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Nutritious by nature

The science behind
the health and nutritional impact
of milk and dairy foods

Muscle mass maintenance in older people

There is evidence to suggest a potential role for milk and dairy foods in helping to maintain muscle mass and function in older people. A number of studies point to the benefits of milk protein for increasing muscle protein synthesis in the elderly, and that supplementation, in combination with physical activity, can improve muscle mass and function. There is some evidence too, that older people with higher intakes of milk, cheese and yogurt have greater muscle mass and better functional capacity. In addition to high-quality protein for muscle health, the rich mix of other nutrients in milk and dairy foods make them a valuable part of the diets of older people.

Sarcopenia

Aging is accompanied by a progressive loss of skeletal muscle mass and strength – sarcopenia, which leads to the loss of functional capacity and a greater risk of developing metabolic disease such as diabetes[1]. Although some degree of sarcopenia is inevitable, the extent to which it can be minimised, and possibly reversed, has important implications as loss of physical function predicts loss of independence, falls, and even mortality.

Muscle protein synthesis

Both food intake and resistance exercise stimulate protein synthesis in muscles. Studies suggest that older people are less responsive to the stimulating effects of protein than their younger counterparts[2,3]. A number of factors may be involved in this including reduced protein digestion and absorption with age[4]. Consequently, research has focused on whether higher intakes of **protein** can overcome this 'anabolic resistance' and enhance the effects of exercise. A number of expert groups have now concluded that to help older people maintain and regain lean body mass and function, higher protein intakes than currently recommended (0.8 g/kg/day) are required: in the range of at least 1.0 to 1.2 g/kg/day and up to 1.5g/kg/day[5,6]. Roughly equal distribution of protein intake at meals across the day is suggested to be the most effective way to achieve this, which, assuming three meals a day, equates to 0.4 to 0.5 g/kg per meal[2,7]. Protein intakes at breakfast time are often low, and increasing protein intake before bed may also represent an opportunity for overnight muscle protein synthesis[7-9].

The quality of protein intake is also important. Protein that has a high concentration of essential amino acids, most importantly **leucine**, has been suggested to best stimulate muscle protein synthesis[10]. This points to milk protein, particularly whey, and a number of studies have confirmed beneficial effects on muscle protein synthesis in older people[11,12]. It is also increasingly recognised that in addition to protein quality, the matrix of the food in which the protein is contained (the combination of other nutrients and structure and how they interact) can influence rates of muscle protein synthesis[13-15]. It is likely that the effects of whey on muscle gain in older people extend beyond its leucine or essential amino acid content since comparable amino acid 'mixes' do not have the same effect[16]. Factors such as rate of absorption influenced by the dairy food matrix, may be important[16,17]. Similarly, with respect to dairy matrix effects, intact milk protein has been reported to have a greater bioavailability, as measured by the rate of delivery of amino acids into the circulation, compared with the same amount of whey or casein[4]. The mechanism of the potential beneficial dairy matrix effects remains to be fully elucidated and more research is needed on the effects of milk per se and of other whole dairy foods on muscle protein synthesis in older people.

Dairy protein supplementation

A meta-analysis in 2012 of longer-term studies examining the effects of diet and exercise in older people found that protein supplementation increased muscle mass and strength gains during resistance exercise programmes: 38% more fat free mass and a 33% increase in strength[18]. All six studies in the meta-analysis used a dairy-based protein; five exclusively dairy (milk, whey or casein) and the sixth a combination of egg, meat and dairy. A subsequent six-month clinical trial from the Netherlands also found that a milk protein drink, given at breakfast and lunch, combined with a resistance exercise programme significantly increased skeletal muscle mass in frail elderly adults[19]. Another long-term study by the same research group, found that although increasing milk protein without exercise did not increase muscle mass, it enhanced physical performance in the frail elderly subjects including improvements in balance, walking speed and ability to 'get up and go' from a chair[20]. The milk drink used in these two studies provided around 30g of protein a day (2 x 15g). In another dairy intervention, adding 210g of ricotta cheese a day to the usual diets of older people (without sarcopenia) for 12 weeks improved skeletal muscle mass and balance-test scores[21]. A meta-analysis in 2019 (eight studies, including those above), on the impact of dairy protein supplementation on muscle mass, muscle strength and physical performance in middle-aged to older adults,

reported a beneficial effect on appendicular muscle mass (13% greater compared with controls)[22].

Observational studies

There is some evidence that older people with higher intakes of dairy have greater muscle mass and better muscle function. In a prospective cohort study of older Spanish adults (60 years plus), higher consumption of low-fat milk and yogurt was associated with lower risk of frailty and, specifically, of slow walking speed and weight loss[23]. Similarly, a study of almost 4,000 older people in Ireland (over 60 years), found higher daily yogurt intake was associated with better physical function scores[24]. A cross-sectional study in 70 to 85-year-old Australian women also reported that those with the highest milk, cheese and yogurt consumption (2.2 or more servings a day) had significantly greater lean body and skeletal muscle mass, greater hand-grip strength and better 'up and go' performance than women who consumed the least (less than 1.5 servings)[25]. The authors highlighted that the bioactive compounds present in dairy such as high-quality proteins and interactions with other components of the dairy matrix such as calcium may be responsible for the beneficial effects.

Ensuring adequate protein intake, including through milk protein, alongside physical activity, appears a promising approach to improve muscle mass and functional performance in older people. Given the consequences of sarcopenia for health and quality of life, and with an aging population, such strategies are increasingly important. In addition to protein, milk and dairy foods offer older people other key nutrients in a palatable, convenient and affordable way. The value of dairy foods for older people, both for muscle health and the wider nutritional benefits, is recognised in recently reviewed national food-based dietary guidelines[26].

References

1. Cruz-Jentoft AJ et al. Sarcopenia: revised European consensus on definition and diagnosis. Report of the European Working Group on Sarcopenia in Older People. Age Ageing. 2018; 48: 16-31.

2. Breen L & Phillips SM. Skeletal muscle protein metabolism in the elderly: Interventions to counteract the 'anabolic esistance' of ageing. Nutr Metab. 2011; 8: 68.

3. Wall BT et al. Aging is accompanied by a blunted muscle protein synthetic response to protein ingestion. PLoS ONE. 015 10:e0140903. 10.1371/journal.pone.0140903

4. Gorissen SHM et al. Protein type, protein dose, and age modulate dietary protein digestion and phenylalanine absorption kinetics and plasma phenylalanine availability in humans. J Nutr. 2020; 150: 2041-2050.

5. Bauer J et al. Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group. J Am Med Dir Assoc. 2013; 14: 542-559.

6. Deutz NE et al. Protein intake and exercise for optimal muscle function with ageing: recommendations from the ESPEN Expert Group. Clin Nutr. 2014; 33: 929–936.

7. Tieland M et al. Dietary protein intake in community-dwelling, frail, and institutionalized elderly people: scope for improvement. Eur J Nutr. 2012; 51: 173-179.

8. Cardon-Thomas DK et al. Dietary protein in older adults: adequate daily intake but potential for improved distribution. Nutrients. 2017; 9: E184.

9. Snijders T et al. The Impact of Pre-sleep Protein Ingestion on the Skeletal Muscle Adaptive Response to Exercise in Humans: An Update. Front Nutr. 2019; 6: 17.

10. Wolfe RR. Regulation of muscle protein by amino acids. J Nutr. 2002; 132: 3219S - 3224S.

11. Paddon-Jones D et al. Differential stimulation of muscle protein synthesis in elderly humans following isocaloric ingestion of amino acids or whey protein. Exp Gerontol. 2006; 41: 215-219.

12. Phillips SM et al. The role of milk- and soy-based protein in support of muscle protein synthesis and muscle protein accretion in young and elderly persons. J Am Coll Nutr. 2009; 28: 343-354.

13. Thorning TK et al. Whole dairy matrix or single nutrients in assessment of health effects: current evidence and knowledge gaps. Am J Clin Nutr 2017: 105:1–13.

14. Geiker NRW et al. Impact of whole dairy matrix on musculoskeletal health and aging – current knowledge and research gaps. Osteoporos Int. 2020; 31: 601–615

15. Burd NA et al. Food-first approach to enhance the regulation of post-exercise skeletal muscle protein synthesis and remodeling. Sport Med. 2019; 49: 59–68.

16. Katsanos CS et al. Whey protein ingestion in elderly results in greater muscle protein accrual than its constituent essential amino acid content. Nutr Res. 2008; 28: 651-658.

17. Churchward-Venne TA et al. Ingestion of casein in a milk matrix modulates dietary protein digestion and absorption kinetics but does not modulate postprandial muscle protein synthesis in older men. J Nutr. 2015; 145: 1438-1445.

18. Cermak NM et al. Protein supplementation augments the adaptive response of skeletal muscle to resistance-type exercise training: a meta-analysis. Am J Clin Nutr. 2012; 96: 1454-1464.

19. Tieland M et al. Protein supplementation increases muscle mass gain during prolonged resistance-type exercise training in frail elderly people: a randomized, double-blind, placebo-controlled trial. J Am Med Dir Assoc. 2012; 13: 713-719.

20. Tieland M et al. Protein supplementation improves physical performance in frail elderly people: a randomized, double-blind, placebo-controlled trial. J Am Med Dir Assoc. 2012; 13: 720-726.

21. Alemán-Mateo H et al. Nutrient-rich dairy proteins improve appendicular skeletal muscle mass and physical performance, and attenuate the loss of muscle strength in older men and women subjects: a single-blind randomized clinical trial. Clin Interv Aging. 2014; 9: 1517-1525.

22. Hanach NI et al. The impact of dairy protein supplementation on muscle mass, muscle strength, and physical performance in middle-aged to older adults, with or without existing sarcopenia: a systematic review and meta-analysis. Adv Nutr. 2019; 10: 59-69.

23. Lana A et al. Dairy consumption and risk of frailty in older adults: a prospective cohort study. J Am Geriatr Soc. 2015; 63: 1852-1860.

24. Laird E et al. Greater yogurt consumption is associated with increased bone mineral density and physical function in older adults. Osteoporos Int. 2017; doi.org/10.1007/s00198-017-4049-5

25. Radavelli-Bagatini S et al. Association of dairy intake with body composition and physical function in older community-dwelling women. J Acad Nutr Diet. 2013; 113: 1669-1674.

26. Food Safety Authority of Ireland Scientific Committee. Scientific Recommendations for Food-Based Dietary Guidelines for Older Adults. 2021. ISBN:978-1-910348-45-1

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