

NUTRITIONAL INTERVENTIONS IN FRAILTY IN OLDER ADULTS: A NARRATIVE REVIEW ON THE CURRENT EVIDENCE

INTERVENÇÕES NUTRICIONAIS NA FRAGILIDADE EM IDOSOS: REVISÃO NARRATIVA DA EVIDÊNCIA ATUAL

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ABSTRACT

In recent years there has been an increase in elderly population and frailty. Although there is no universal definition of frailty, the most used is the frailty phenotype defined by Fried *et al.* (2001). Unbalanced eating habits and/or an inadequate nutritional status are modifiable risk factors for frailty.

The aim of this literature review is to analyse the role of nutrition in frailty's treatment in community-dwelling, institutionalized and hospitalized older adults.

Regardless the setting, educational strategies, food fortification, supplementation, multidisciplinary and individualized interventions are important and effective strategies for frailty's treatment.

In community-dwelling older adults, multifactorial interventions that combine nutritional education and supplementation seem to be effective in treating frailty. In institutionalized older adults, multifactorial intervention that include protein-energy, vitamin D, calcium and fiber and physical exercise improves nutritional status and also physical capacity.

In hospital setting, the most effective strategy is an individualized approach regarding patients' favourite foods, additional snacks, the use of oral nutritional supplements or use protein-enriched foods and artificial nutrition when necessary. Further studies are needed in order to establish specific recommendations for the intervention in the prevention and treatment of frailty in older adults.

KEYWORDS

Frailty, Nutritional interventions, Older adults, Treatment

RESUMO

Nos últimos anos tem-se verificado o aumento da população idosa e da fragilidade. Apesar de não existir uma definição universal de fragilidade, a mais usada é o Fenótipo de Fragilidade definido por Fried *et al.* (2001). Hábitos alimentares desequilibrados e/ou um estado nutricional desadequado são fatores de risco modificáveis para a fragilidade.

O objetivo desta revisão literária é analisar o papel da nutrição na prevenção e no tratamento da fragilidade em idosos a viver na comunidade, institucionalizados e hospitalizados.

Conclui-se que, em indivíduos inseridos na comunidade, educação alimentar, a fortificação alimentar, a suplementação e intervenção multidisciplinar são estratégias importantes para a prevenção e o tratamento da fragilidade. No que diz respeito a idosos institucionalizados, intervenção que inclua suplementação proteico-energética, vitamina D, cálcio e fibra contribui para melhorar o estado nutricional e a capacidade física. Em meio hospitalar, a estratégia mais eficaz é a intervenção individualizada tendo em consideração os alimentos preferidos das pessoas, *snacks* e suplementos alimentares ou alimentos enriquecidos em proteína, além da nutrição artificial. Serão necessários mais estudos para estabelecer recomendações específicas para a intervenção nutricional na fragilidade em pessoas idosas.

PALAVRAS-CHAVE

Fragilidade, Intervenções nutricionais, Idosos, Tratamento

INTRODUCTION

Over the past few years, there has been an increase in Average Life Expectancy. In 2050 it is estimated that over two billion people are 65 years old or older (1, 2). This gradual aging of the world population leads to major changes in health care and economic systems as conditions associated with aging are emerging (1, 3). The aging process differs between individuals (4). Although aging can be a healthy process, with preservation of

physical and mental health, in most cases, it often results in physical and psychological decline and compromises the performance of daily activities (4). One of the most problematic condition associated with the aging process is frailty (1).

Frailty is a condition characterized by the decline of different systems associated with age and body's inability to respond to stress factors (6). This vulnerability leads to an increased risk of disability and mortality as well as

an increased risk of falls, delirium, fractures, dependence, cognitive impairment, hospitalization, institutionalization and, consequently, poor quality of life (1-6). However, when this syndrome is diagnosed, there is an opportunity to delay the progression of the disease and to avoid negative consequences (6). The frailty definition most commonly used is the frailty phenotype proposed by Fried *et al.* in 2001(6). According to the frailty phenotype (6), frailty is a condition characterized by physiological changes such as unintentional weight loss, reported exhaustion, decreased gait speed, decreased physical activity and muscle weakness (6). Older adults who demonstrate at least three of the above-mentioned features are frail whereas older adults that present one or two of these features are considered pre-frail (6).

According to a cross-sectional study published by Santos-Eggimann *et al.* (2009) that compares the prevalence of this condition among 10 countries in Europe, and considering the frailty phenotype, Southern European countries such as Spain (27.3%), Italy (23.0%), France (15.0%) and Greece (14.7%) have a higher prevalence of frailty compared to countries such as Switzerland (5.8%), Sweden (8.3%), the Netherlands (11.3%), Denmark (12.4%), Germany (12.1%) and Austria (10.8%) (7). According to the Nutrition UP 65 study results (8), the frequency of frailty in Portuguese older adults was 21.5% and the frequency of pre-frailty was 54.3% (8).

Among the various factors that are associated with frailty, nutrition plays a major role (9, 10). Regarding the frailty phenotype proposed by Fried *et al.* (6) the features that identify the presence of frailty are closely related to nutrition: poor eating habits can be seen either as a cause of unintentional weight loss, exhaustion, muscle weakness, decreased walking speed and physical activity or as a consequence of frailty (9, 10).

Anorexia of aging, a condition characterized by loss of appetite or reduced food intake associated with advanced age, is a modifiable risk factor of frailty (11).

There is a consistent body of evidence on the role of nutrition in frailty management. Therefore, the aim of the present study is to review the literature and to analyse the information regarding nutritional interventions for frailty's treatment in community-dwelling, institutionalized and hospitalized older adults (11).

METHODOLOGY

Since November 2019 until April 2022, a literature review was performed on Pubmed and Google Scholar databases with these following keywords: frailty, elderly, nutritional interventions, institutionalized older adults, hospitalized older adults, treatment. In the present narrative review, 34 original articles and 6 reviews in community-dwelling, institutionalized and hospitalized elderly (age ≥ 65 years) published in English between 2001 and 2023. The keywords used for the search were: frailty, nutritional interventions, older adults, treatment.

Nutritional Interventions in Frailty in Older Adults

Over the years, different nutritional approaches have been studied concerning the treatment of frailty in older adults, although available data is still scarce. The strategies must be adapted to different settings such as community, hospital and institutions since nutritional status of older adults and the risk of frailty varies according to the context. Besides, resources available for nutritional intervention also change according to the setting. In the next section these different nutritional strategies are described in detail.

1. Community Dwelling Older Adults

1.1 Educational Strategies

Nutritional education along with the practice of physical activity and social support should be taken into consideration to reverse frailty in older adults (11-14).

In a controlled randomized study by Seino *et al.* (2017), 77 pre-frail and frail community-dwelling elders underwent a multidomain intervention that included nutritional education sessions about the importance of food, cooking methods, adequate food intake and food variety, practice of resistance exercise and psychosocial sessions (12). This resulted in an improved nutritional status due to an increased food consumption variety and intake of protein and micronutrients, reduced frailty, increased functional mobility and greater social interaction (12). Educational sessions on health concepts such as frailty, sarcopenia, healthy eating, the distribution of an informational leaflet, the practice of balance, posture, resistance, stretching and strengthening exercises and psychotherapy sessions, led to reversal of frailty (13-15). In a randomized controlled trial published by Chan *et al.* (2012) conducted in 117 community dwelling frail elderly, a physical exercise and nutritional intervention significantly improved not only frailty phenotype criteria such as "low gait speed" and "low muscle strength" but also bone mass density and, consequently, reduced percentage of osteopenia (13). Considering nutritional status, there was an increase in serum Vitamin D levels and an improvement in BMI values (14). In agreement with a randomized controlled trial published by Luger *et al.* (2016) with 80 frail and pre-frail, at risk of undernutrition and undernourished elders, multidisciplinary intervention that included the practice of resistance physical activity, education on the food variety, food fortification and energy and protein intake to elucidate individuals about adequate food intake, also proved to be effective in improving diet and nutritional intake assessed by Mini-Nutritional Assessment Long-Form (MNA-LF) and reversing frailty assessed by SHARE-FI (15). Concerning nutritional status, there was an increase of fruit, vegetables, fluid, protein intake. Regarding frailty status, there was an improvement in frailty criteria "exhaustion", "weakness" and "low physical activity" (15).

A randomized controlled trial by Huguet *et al.* (2018) performed in 200 pre-frail community-dwelling elderly Spanish population highlighted the importance of multidisciplinary intervention that included educational sessions about Mediterranean diet, practice of strength, endurance, balance and coordination exercises, the evaluation of incorrect prescription of drugs and social support since it reproduced beneficial effects on functional status, adherence to Mediterranean diet, quality of life and functional mobility, thus preventing the progression of early stages of frailty and avoiding negative outcomes (16).

Although nutritional education interventions resulted in positive outcomes both in improving nutritional status and reversing frailty, interventions that combined nutritional education, supplementation and strength, balance, resistance and flexibility exercises were equally feasible approaches (17). In a four-arm, single blind, randomized controlled trial conducted by Hsieh *et al.* (2019), 319 frail and pre-frail old adults were provided with personalized dishes and skimmed milk powder supplement in order to ensure the maintenance of body weight and adequate food intake (17). This resulted in improved eating habits since elderly increased high-protein foods' consumption, which, consequently, led to an increase in energy intake (17).

1.2 Supplementation

A randomized controlled study with a 241 frail community-dwelling elderly population, published by Cameron *et al.* (2013), introduced a novel individualized intervention to treat frailty (18). In other words, if a person met "weight loss" criteria, nutritional assessment and protein-energy supplementation were provided (18). Regarding "exhaustion"

criteria, psychological help was provided and if “weakness”, “slowness” or “low energy expenditure” were met, an individualized home exercise plan was performed (18). In fact, this innovative, customized intervention revealed to be effective in reversing frailty and improving mobility (18). Regarding L-carnitine supplementation, a randomized, double-blind, placebo-controlled trial by Badrasawi *et al.* (2016) performed in a 50 prefrail community-dwelling elderly population demonstrated that L-carnitine supplementation not only improved physical function, since it increased muscle strength, reversed exhaustion, weakness, and consequently, reversed frailty (19). In 187 community-dwelling frail elderly of low socioeconomic status and who lived alone and took part in a randomized controlled trial conducted by Jang *et al.* (2018), the practice of resistance, balance and aerobic exercise along with protein supplementation, control of depression’s signs, reduction of medication and home hazards showed positive effects on frailty as well as in physical function, depressive symptoms, reduced functional decline and symptoms of depression (20). In agreement, a randomized controlled trial by Kim and Lee (2012) with 87 frail, low income community-dwelling population, protein-energy supplementation resulted in greater protein intake and energy intake and reduces the progress of functional decline (21). Multidisciplinary intervention that included protein supplementation, the practice of aerobic physical exercises, memory exercises and revision of drug prescription proposed by Romera-Liebana *et al.* (2018) in a randomized controlled trial with 352 frail community-dwelling older adults, showed not only improvement of frailty but also improved aspects that contribute directly or indirectly to frailty such as improvement of cognitive status and muscle strength, stretching, balance, mobility and reduction in therapeutic drug consumption (22). In a randomized controlled trial published by Kang *et al.* (2019) that included 115 frail community-dwelling chinese old individuals, whey protein supplementation along with resistance exercises led to increased muscle function (23). In agreement, in a randomized controlled trial conducted by Kim *et al.* (2015) with 131 community-dwelling frail older women, the practice of strength, balance and gait training exercises along with milk fat globule membrane supplementation resulted in a decrease in all frailty phenotype criteria, except muscle strength, and in an improvement of physical function (24). However, according to a multifactorial, double-blind, randomized placebo-controlled trial conducted by Roschel *et al.* (2021) with 200 community-dwelling pre-frail and frail older individuals- mainly women- that underwent in a resistance exercises, neither whey and soy protein, leucine nor creatine supplementation were effective to improve muscle mass and resistance exercises (25).

Regarding vitamin supplementation, Ng *et al.* (2015) conducted a randomized controlled trial in 246 community-dwelling frail older adults. In this study, a multivitamin nutritional supplementation composed of iron and folate, vitamin B6 and vitamin B12, calcium and Vitamin D was used along with cognitive training. The results showed a decrease in frailty prevalence possibly due to the combination of nutritional supplementation and physical exercise that increased gait speed and muscle strength (26).

Despite low serum levels of vitamin D being related to frailty (27), Vaes *et al.* (2018) demonstrated in a randomized controlled trial with 78 prefrail and frail community-dwelling elderly that vitamin D supplementation had not been shown to reproduce any effect in improving frailty’s features such as physical performance and muscle strength (28).

2. Institutionalized Older Adults

2.1 Supplementation

According to a multicentre prospective observational study conducted by Abizanda *et al.* (2015) among 91 institutionalized frail nursing home

residents, Vitamin D, calcium and prebiotic fiber enriched protein-energy supplementation combined with the practice of strength, balance and flexibility physical exercises had a positive impact at different levels that led to a better quality of life (29). Regarding nutritional status, this multidisciplinary intervention caused an increase in weight and BMI and reduction of undernutrition (29). Concerning functional status, a significant improvement in balance and gait speed was observed (29). Since older adults have difficulties in chewing and swallowing, the most common oral nutritional supplements (ONS) are the liquid and creamy (30). Therefore, a randomized controlled trial published by Pouyssegur *et al.* (2015) with 175 undernourished older nursing home residents, suggested an adapted cookie-shaped protein-energy supplement as an alternative to the liquid or powder supplement usually used (30). In fact, besides increasing appetite, this supplement also increased weight and stimulated senses such as touch and smell, factors closely related to frailty (30).

It is known that in frail, at risk of undernutrition and undernourished institutionalized elderly, protein supplementation is an effective intervention (31). In fact, Park *et al.* (2018) showed in a randomized, double-blind, placebo-controlled trial with 120 undernourished prefrail and frail institutionalized old adults that the higher the protein intake, the higher are muscle strength and gait speed, preventing progression of frailty and pre-frailty in older individuals (31). Likewise, Stange *et al.* (2013) determined in a randomized controlled trial with 286 pre-frail individuals at risk of undernutrition or undernourished, with high level of mental and physical impairment, that low volume and high protein-energy density supplementation improved nutritional status since it was observed an increase in energy, protein and micronutrient intake and improved body composition due to the increase in BMI, body weight, and, consequently, improved quality of life and reduced the risk of frailty in this population (32).

As reported by Abe *et al.* (2016) in a randomized controlled trial that involved 38 frail nursing home old residents, medium-chain triglycerides with leucine and vitamin D supplementation resulted in weight gain as well as in an increase of muscle strength and muscle function (33). Buigues *et al.* (2016) determined in a randomized controlled trial enrolled in 60 frail institutionalized older adults that despite pre-biotic supplementation did not reproduce any nutritional effect, there was a positive correlation with frailty features such as exhaustion and muscle strength leading to prevention of progression of frailty (34).

3. Hospitalized Patients

3.1 Individualized Nutritional Intervention

In hospitalized older adults, there are several factors that contribute to the deterioration of nutritional status and undernutrition risk such as the presence of comorbidities and poor appetite. Thus, the risk of frailty in hospitalized older adults is high. Therefore, it is important to develop appropriate nutritional interventions to improve nutritional status (35). As reported in a randomized controlled trial published by Schuetz *et al.* (2019) with 288 frail hospitalized patients at risk of undernutrition, the best nutritional approach consisted in a nutritional plan adjusted to the energy and protein needs and comorbidities of each patient, implemented from admission to discharge (36). The choices of the patients’ favourite foods, additional snacks, the use of oral nutritional supplements or the use of protein-enriched foods and the use of enteral tube or parental feeding when necessary were feasible approaches to improve the nutritional status of patients leading to the improvement in weight and in BMI (36). This individualized approach led not only to an increase in energy and protein intake, but also to an improvement in physical capacity, functional status and, consequently, quality of life and reversed frailty (36).

3.2 Supplementation

According to a randomized controlled trial published by Niccoli *et al.* (2017) in 47 hospitalized frail individuals, whey protein supplementation was accepted by the frail elderly and improved protein intake, usually deficient in this population (37). In addition to the nutritional benefits, it also showed improvements in physical function, particularly in muscle strength and gait speed, leading to the reversal of frailty and in controlling inflammation as it led to a decrease in the pro-inflammatory cytokine IL-6 and an increase in serum levels of prealbumin (37).

CRITICAL ANALYSIS

Nutrition plays an important role in treating frailty and also associated comorbidities. Protein, protein-energy, selenium, vitamins C and D and omega-3 fatty acids supplementation together with the practice of physical exercise has shown to reverse frailty, to improve nutritional status and functional status and to decrease inflammation in frail community-dwelling older adults.

In institutionalized older adults, generalized reduced appetite leads to increased plate waste (38). A possible strategy to the prevention or treatment of undernutrition is increasing energy and nutrient density through dietary fortification. Standard food fortification can improve nutritional status by contributing to improve food intake and to weight gain and, consequently, can prevent frailty.

Although older adults prefer food to supplements, protein and leucine supplementation together with the practice of resistance and balance exercises showed to improve nutritional and functional status and biological markers in healthy and at risk of undernutrition older adults. As far as frailty treatment in institutionalized frail older adults is concerned, protein-energy, vitamin D, omega-3 fatty acids and prebiotics supplementation, have both nutritional and physical benefits, improving the quality of life. However, improving physical status can mean an increase in the frequency of falls.

The treatment of frailty in hospital settings consisted in individualized interventions according to the needs of each patient, and their different comorbidities, with the aim of improving nutritional status. In these conditions, whey supplementation demonstrated to be effective in improving nutritional and functional status (37).

In conclusion, nutritional interventions for treatment of frailty are essential. In community-dwelling older adults, multifactorial interventions that combine nutritional education and supplementation seem to be effective in treating frailty. In institutionalized older adults, a multifactorial intervention that include protein-energy, vitamin D, calcium and fiber and physical exercise improves nutritional status and also physical capacity.

In hospital setting, the most effective strategy is an individualized approach regarding patients' favourite foods, additional snacks, the use of oral nutritional supplements or use protein-enriched foods and artificial nutrition when necessary.

It is worth noticing that in both institutional and hospital settings data on nutritional interventions in frailty are scarce which limited the evidence presented in this narrative review. Moreover, there is little information on the actual effectiveness of the nutritional interventions in frail older adults. Further studies are needed particularly in institutional and hospital settings and in order to establish specific recommendations for the intervention in the prevention and treatment of frailty in older adults.

CONFLICTS OF INTEREST

None of the authors reported a conflict of interest.

AUTHORS' CONTRIBUTIONS

CVF, ASS: Conceptualization, design and writing of the study; ASS, RG: Validation, formal analysis and investigation of the study. All authors have read and agreed with the final version of the manuscript.

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