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Research Article

Whey Protein Supplementation as a Strategy to Preserve Muscle Mass and Increase Protein Synthesis inthe Elderly: A Review of Literature

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Abstract

Introduction: Aging often coincides with loss of muscle mass, strength and function, known as sarcopenia. Sarcopenia, a geriatric syndrome closely linked to physical frailty, has a substantial impact on the quality of life. Inadequate dietary intake, especially protein intake, has been associated with decreased lean body mass. Dietary protein affects muscle mass by the stimulation of muscle protein synthesis after absorption of amino acids into muscle cells

Aims: Verify the effectiveness of whey protein supplementation in increasing protein synthesis and muscle mass in elderly.

Methods: This is a systematic review conduced in the pub med database, which sought clinical trials published between 2012 and 2016, with the combination of descriptors: Whey protein, muscle mass, protein synthesis, sarcopenia.

Results: We found 30 articles and after exclusion of non-relevant issues and duplicate articles were included 11 articles in this study. Of the selected material, 3 studies did not find positive effects with supplementation, this null response could have occurred because of dose and/or timing of supplementation, 1 study found the same effect with leucine supplementation and 7 studies found positive effects with whey proteinsupplementationfor the protein synthesis and the increase of lean body mass in the elderly.

Conclusions: Therefore, we can conclude that supplementation of whey protein shows positive results for increased protein synthesis and muscle mass in the elderly. However, the results differ between the sexes, quantity and timing of consumption, which after the need of new studies for the best understanding of the subject. It seems that the elderly respond best to higher amounts of supplement and the periods more distant from the practice of resistive exercise. In addition, after reviewing the articles it appears that men present better results than women do. The results give us another option to maintain the independence and quality of the elderly.

Keywords: Muscle Mass; Protein Synthesis; Sarcopenia; Whey Protein

Introduction

Based on demographic extrapolations, the number of elderly citizens above the age of 65 years will increase in the next three decades by 50-200 %, with the specific proportion being dependent on country [1].

Aging often coincides with loss of muscle mass, strength and function, known as sarcopenia. Sarcopenia, a geriatric syndrome closely linked to physical frailty, has a substantial impact on the quality of life of the individual and increases the risk of disability and hospitalization [2]. Sarcopenia takes place at an annual rate of up to 1-2 % starting in the sixth decade of life [3]. The impact of sarcopenia progression may become detrimental to an individual's personal life and autonomy, and the societal implications are vast when one considers future healthcare and nursing expenditures [4].

Because of the aging muscle becoming less sensitive to daily anabolic stimuli due to protein intake and muscular activity, it is suggested that exactly these two factors possess a high potential to antagonize sarcopenia [5]. Inadequate dietary intake, especially

protein intake, has been associated with decreased lean body mass [6]. Dietary protein affects muscle mass by the stimulation of Muscle Protein Synthesis (MPS) after absorption of amino acids into muscle cells [7].This brief increase in MPS above post absorptive rates serves the purpose of replenishing protein stores lost during fasting, ensuring preservation of muscle protein mass [8].With regard to protein intake, cohort studies strongly suggest an association between high protein intake and decreased rates of age-dependent decline in physical performance and reduced risk of frailty [9].

Whey protein, a fast-acting protein that is quickly digested and becomes fast-absorbing peptides and amino acids, can potentially be the most effective in maintaining adequate anabolic/catabolic balance in the musculature of elderly individuals [10]. Research has shown a superiority of whey protein in enhancing muscle protein synthesis compared with other protein sources in older adults [11]. The purpose of study was verifying the effectiveness of whey protein supplementation in increasing protein synthesis and muscle mass in elderly.

Methods

This is a review conduced in the pub med database, which sought clinical trials published between 2012 and 2016, with the combination of descriptors: Whey protein, muscle mass, protein synthesis, sarcopenia.

Inclusion criteria

Be published in English with humans Age more than 65 years

Exclusion criteria

Not full text Disabling Diseases Chronic obstructive pulmonary disease.

Results

We found 30 articles, after exclusion of non-relevant issues and duplicate articles were included 11 articles in this study which are described in (Table 1).

Authors/ year	Design of study	Characteristics of participants	Interventions	Variables of interesting	Conclusions
BURD NA, et al. 2012 [12]	Clinical trial	14 elderly men	1 session of Resistance exercise, supplementation of 20g of micellar casein or isolated whey protein	Myofibrillar protein synthesis	The ingestion of isolated whey proteinsupports greater rates of myofibrillar protein synthesis than micellar casein.
CHALÉ A, et al. 2013[8]	Clinical trial, double blind, controlled	80 older adults with mobility-limited	6 months of progressive resistance training, 3 times a week, 40g of whey protein concentrated or an isocaloric drink, in 2 times a day (morning and evening)	Lean mass, mid-thigh muscle cross-sectional area, muscle strength and stair-climbing performance	They suggest the whey protein concentrated supplementation at this dose not offer additional benefit to the effects of resistance training.
COKER RH, et al. 2012 [13]	Clinical trial, randomized	12 Males and females, 65-80 years, obese	Caloric-restriction (7% weight loss), Whey protein + essential amino acid supplementation or competitive meal replacement, 5 times/day for 8 weeks	Biopsies of the vastuslateralis, Skeletal muscle protein synthesis	Whey protein + essential amino acids during a caloric restriction-induced weight loss promotes the preferential reduction of adipose tissue and modest loss of lean tissue.
ARNARSON A, et al. 2013 [14]	Clinical trial, randomized, controlled, double-blind	161 men and women, 65-91 years	12 weeks of resistance exercise program, 3 times a week and supplementation of 20g of whey protein or isocaloric carbohydrate	Body composition (DEXA), physical function, Strength, dietary intake	The ingestion of 20g of whey protein immediately resistanceexercise, not lead to greater gains in lean body mass, strength and physical function in elderly with sufficient energy and protein intake.

LUIKING YC, et al. 2014 [15]	Clinical trial, randomized, controlled, double-blind	20 older adults, > 60 years	1 session of unilateral leg resistance exercise protocol, supplementation of 1 single dose of 200 ml of a high whey protein, leucine-enriched or a isocaloric drink (milk)	Body composition (DEXA), muscle biopsies, muscle protein synthesis	Ingestion of a high whey protein, leucine-enriched supplement resulted in a larger overall postprandialmuscle protein synthesis rates.
BUKHARI SS I, et al. 2015 [16]	Clinical trial	16 postmenopausal women, > 65 years	1 session of resistance exercise at 75% of their predetermined 1-RM using the dominant leg	Body composition (DEXA), Appendicular muscle mass, Skeletal muscle index, biopsies	The findings show that low dose Intriguingly though, bolus of whey protein offers no trophic advantage over Leucineessential amino acid. LE.A.Asupplementation have potential as strategies for older women to enhance muscle maintenance.
KIRN DR, et al. 2015 [17]	Multi-center, clinical trial, randomized, double blind	Males and Females, >70 years, BMI > 35 kg/M^{20}	6 month exercise program 3 times a week and supplementation of once daily 20g whey protein drink with 800 UI of Vitamin D or Low calorie placebo drink	400 meter walk time in mobility-limited older adults	better average gait speed during the 400m walk
BAUER JM, et al. 2015 [18]	Multi-center, clinical trial, randomized, double blind, placebo-controlled	380 sarcopenic primarily, with mobility limitations, > 65 years, men and women	supplementation 20g whey protein with 3g leucine and 800 UI vitamin D or isocaloric drink control with only carbohydrates, to consumed in 2 doses a day (before breakfast and lunch) for 13 weeks	handgrip strength, physical function, skeletal muscle mass index,	the group with whey protein supplementation obtained improvements in muscle mass and lower-extremity function among sarcopenic older adults.
ZHU K, et al. 2015 [19]	Clinical trial, randomized, double-blind, placebo-controlled	219 postmenopausal women, 70-80 years	supplementation with high whey protein drink (30g) or placebo drink low in protein, 1 dose a day for 2 years	Body composition (DEXA), handgrip strength, lower limb muscle strength, time up and go, 24h urinary nitrogen	extra 30g/day did not improve the maintenance of muscle mass or physical function in healthy older postmenopausal women.
KRAMER IF, et al. 2015[20]	Clinical trial, randomized, double-blind	45 nonsarcopenic older men,	supplementation with 21g leucine-enriched whey protein with carbohydrate or leucine-enriched whey protein without carbohydrate or a isocaloric with no protein or a.a.	gait speed, handgrip-strength, body-composition (DEXA), BMI	the leucine-enriched whey protein with no carbohydrate significantly raises muscle synthesis rate in nonsarcopenic older men.

RONDANELLI, M., et al. 2016	Clinical trial, randomized, double-blind, placelo-controlled	130 sarcopenic, men and women, > 65 years	12 weeks of a comprehensive physical fitness and muscle mass enhancement training program and supplementation with 32g amino-acid, whey protein and vitamin d mixture or an isocaloric placebo (maltodextrin)	body-composition (DEXA), muscle strength, blood biochemical index of nutrition, physical function, global nutrition status an quality of life	Supplementation with whey protein, amino-acids and vitamin D, in conjunction with age-appropriate exercise, not only boosts fat-free mas and strength but also enhances like physical function and quality of life, contributing to well-being in sarcopenic elderly.
Source: Authors					

Table 1: Articles included in study.

Discussion

As demonstrated in results, we can verify that only 4 researches [8,12,14,19] did not find positive effects for the gain of muscular mass in the elderly with the supplementation of whey protein. Some of these results can be explained for the low dose used in some of them (20g.), or the timing for supplementation (immediately of exercise).

According Paddon-Jones D., Rasmussen B. B, [21] to counteract protein catabolism, the elderly must increase the anabolic stimulus, consuming 30 g protein/meal. With advancing age, an impaired and/or delayed response to the anabolic effects of hyperaminoacidemia and resistance exercise has been seen (Kumar V., et al 2009) [22].

Although some authors mentioned positive effects of whey protein supplementation in the elderly without the presence of physical exercises [18], other studies investigating protein supplementation in combination with exercise have been mixed [23].

In the 7 positive results we can verify that whey protein was responsible for a greater loss of body fat and improved preservation of muscle mass, in an obese elderly group [13]. A recently meta-analysis demonstrates favorites results for reduction of fat mass, comparing groups controls and groups with whey protein supplementation [24], protein source is an important factor in the success of these weight-loss interventions. For example, ingestion of whey protein throughout the day, along with an ad libitum diet independent of caloric restriction, may mediate the increased satiety and enhanced body weight loss and composition changes compared with isoenergetic soy or Carbohydrate (CHO) [25], additionally, recent findings provide compelling, new data in support of beginning and ending the day with a 20- to 30-g protein feeding to reduce abdominal fat and favorably alter adipokines [26,27], concludes the whey protein supplementation can reduce fat free mass loss due to low-calorie diets and prevent sarcopenia in obese adults.

Whey protein supplementation also increased muscle mass, functionality, strength besides reducing inflammatory markers and catabolic mediators [17,18] a growing body of evidence supports an enhanced rate of protein synthesis (muscle and whole body) from protein ingestion at rest and during exercise [28,29], Kirsten E. Bell, et al. [30] also reported that consumption of a whey protein-based, multi-ingredient supplement resulted in significant gains in muscle strength and lean mass. Pal S, Ellis V, also demonstrated it, [31] a reduction of pro-inflammatory cytokines may be associated with reduction of body weight gain after consumption of whey protein and it amino acids.

Finally, when was compared whey protein with E.A.A, in regards to improved muscle strength and functionality, whey protein was more effective [15,20].Cruz-Jentoft, A.J, Morley J.E, Ebrary, I., 2012 and Makanae Y, Fujita S., 2015 [32,33]reported that leucine alsocan activate the mTORC1 signaling pathway to increase the rate of MPS and hypertrophy.

Conclusions

Therefore, we can conclude that supplementation of whey protein shows positive results for increased protein synthesis and muscle mass in the elderly. However, the results differ between the sexes, quantity and timing of consumption, which after the need of new studies for the best understanding of the subject. It seems that the elderly respond best to higher amounts of supplement and the periods more distant from the practice of resistive exercise, whichis attributed to the process of anabolic resistance present in individuals of this age. In addition, after reviewing the articles it appears that men present better results than women do.

The results give us another option to maintain the independence and quality of the elderly.Further studies should be done in this specific population so that we can have all the answers

about this effect and the safety of the product.

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Conflate of Interest: not disclose.

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