

## A SELECTION OF TEN READINGS ON TOPICS RELATED TO "2021 UPDATE: MALNUTRITION, MUSCLE LOSS, AND SARCOPENIA"

All are available as free full text, and some require payment

Selection of readings made by A/Prof Goh Lee Gan

### READING 1 – SARCOPENIA AMONG OLDER ADULT POPULATIONS

**Papadopoulou SK(1). Sarcopenia: A Contemporary Health Problem among Older Adult Populations. Nutrients. 2020 May 1;12(5):1293. PMID: 32370051.**

**doi: 10.3390/nu12051293. PMID:32370051 (Free full text)**

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#### ABSTRACT

Sarcopenia, a geriatric disease characterised by a progressive loss of skeletal muscle mass and loss of muscle function, constitutes a rising, often undiagnosed health problem. Its prevalence in the elderly population is largely considered variable, as it ranges from 5 percent to 50 percent depending on gender, age, pathological conditions as well as diagnostic criteria. There is no one unified approach of treatment or assessment, which makes sarcopenia even harder to assess. There is a pressing need to provide better diagnosis, diagnostics, prevention, and individualised health care. Physical activity and nutrition are the main studied ways to prevent sarcopenia, and they also offer better outcomes. This review aims to report the prevalence of sarcopenia in older adults, its etiology, prevention, and treatment techniques.

### READING 2 – KNOWING NUTRITION AND SARCOPENIA

**Ganapathy A(1), Nieves JW(1)(2)(3). Nutrition and Sarcopenia-What Do We Know? Nutrients. 2020 Jun 11;12(6):1755. doi: 10.3390/nu12061755.**

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#### ABSTRACT

Muscle health is important for the functionality and independence of older adults, and certain nutrients, as well as dietary patterns have been shown to offer protective effects against declines in strength and function associated with aging. In this paper, micronutrients, macronutrients, and food groups have been reviewed, along with their studied effects on the prevalence and incidence of sarcopenia, as well as their ability to preserve muscle mass and optimise physical performance. Randomised controlled trials appear to suggest a critical role for dietary intake of protein in preventing sarcopenia and muscle loss, although the optimal dose and type of protein are unknown. There are some promising data regarding the role of vitamin D and sarcopenia, but it is unclear whether the dose, frequency of dose, or length of treatment impacts the efficacy of vitamin D on improving muscle mass or function. Selenium, magnesium, and omega 3 fatty acids have been studied as supplements in clinical trials and in the diet, and they appear to demonstrate a potential association with physical activity and muscle performance in older individuals. Following the Mediterranean diet and higher consumption of fruits and vegetables have been associated with improved physical performance and protection against muscle wasting, sarcopenia, and frailty.

### READING 3 – OMEGA-3 IN PREVENTION AND TREATMENT OF SARCOPENIA

**Dupont J(1), Dedeyne L(1), Dalle S(2), Koppo K(2), Gielen E(3)(4). The role of omega-3 in the prevention and treatment of sarcopenia. *Aging Clin Exp Res.* 2019 Jun;31(6):825-836.**

**doi: 10.1007/s40520-019-01146-1. PMID: 30784011 (Free full text)**

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#### ABSTRACT

Sarcopenia is a geriatric syndrome with increasing importance due to the aging of the population. It is known to impose a major burden in terms of morbidity, mortality and socio-economic costs. Therefore, adequate preventive and treatment strategies are required.

Progressive resistance training and protein supplementation are currently recommended for the prevention and treatment of sarcopenia. Omega-3 polyunsaturated fatty acids (PUFAs) might be an alternative therapeutic agent for sarcopenia due to their anti-inflammatory properties, which target the 'inflammaging', the age-related chronic low-grade inflammation which is assumed to contribute to the development of sarcopenia. In addition, omega-3 PUFAs may also have an anabolic effect on muscle through activation of the mTOR signalling and reduction of insulin resistance. This narrative review provides an overview of the current knowledge about omega-3 PUFAs and their role in the prevention and treatment of sarcopenia.

We conclude that there is growing evidence for a beneficial effect of omega-3 PUFAs supplementation in sarcopenic older persons, which may add to the effect of exercise and/or protein supplementation. However, the exact dosage, frequency and use (alone or combined) in the treatment and prevention of sarcopenia still need further exploration.

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### READING 4 – NUTRITIONAL INTERVENTIONS FOR ELDERLY

**Kaur D(1), Rasane P(1)(2), Singh J(1), Kaur S(1), Kumar V(1), Mahato DK(3), Dey A(4), Dhawan K(1), Kumar S(2). Nutritional Interventions for Elderly and Considerations for the Development of Geriatric Foods. *Curr Aging Sci.* 2019;12(1):15-27. PMID: 31109282.**

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#### ABSTRACT

The process of aging is characterised by numerous changes in the body which has an overall negative effect on the health and lifestyle of the elderly. Nutrition deserves special attention as an individual reaches old age. It plays a vital role in affecting the quality of life, including physical, mental and social health. The physiological decline in food intake is very common among older age and this results in nutritional deficiencies. These increased nutritional deficiencies are the major risk factors for certain chronic diseases and deteriorated age-related health. Thus, the adoption of nutritional intervention can be a measure to tackle the current situation of nutritional deficiencies and promote a healthy lifestyle.

**READING 5 – MUSCLE GAIN FOLLOWING PROTEIN SUPPLEMENTATION PLUS EXERCISE THERAPY FOR OLDER ADULTS WITH SARCOPENIA**

**Liao CD(1)(2), Chen HC(2)(3), Huang SW(2)(4)(5), Liou TH(6)(7). The Role of Muscle Mass Gain Following Protein Supplementation Plus Exercise Therapy in Older Adults with Sarcopenia and Frailty Risks: A Systematic Review and Meta-Regression Analysis of Randomized Trials. *Nutrients*. 2019 Jul 25;11(8):1713. PMID: 31349606.**

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ABSTRACT

Aging and frailty are associated with a high risk of lean mass (LM) loss, which leads to physical disability and can be effectively alleviated by protein supplementation (PS) and muscle-strengthening exercise (MSE). In this study, the associations between LM gain and PS + MSE efficacy (measured using physical outcomes) in elderly patients with a high risk of sarcopenia or frailty were identified. A comprehensive search of online databases was performed to identify randomised controlled trials (RCTs) reporting the efficacy of PS + MSE in elderly patients with sarcopenia or frailty. The included RCTs were analysed using meta-analysis and risk of bias assessment. We finally included 19 RCTs in this meta-analysis with a median (range/total) Physiotherapy Evidence Database score of 7/10 (5-9/10). The PS + MSE group exhibited significant improvements in the whole-body LM (standard mean difference (SMD) = 0.66;  $p < 0.00001$ ), appendicular LM (SMD = 0.35;  $p < 0.00001$ ), leg strength (SMD = 0.65;  $p < 0.00001$ ), and walking capability (SMD = 0.33;  $p = 0.0006$ ). Meta-regression analyses showed that changes in appendicular LM were significantly associated with the effect sizes of leg strength ( $\beta = 0.08$ ;  $p = 0.003$ ) and walking capability ( $\beta = 0.17$ ;  $p = 0.04$ ), respectively. Our findings suggest that LM gain after PS + MSE significantly contributes to the efficacy of the intervention in terms of muscle strength and physical mobility in elderly patients with a high risk of sarcopenia or frailty.

**READING 6 – DIETARY FACTORS ASSOCIATED WITH FRAILTY IN OLDER ADULTS**

**Hernández Morante JJ(1), Gómez Martínez C(2)(3), Morillas-Ruiz JM(4). *Nutrients*. 2019 Jan 5;11(1):102. Dietary Factors Associated with Frailty in Old Adults: A Review of Nutritional Interventions to Prevent Frailty Development. PMID: 30621313.**

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ABSTRACT

Frailty syndrome is a medical condition that is characterised by a functional decline, usually from 65 years old on, and creates the need for assistance to perform daily living activities. As the population ages, the need for specialised geriatric care will increase immensely, and consequently, the need for specialised services for the care of these people will increase accordingly.

From a nutritional point of view, to control or balance the nutritional status of residents will be essential in order to prevent sarcopenia and, consequently, frailty development.

In this line, previous studies have highlighted the association between low energy intake, inadequate intake of protein and vitamin D, and an increased risk of frailty development. However, there is a lack of intervention studies on frail patients, especially in the realm of quality clinical trials.

The few studies performed to date seem to indicate that there is a protective role of protein supplementation against frailty syndrome. In this regard, it is tempting to suggest daily 30 g protein supplements to prevent frailty. However, it is well established that excess protein can also be harmful; therefore, specific individual characteristics should be considered before prescribing these supplements. On the other hand, the relevance of other nutritional interventions, such as vitamin D, omega-3, and medium-chain triglycerides, is much scarcer in the literature.

Therefore, we encourage the development of new clinical trials to carry out effective therapies to prevent frailty development.

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## READING 7 – SARCOPENIA, FRAILTY AND THEIR PREVENTION BY EXERCISE

**Nascimento CM(1), Ingles M(2), Salvador-Pascual A(3), Cominetti MR(1), Gomez-Cabrera MC(4), Viña J(3). Sarcopenia, frailty and their prevention by exercise. Free Radic Biol Med. 2019 Feb 20;132:42-49. PMID: 30176345.**

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### ABSTRACT

Sarcopenia is a major component of the frailty syndrome, both being considered as strong predictors of morbidity, disability, and death in older people.

In this review, we explore the definitions of sarcopenia and frailty and summarise the current knowledge on their relationship with oxidative stress and the possible therapeutic interventions to prevent or treat them, including exercise-based interventions and multimodal strategies.

We highlight the relevance of the impairment of the nervous system and of the anabolic response (protein synthesis) in muscle aging leading to frailty and sarcopenia. We also discuss the importance of malnutrition and physical inactivity in these geriatric syndromes.

Finally, we propose multimodal interventions, including exercise programs and nutritional supplementation, as the strategies to prevent and treat both sarcopenia and frailty.

**READING 8 – SKELETAL MUSCLE AGEING ATROPHY**

**Marzuca-Nassr GN(1)(2), SanMartín-Calisto Y(3), Guerra-Vega P(3)(4), Artigas-Arias M(3), Alegría A(3), Curi R(5). Skeletal Muscle Aging Atrophy: Assessment and Exercise-Based Treatment. Adv Exp Med Biol. 2020;1260:123-158. PMID: 32304033.**

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ABSTRACT

In the ordinary course of aging, individuals change their body composition mainly reducing their skeletal muscle mass and increasing their fat mass. In association, muscle strength and functionality also decrease. The geriatric assessment allows knowing the baseline situation of the patients, determines the impact of diseases, and defines specific treatments.

There are various tools to evaluate the health condition of older people. These tools include the assessment scales of necessary Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL), physical and functional assessment scales, and instruments that assess the cognitive state of the person.

There are several strategies that have been proposed to combat skeletal muscle atrophy due to aging, such as physical exercise, nutritional supplements, or drugs. Some researchers have highlighted the efficacy of the combination of the mentioned strategies.

In this chapter, we will focus only on physical exercise as a strategy to reduce skeletal muscle loss during aging.

**READING 9 – NUTRITIONAL SUPPLEMENTS TO SUPPORT RESISTANCE EXERCISE IN COUNTERING THE SARCOPENIA OF AGING**

**McKendry J(1), Currier BS(1), Lim C(1), Mcleod JC(1), Thomas ACQ(1), Phillips SM(1). Nutritional Supplements to Support Resistance Exercise in Countering the Sarcopenia of Aging. Nutrients. 2020 Jul 10;12(7):2057. PMID: 32664408.**

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ABSTRACT

Skeletal muscle plays an indispensable role in metabolic health and physical function. A decrease in muscle mass and function with advancing age exacerbates the likelihood of mobility impairments, disease development, and early mortality. Therefore, the development of non-pharmacological interventions to counteract sarcopenia warrants significant attention. Currently, resistance training provides the most effective, low-cost means by which to prevent sarcopenia progression and improve multiple aspects of overall health. Importantly, the impact of resistance training on skeletal muscle mass may be augmented by specific dietary components (i.e., protein), feeding strategies (i.e., timing, per-meal doses of specific macronutrients) and nutritional supplements (e.g., creatine, vitamin-D, omega-3 polyunsaturated fatty acids, etc.). The purpose of this review is to provide an up-to-date, evidence-based account of nutritional strategies to enhance resistance training-induced adaptations in an attempt to combat age-related muscle mass loss. In addition, we provide insight on how to incorporate the aforementioned nutritional strategies that may support the growth or maintenance of skeletal muscle and subsequently extend the healthspan of older individuals.

## READING 10 – FIVE-INGREDIENT NUTRITIONAL SUPPLEMENT AND HOME-BASED RESISTANCE EXERCISE

**Nilsson MI(1)(2), Mikhail A(1)(3), Lan L(1), Di Carlo A(1), Hamilton B(1), Barnard K(1), Hettinga BP(2), Hatcher E(1), Tarnopolsky MG(1), Nederveen JP(1), Bujak AL(2), May L(1), Tarnopolsky MA(1)(2). A Five-Ingredient Nutritional Supplement and Home-Based Resistance Exercise Improve Lean Mass and Strength in Free-Living Elderly. *Nutrients*. 2020 Aug 10;12(8):2391. PMID: 32785021.**

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### ABSTRACT

Old age is associated with lower physical activity levels, suboptimal protein intake, and desensitisation to anabolic stimuli, predisposing for age-related muscle loss (sarcopenia). Although resistance exercise (RE) and protein supplementation partially protect against sarcopenia under controlled conditions, the efficacy of home-based, unsupervised RE (HBRE) and multi-ingredient supplementation (MIS) is largely unknown.

In this randomised, placebo-controlled and double-blind trial, we examined the effects of HBRE/MIS on muscle mass, strength, and function in free-living, older men.

Thirty-two sedentary men underwent twelve weeks of home-based resistance band training (3d/week), in combination with a daily intake of a novel five-nutrient supplement ('Muscle5'; M5, n = 16, 77.4 ± 2.8 y) containing whey, micellar casein, creatine, vitamin D, and omega-3 fatty acids, or an isocaloric/isonitrogenous placebo (PLA; n = 16, 74.4 ± 1.3 y), containing collagen and sunflower oil. Appendicular and total lean mass (ASM; +3 percent, TLM; +2 percent), lean mass to fat ratios (ASM/percent body fat; +6 percent, TLM/percent body fat; +5 percent), maximal strength (grip; +8 percent, leg press; +17 percent), and function (5-Times Sit-to-Stand time; -9 percent) were significantly improved in the M5 group following HBRE/MIS therapy (pre vs. post-tests; p < 0.05). Fast-twitch muscle fibre cross-sectional areas of the quadriceps muscle were also significantly increased in the M5 group post-intervention (Type IIa; +30.9 percent, Type IIx, +28.5 percent, p < 0.05). Sub-group analysis indicated even greater gains in total lean mass in sarcopenic individuals following HBRE/MIS therapy (TLM; +1.65 kg/+3.4 percent, p < 0.05).

We conclude that the Muscle5 supplement is a safe, well-tolerated, and effective complement to low-intensity, home-based resistance exercise and improves lean mass, strength, and overall muscle quality in old age.