay skeletal muscle aging.

With the increase of age, the olfactory and taste of the elderly may have dysfunction, delayed gastric emptying or loss of appetite, which is caused by insufficient nutrient intake? In addition, many clinically wasting diseases and the development of most malignant tumors competitively consume different levels of protein in the body [22]. In addition, when they have acute and chronic conditions, this malnutrition will worsen.

The RDA for protein is 0.8/g/kg/day, in order to maintain muscle health in old age, the protein intake of the elderly should be higher than RDA [45-48]. Therefore, it is suitable to promote protein intake of 1.0-1.2g/kg/day. However, for elderly people with acute or chronic conditions, 1.2-1.5g/kg/day of protein may be required [47-49]. Finally, older people with severe illness and significant malnutrition

may require up to 2.0g/kg/day of protein [48]. Many metabolic studies have shown that dietary amino acids in healthy older people have reduced or impaired the utilization of MPS compared to younger adults. This anabolic resistance can be overcome by higher levels of protein/amino acid uptake [50,51]. A number of recent studies have shown that the need for 25-30g of high quality protein can alleviate age-related muscle mass loss [52]. Katsanos et al. [53] have shown that about 250-350g of protein is metabolized daily by healthy individuals. However, the higher the metabolic condition, the faster the number. For example, senile muscles have reduced anabolic response to Essential Amino-Acid (EAA) at low doses (e.g., less than 10g); Conversely, higher doses (e.g., 10-15g, at least 3g leucine) are sufficient to induce comparable protein anabolic reactions observed in young adults [53]. To illustrate, Symons et al. [54] found that 60g of protein stimulated MPS to no more than 30g per meal. This phenomenon is considered refractory; meaning that ~30g of protein appears to be the upper limit of the anabolic response to the diet. Therefore, it is recommended that older people should consume high-quality protein foods with high amino acid content, such as lean meat and other foods with higher leucine content (such as soybeans, peanuts, chickpeas and lentils) [55].

A three-year prospective observational study by Houston et al. [56] showed that protein intake in women aged 70-79 and men was positively correlated with lean body mass. One-fifth of the daily protein intake (1.1g/kg BW) of the total body and appendage lean body weight is reduced by 40% compared to the lowest one-fifth (0.7g/kg BW) [56]. Therefore, the daily protein intake is much higher than the recommended daily allowance and is currently set at 0.8g/kg body weight. For adults, the risk of sarcopenia in the elderly can be reduced [56]. Dietary protein requirements have been proposed to increase from 0.8g to 1.0-1.2g/kg body weight. Best skeletal muscle and healthy bones for the elderly every day [57]. Therefore, based on comprehensive data, it is recommended that the daily protein requirement for the elderly be 1.0-1.5g protein/kg/day, which can reduce the risk of sarcopenia.

### **Food nutrients: Protein-rich foods**

Because older people digest, the ability to absorb and utilize proteins is poor, and additional measures to increase patient intake are focused on energy and protein-rich menus or diets. Oral Nutritional Supplements (ONS) are often proposed when the recommended protein intake is not available through conventional foods. A study by Janne Beelen et al., a group of foods rich in protein and food; the control group relied mainly on foods rich in natural protein dairy products, meat and cheese, while the intervention group received most of the protein from dairy products (including protein-rich dairy drinks), bread (including protein-rich). Bread products and non-dairy drinks (including protein-rich juices). The results of this study show that each patient produces an average of 12 and 7 grams of protein per day. And the study also showed a significant difference in protein intake between breakfast and dinner when observing the protein intake of the patient at each meal [58]. Most people, regardless of age, are unlikely to adequately distribute protein. Therefore, the elderly should focus on at least 25g of protein per day for three meals, each interval should be 4-5 hours, thus maximizing protein synthesis, improving skeletal muscle health and maintaining muscle mass throughout the day [59].

In addition, meat is a good source of high quality protein and is essential for bone and muscle development. Proper intake of bioactive compounds (such as creatine, carnitine and other nutrients) in meat has a significant effect on human protein metabolism and may therefore be beneficial for sarcopenia. For the balanced diet of the elderly, it is recommended to eat 4-5 times a week (i.e., white meat twice a week, lean meat less than twice a week, processed meat less than twice a week) [60]. Therefore, providing protein-rich foods and beverages as a substitute for traditional products or as a supplement to hospital menus can enable older patients to better achieve the recommended protein intake.

## Conclusion

The maintenance of muscle mass and function is increasingly recognized as a key factor in promoting healthy aging and improving quality of life. As the world's population ages, sarcopenia is an ideal intervention goal to prevent or delay adverse health-related events in later life. This review summarizes the link between protein and muscle; it is recommended that the elderly should reasonably consume protein and eat more protein-rich foods and beverages to increase protein absorption. It also proves that increasing dietary protein intake or protein supplementation during aging can improve muscle mass, reduce muscle loss, stimulate protein synthesis, and improve body performance.

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