11-9-2018

Effects of Aging on Muscle Hypertrophy

Jake Herber  
Marian University - Indianapolis

Loren Bertocci  
Marian University - Indianapolis

Follow this and additional works at: https://mushare.marian.edu/mucom_rd

Part of the Medicine and Health Sciences Commons

Recommended Citation
https://mushare.marian.edu/mucom_rd/75

This Poster is brought to you for free and open access by the College of Osteopathic Medicine at MUShare. It has been accepted for inclusion in MUCOM Research Day by an authorized administrator of MUShare. For more information, please contact emandity@marian.edu.
Effects of Aging on Skeletal Muscle Hypertrophy
Division of Biomedical Sciences, Marian University College of Osteopathic Medicine, Indianapolis, IN, USA
Jake Herber, Loren Bertocci PhD

Abstract:
Context: Skeletal muscle is essential for proper bodily functions by playing key roles in strength and movement, and it accounts for roughly 40% of our total body mass. Decreases in total muscle mass or mass-specific function would be expected to have a magnified negative impact. Sarcopenia, an age–dependence loss of motor nerves, leading by necessity to a coincident loss of muscle mass, would have exactly this kind of effect.

Results: This age–dependence disorder may be the result of aberrant mTOR signaling, irregular miRNAs content, malnutrition and lack of activity, and age–related inflammation. It may be possible to reduce the effects of sarcopenia via strength training, as well as increasing daily intakes of protein, essential amino acids, and fish oils. Combining the consumption of whey protein, which is high in leucine, and polyunsaturated fatty acids with strength training resulted in increases in muscle mass and strength.

Objective: This review examines the existing causes and effects of age–related sarcopenia, as well as methods that might ameliorate problems associated with age–related sarcopenia.

Muscle Loss
The proximal cause of sarcopenia is the loss of motor neurons and their subsequent motor units due to lack of stimulus. In addition, detrimental changes in neuromuscular junction structure with aging may destabilize skeletal muscle. Loss of muscle mass may result from preferential decreased cross-sectional area of Type II muscle fibers.

Anabolic resistance: The inability of aged muscle to respond to anabolic stimuli. It can be attributed to age–associated downstream target of mTORC1 by necessity to a coincident loss of muscle mass, would have exactly this kind of effect.

Interventions for Aged Muscle
Exercise: Exercise of various types and a well-balanced nutrition can improve day–to–day life and health and promote longevity. Exercise had a positive impact on gait speed, balance, and the chair rising test, all of which may be increasingly difficult to accomplish in elderly adults. Resistance exercise training improves muscle strength and stimulates muscle hypertrophy. Additionally, benefits of resistance training in older adults may result from blocking muscle degradation rather than up regulating muscle growth.

Protein Intake: Adequate nutritional intake and additional supplementation may further benefit increases in muscle mass in aged adults via increased muscle protein synthesis. Healthy older individuals should consume 1.2–1.5 g of protein per kg of body weight to preserve muscle mass and combat anabolic resistance.

Whey protein and EAAs: A popular and effective source because it promotes increase in skeletal muscle mass, strength, and functional capacity when in combination with resistance training. Whey is a complete, high quality protein based on its amino acids content and rapid digestibility. Compared to casein and soy, whey protein may stimulate muscle protein synthesis to a higher level during rest and exercise. A blend of proteins may combine to increase hyperaminoacidemia and also prolong hyperaminoacidemia better than any one protein supplement. This prolonged hyperaminoacidemia is important to support increased rates of muscle protein synthesis in addition, increasing total essential amino acids intake, most importantly leucine, increases muscle protein synthesis by extending hyperaminoacidemia.

PUFAs: Poly Unsaturated Fatty Acids (PUFAs) have been linked with positive effects on metabolic function and other health benefits. They may increase the anabolic response to resistance training and whey protein supplementation. In combination with other supplements, PUFAs may decrease anabolic resistance associated with aging by boosting the anabolic response of muscle protein synthesis to hyperinsulinemia/hyperaminoacidemia. Their supplementation may be involved in down regulation of anabolic pathway inhibitors, and also up regulation of pathways that promote growth. While they are insufficient to elicit an anabolic response alone, their effects on muscle protein synthesis are enhanced when associated with the anabolic stimulus of amino acids administration

Conclusion
Sarcopenia is a serious problem the aged population may face if they are increasingly sedentary and malnourished. Recent data have demonstrated that strength training combined with increased protein intake can reduce effects of sarcopenia and promote health benefits in older adults. Anabolic resistance may decrease benefits of exercise for older adults and make sarcopenia a greater problem, but increasing protein intake and supplementing with polyunsaturated fatty acids may enhance the anabolic response that normally results from exercise. An optimal protein source is whey protein because of its amino acids content, especially leucine, and its rapid digestibility. Because of this, it is quickly bioavailable and results in a rapid hyperaminoacidemic state. Sources rich in leucine are vital, as these sources increase hyperaminoacidemia to a greater level compared to low or no leucine. In addition, polyunsaturated fatty acids may increase the anabolic response alone, their effects on muscle protein synthesis are enhanced when associated with the anabolic stimulus of amino acids administration.