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Original article

Nutritional Supplementation in the Elderly Population: A Review Study

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Abstract
The global demographic shift towards an aging population presents significant challenges in nutritional health for older adults. This review discusses the current research revealing the role of dietary supplements in addressing common nutrient deficiencies and supporting the health of the elderly. As the number of individuals aged 60 and older is expected to double by 2050, understanding the impact of age-related physiological changes on nutrition is crucial. Elderly individuals face an increased risk of nutrient deficiencies due to decreased appetite, impaired absorption, and chronic health conditions. Key deficiencies often observed include calcium, vitamin D, zinc, iron, vitamin B, and omega-3 fatty acids. These deficiencies are critical for bone health, immune function, cognitive abilities, and muscle maintenance. This review evaluates evidence from peer-reviewed studies and clinical trials, highlighting the efficacy and safety of various supplements in mitigating these deficiencies. Additionally, it explores the role of dietitians in managing nutritional care for the elderly, emphasizing the need for personalized dietary strategies. The findings underscore the importance of targeted nutritional interventions and supplementation to enhance the aging population's well-being and quality of life.
Keywords. Elderly Nutrition, Nutritional Supplements, Malnutrition, Older Adults, Healthy Diet.

Introduction

The global population is undergoing a significant demographic shift, marked by an exceptional increase in the number of older adults worldwide. According to the World Health Organization, the number of people aged 60 and older is projected to increase from 1 billion in 2020 to 2 billion by 2050 [1]. This demographic trend, often referred to as an aging population, results from declining fertility rates and increasing life expectancy in many parts of the world [2].

An older adult is typically defined as someone 65 years or older. A geriatric patient, however, is not strictly defined by age. Instead, this term refers to individuals who are highly frail and have multiple ongoing health issues, a condition that becomes increasingly common in those over the age of 80. [3].

As individuals age, they face physiological changes that can create unique nutritional challenges. These age-related alterations can significantly impact dietary intake, nutrient absorption, and overall nutritional status in the elderly population. Older adults often face unique nutrition challenges, such as decreased appetite, reduced nutrient absorption, and increased risk of malnutrition and micronutrient deficiencies [3]. These nutritional vulnerabilities can contribute to the development of chronic diseases, functional decline, and impaired quality of life among the elderly.

In this context, using nutritional supplements has become increasingly important in supporting the health and well-being of older adults. A comprehensive understanding of the evidence-based use of supplements in the elderly is essential for these healthcare professionals to provide optimal nutritional care [4].

This review article aims to clarify the cause and benefits of using nutritional supplements for the elderly, revealing the common nutrient deficiencies, the efficacy, and safety of various supplement types, and discusses the most important factors that cause reduced appetite and poor nutrition in the elderly and the potential role of nutritional supplements in addressing this issue.

Nutritional Needs of the Elderly

Common Nutritional Deficiencies

Common nutrient deficiencies observed in the elderly include inadequate intake of protein, vitamins (e.g., B12, D, and E), minerals (e.g., calcium, magnesium, and zinc), and omega-3 fatty acids. These deficiencies affect the overall health, immune function, cognitive abilities, and physical function. Malnutrition, a state of nutrition where a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on body form and function [9], is a serious issue for older adults, particularly those in hospitals. It can arise from insufficient food intake due to illness or difficulty with mobility and swallowing, leading to more health problems, longer hospital stays, and a higher risk of infections. Regular check-ups are essential to prevent and treat malnutrition, ensuring that older adults receive the nutrition they need to maintain health and improve their quality of life [5].

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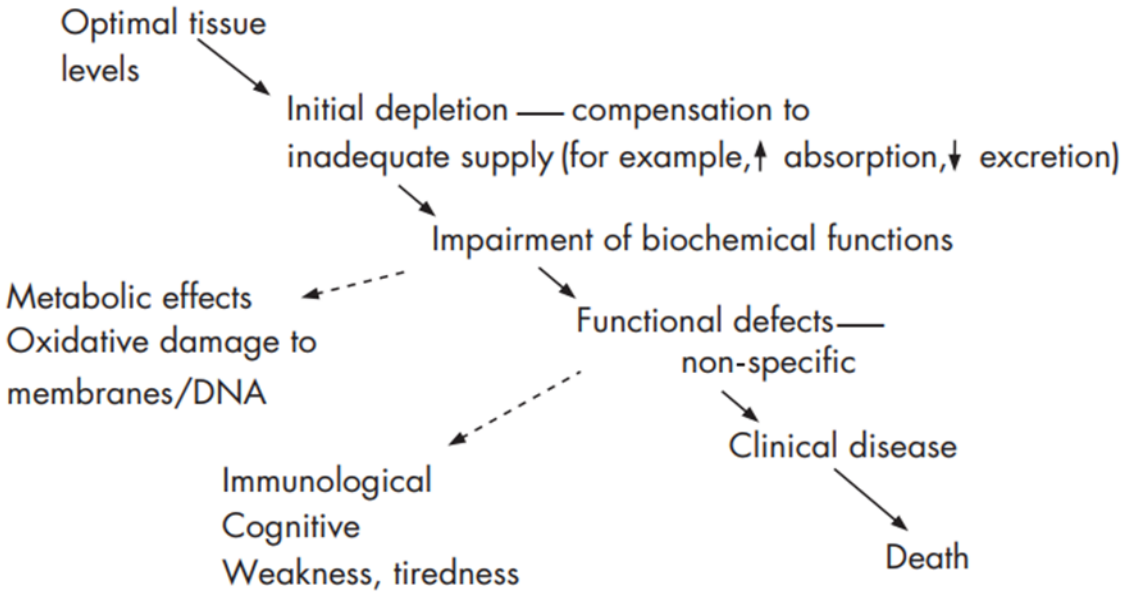

Figure 1. Development of micronutrient deficiency [24].

Vitamin B12: Often recommended for supplementation, as elderly individuals are at higher risk of malabsorption due to atrophic gastritis and reduced stomach acid production [6]. Vitamin D: Crucial for maintaining bone health and preventing falls and fractures in the elderly [7]. Calcium and Magnesium: Supplements can help address these minerals' decreased absorption and utilization in the aging population [8]. Magnesium absorption is reduced by 30% with aging [9].

Omega-3 Fatty Acids: Omega-3 supplementation has improved cognitive function, decreased the risk of cardiovascular disease, and reduced inflammation [12]. This is particularly relevant for the elderly, who are at greater risk of cognitive decline and cardiovascular comorbidities.

Calcium and Vitamin D3 are crucial for maintaining healthy bones. As people age, they often lose bone density, which leads to fractures and difficulty moving, especially in older adults. Women are particularly vulnerable to significant bone loss after menopause, due to lower estrogen levels. This decrease in estrogen leads to reduced calcium absorption in the intestines, less calcium reabsorption by the kidneys, and increased breakdown of bone tissue. A deficiency in Vitamin D3 worsens the situation by lowering calcium absorption, partly due to decreased production from sunlight exposure and limited sun intake. Additionally, the kidneys become less effective at converting Vitamin D3, and the intestines struggle to absorb it. Low levels of 25(OH)D in the blood are associated with greater muscle weakness, reduced physical ability, and an increased risk of falls and fractures in older adults. Several dietary factors influence calcium absorption in the intestines, including antinutrients such as phytates, oxalates, and tannins, which bind to calcium and hinder absorption. A diet high in sodium also leads to increased calcium loss through urine, reducing overall calcium retention in the body [13,14].

Zinc is an essential micronutrient that plays a key role in many bodily functions, including enzyme activity, immune system health, DNA synthesis, and the metabolism of other micronutrients. Older adults often have low serum zinc levels, which weakens their immune systems, making them more susceptible to infections and illnesses. Aging negatively affects T-cell function, and zinc deficiency worsens this problem. Lack of production of metallothionein leads to imbalances of zinc in the gut and other tissues. Certain dietary factors, such as phytates, iron, and calcium, hinder zinc absorption. However, some studies indicate that phytates may not be the main reason for decreased zinc absorption [13].

Iron deficiency is common in older adults and often results in anemia. Several factors contribute to this issue, including decreased food intake, regular use of medications, gastrointestinal problems, and concealed bleeding. Iron malabsorption can also lead to excessive iron buildup in the body. Additionally, higher levels of hepcidin, a hormone that decreases intestinal iron absorption, lead to lower iron levels [13].

The B-vitamin complex, including vitamins B6, B12, and folate, is essential for cellular function and brain health. Deficiencies in these vitamins among older adults can impair cognitive function and contribute to symptoms of depression. Severe deficiency is indicated by plasma vitamin B12 levels below 148 pmol/L, while levels between 148 and 221 pmol/L suggest marginal deficiency. Low levels of B-complex vitamins, particularly B6, B12, and folate, are associated with increased serum homocysteine levels, which raise the risk of Alzheimer's disease and dementia. Sufficient intake of these vitamins helps lower homocysteine levels and reduce the risk of these conditions. The use of laxatives by older adults to treat constipation can also disrupt gut metabolism and affect the absorption of B vitamins [13].

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Protein deficiency is common among older adults due to reduced food intake, which can lead to sarcopenia or loss of muscle mass. Approximately 30% of individuals aged 60 and older, and more than 50% of those aged 80 and above, are affected by sarcopenia. Inadequate protein intake causes muscle wasting, poor bone health, functional decline, and frailty. It is recommended that older adults distribute their protein intake evenly throughout the day. Aging reduces the body's ability to produce muscle protein, but sufficient intake of essential amino acids, especially leucine, can promote muscle protein synthesis. Consuming about 25-30 grams of high-quality protein daily is necessary to achieve the benefits of leucine. Additionally, metabolic changes in older adults decrease their ability to synthesize muscle protein [13,14].

Deficiency in omega-3 polyunsaturated fatty acids (PUFAs), particularly EPA and DHA, has significant negative effects on older adults. Low levels of these fatty acids are linked to increased risks of dementia and cognitive decline, as DHA is essential for brain function and neuroprotection. Insufficient omega-3 intake is also associated with higher depressive symptoms, although the effectiveness of supplementation on mood varies among individuals. Omega-3 deficiency contributes to cardiovascular risks, including atherosclerosis and stroke, due to an unfavorable omega-3 to omega-6 ratio. This imbalance is associated with greater plaque development in coronary arteries and may worsen existing cardiovascular conditions. Low omega-3 levels impair T-cell proliferation and increase pro-inflammatory cytokines, leading to heightened inflammation. Omega-3 deficiency also adversely affects muscle mass and function, exacerbating age-related anabolic resistance and contributing to sarcopenia, resulting in muscle wasting and functional decline among older adults [19].

Challenges and Factors Contributing to Nutritional Deficiencies in the Elderly: A Holistic Perspective

Nutritional challenges in the elderly increase the risk of malnutrition, particularly in those over 90 years old, who face a nearly 40% higher risk compared to individuals under 70 years. Aging decreases dietary intake and nutrient absorption, leading to higher morbidity and mortality rates. Socio-economic factors, along with physical and mental health issues, also negatively impact nutrient intake in older adults [19].

Inadequate nutrition, often resulting in Protein-Energy Malnutrition (PEM), affects between 23 and 60% of the elderly. This issue is exacerbated by physiological changes associated with aging that reduce food consumption and cause nutrient deficiencies. Approximately 20-30% of older adults experience anorexia due to loss of appetite, which is often linked to sensory impairments such as anosmia (loss of smell) and hypogeusia (reduced taste) caused by diminished olfactory and gustatory functions, including dry mouth and decreased taste bud sensitivity [13].

Hormonal changes further contribute to poor appetite in the elderly. Higher levels of hormones like cholecystokinin (CCK), glucagon-like peptide-1 (GLP-1), and peptide YY (PYY) lead to early satiety, while lower levels of ghrelin and insulin, along with increased leptin and proinflammatory cytokines (IL-1, TNF-α), reduce hunger and delay gastric emptying. Gastrointestinal problems such as slow bowel motility, chronic gastritis, and xerostomia (dry mouth) hinder digestion. Oral health issues like tooth loss and ill-fitting dentures complicate eating, contributing to anorexia, frailty, and sarcopenia [13].

Psychological issues such as depression, relocation, and social isolation reduce the desire to eat. Swallowing and chewing difficulties, along with the need for texture-modified foods, further impact food intake and nutrient absorption. Current food recommender systems often lack personalization and accurate tracking, making it challenging to meet the specific needs of older adults. A comprehensive approach should focus on better tracking, personalized dietary recommendations, and supporting the emotional and social aspects of eating [21].

The elderly also face an increased dependence on medications, which can interfere with nutrient absorption and metabolism. Despite the increased need for nutrients like protein with age, many elderly individuals fail to meet these needs, leading to conditions such as sarcopenia [26].

Gut health and nutrition challenges include age-related changes in digestion, chronic illnesses, and medications such as antibiotics that alter gut microbiota. Limited and repetitive diets, often due to living alone and avoiding raw vegetables and fruits, along with slower processing and decreased gastrointestinal function, further affect gut microbiota and overall health [4]

Physiological Changes and Nutritional Challenges in Aging

1. Reduced Appetite and Food Intake: Many elderly individuals experience a diminished sense of taste and smell, which leads to decreased interest in food and enjoyment of meals. Factors such as dental problems, difficulty chewing or swallowing, and gastrointestinal disturbances like constipation further contribute to reduced dietary intake in the elderly [25]. Environmental factors like social isolation, cultural influences, and the eating environment (e.g., atmosphere, eating effort, eating with others) also impact food consumption [20].
2. Nutrient Absorption and Malabsorption. Nutrient absorption declines with age. For instance, vitamin B12 absorption decreases due to age-related atrophic gastritis and reduced stomach acid production. Similarly, calcium absorption may be impaired by factors such as lactose intolerance, reduced vitamin

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D synthesis, and decreased intestinal calcium transporters. These malabsorption issues predispose the elderly to nutrient deficiencies. Chronic diseases and polypharmacy add complexity to nutritional challenges. Many elderly individuals have multiple co-morbidities, such as cardiovascular disease, diabetes, and cancer, impacting their nutritional needs and status. [8,46].

3. Medications used to manage these conditions may interfere with nutrient absorption or utilization. A study found that 50% of those taking 10 or more medications were malnourished or at risk. Polypharmacy was associated with reduced fiber intake, fat-soluble B vitamins, and minerals, along with increased cholesterol, glucose, and sodium [15].

Nutritional Needs and Recommendations for Older Adults

Energy and Protein Intake

Energy Requirements: Older adults should aim for an energy intake of 30 kcal/kg of body weight per day [13].

Protein Recommendations: A minimum protein intake of 1 g per kg of body weight per day is essential. This value should be individually adjusted to nutritional status, physical activity level, disease status, and tolerance [15].

Fiber Intake: Fibers daily amount of 25 g is considered adequate for normal laxation in adults.

Micronutrient Recommendations: General Guidelines: Dietary recommendations for micronutrients for older persons do not differ from those for younger adults. The Reference Nutrient Intakes (RNI) in the UK and Dietary Reference Intakes (DRI) in the USA are defined as the intakes of each micronutrient that meet the requirements of almost all (97%– 98 %) of persons in the group [30].

Supplementation and Nutrient Adequacy: A meta-analysis of 24 trials (2387 patients) on oral protein and energy supplementation in older adults showed that oral nutritional supplements (ONS) reduced mortality. This was consistently significant in undernourished older adults (>75 years) who were offered ≥400 kcal/day in the supplement for ≥35 days, and when patients were hospitalized. The length of stay was approximately 6 days shorter, although this did not reach statistical significance. Body weight increased significantly (+2.4%) when ONS was used [19].

A study assessed the nutrient intake adequacy of vitamin and mineral supplement users versus nonusers aged 51 and older, analyzing data from 4,384 adults collected between 1994 and 1996. It found that supplement users generally had better nutrient intake for vitamins A, B-6, C, folate, zinc, and magnesium than nonusers. However, less than 50% of both groups met the Estimated Average Requirement (EAR) for folate, vitamin E, and magnesium from food alone. Supplements improved nutrient intake, with over 80% of users meeting the EAR for several vitamins and minerals. However, some exceeded safe limits for iron, zinc, and vitamin A. Sociodemographic factors influencing supplement use varied by gender, with education and health attitudes being significant predictors. Overall, the findings indicate that many older adults lack sufficient nutrients from food, highlighting the need for tailored supplement recommendations and strategies to enhance dietary attitudes in this population [25,37].

Specific Studies and Findings: A study analyzing nutritional intake in older Mexican adults used data from the National Health and Nutrition Survey (Ensanut) conducted in 2006 and 2012. It involved dietary information from 526 participants aged 60 and older in 2012 and 3,326 in 2006. The findings showed that while energy and nutrient intakes remained consistent across both surveys, many individuals faced risks of deficiencies in essential micronutrients, including vitamins A, B-12, C, D, and folate, as well as minerals like calcium, iron, and zinc. Additionally, high consumption of sugar and saturated fats, along with low fiber intake, was prevalent. These results highlight the urgent need for targeted interventions to promote healthier dietary habits among older adults in Mexico [6, 10].

A study in France involving 725 institutionalized patients aged 65 and older assessed the effects of trace elements and vitamins on respiratory infections over two years. Participants received either trace elements (20 mg zinc and 100 mg selenium), vitamins (120 mg vitamin C, 6 mg beta-carotene, and 15 mg alpha-tocopherol), or both. While a reduction in respiratory infections was suggested among those receiving trace elements, the results did not reach statistical significance, except for a notable decrease in combined respiratory and urogenital infections in one nursing home. In addition, the trace element group showed significantly better seroconversion to the influenza vaccine, while the vitamin group fared worse. These findings underscore the need for further research to determine whether targeted supplements are more beneficial for the elderly than general multivitamin preparations, as no improvement in vaccine response was observed after one month of supplementation with a balanced formulation [28].

Protein and amino acid supplements have also been studied in the context of sarcopenia and frailty prevention in the elderly. Adequate protein intake is essential for maintaining muscle mass and function, which tend to decline with age. Supplementation with essential amino acids, such as leucine, has been shown to stimulate muscle protein synthesis and potentially slow the progression of sarcopenia.

Recent research focused on the dietary protein needs of older adults to maintain muscle mass and physical function. One study examined the effects of whey protein supplementation in community-dwelling older Australian women aged 70-80 over two years. In this randomized, double-blind, placebo-controlled trial,

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participants were assigned to consume either a high-protein drink containing 30 g of whey protein or a placebo with only 2.1 g of protein daily. Although there was a confirmed increase in protein intake among those receiving whey protein, the study found no significant improvements in muscle mass or physical function measures, even as declines in upper limb muscle area and hand grip strength were observed in both groups. These findings suggest that, in protein-replete, healthy older women, additional whey protein may not be effective in preserving muscle mass or physical function. This underscores the complexity of nutritional interventions in aging populations and highlights the need for further research to explore effective strategies for maintaining physical health in older adults [34].

Chromium and Glucose Tolerance: Chromium plays a significant role in enhancing insulin action and improving glucose tolerance. It does this through a low molecular weight intracellular octapeptide called thrombomodulin, which binds trivalent chromium and enhances the response of insulin receptors. This effect has been particularly noted in individuals with non-insulin-dependent diabetes mellitus (NIDDM) and nondiabetic obese patients with a family history of type II diabetes. Growing evidence suggests that chromium supplementation may help maintain glucose tolerance, reduce body fat, and increase lean tissue mass. However, the findings are inconsistent, possibly due to variations in dosages of food in studies. While some research indicates that doses around 200 mg to 1000 mg per day may be effective, a study using 100 mg per day of chromium picolinate showed no significant benefit [28].

Dietary supplements for the elderly

Overview of the most commonly used supplements

Older adults often struggle to get enough nutrients from their diet because they may not eat enough food. This has led to an increased reliance on dietary supplements. The use of multivitamins, protein supplements, and minerals has risen significantly in recent years, with many older individuals regularly taking these products. Research shows that many elderly people use supplements to help meet their nutritional needs [13].

Dietary supplements are important for older adults because they help fill nutritional gaps when the food consumed was insufficient. These supplements provide various nutrients, including vitamins, minerals, amino acids, and herbal extracts, designed to ensure adequate nutrient levels and support specific bodily functions. Challenges such as limited access to healthy foods, disabilities, and decreased appetite can make it hard for older adults to obtain the nutrition they need. By supplying these essential nutrients, supplements can help bridge the gap between what older adults consume and what they require, potentially improving their health and reducing the risk of chronic diseases [14]

Calcium and Vitamin D3: Older adults typically consume about 600 mg of calcium daily, which increases their risk of osteoporotic fractures and falls. To support optimal bone health, a daily intake of 1000-1200 mg of calcium is recommended. Additionally, an intake of 800-1000 IU/day of vitamin D3 is advised to maintain adequate serum levels and help lower the risk of falls and fractures. For those with sufficient sun exposure, 800 IU/day of vitamin D3 is generally enough daily dose for the elderly. However, individuals with limited sun exposure or obesity may require up to 2000 IU/day [10, 13, 19].

Zinc: supplementation is essential for older adults as it helps prevent age-related health issues. Zinc supports the immune system, reduces oxidative stress, and promotes metabolic balance. Studies show that it lowers the risk of developing advanced age-related diseases. Zinc influences key immune functions, including DNA repair, stabilizing cell membranes, and reducing inflammation. By preventing zinc deficiency, supplementation may lower the risk of infections, cancer, and other degenerative conditions common in aging, helping to delay the onset of these diseases and reduce disability. [20].

The recommended zinc intake for older men is 11 mg/day, and for older women, it is 8 mg/day, with a safe upper limit of 25-40 mg/day that includes both dietary and supplemental zinc. However, people over 60 often consume less than half the recommended amount for proper body function. [13].

Iron: The recommended daily iron intake is 8 mg for both men and women, with a maximum safe limit of 45 mg. For effective management of iron deficiency, increasing dietary iron and taking supplements like 300 mg of ferrous sulfate (providing 60 mg of elemental iron) can help. Vitamin C enhances iron absorption, but excessive iron levels can lead to harmful free radicals, especially if iron is overloaded. For severe cases, intravenous iron or chelation therapy may be necessary. [13].

Vitamin B12: The Recommended Dietary Allowance (RDA) for vitamin B12 ranges from 0.9 to 2.4 µg per day. In the United States and Canada, the average requirement is between 0.7 and 2 µg per day. Blood levels of vitamin B12 below 148 pmol/L indicate a severe deficiency, while levels between 148 and 221 pmol/L suggest a marginal deficiency. Increasing vitamin B12 intake can help lower high homocysteine levels, which may reduce the risk of Alzheimer's disease and dementia [13].

In the UK, guidelines for older adults have been updated to recommend daily intakes of 400 µg for folate and 2.4 µg for vitamin B12. These changes are based on recent evidence to ensure adequate nutrient intake in the elderly. However, recommendations for vitamin B6 remain unchanged at 1.4 mg per day for men and 1.2 mg per day for women, due to limited evidence on its optimal levels. [14].

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Nutritional supplements, especially omega-3 polyunsaturated fatty acids (PUFAs), have received significant attention for their potential health benefits. Omega-3 PUFAs, particularly EPA and DHA, are found in fish oil and are recognized for their roles in brain function, heart health, immune response, muscle maintenance, and bone health. Research widely explores their effects on age-related issues, such as cognitive decline, depression, heart disease, and loss of muscle mass. [21].

Omega 3: The current recommendation for long-chain n–3 PUFAs (omega-3) in older adults is 450 mg per day, and it is advised to consume at least 2 portions of fish per week, with 1 portion being oily fish, such as salmon or mackerel. [7].

Omega-3 fatty acids, particularly eicosatetraenoic acid (EPA) and docosahexaenoic acid (DHA), are emphasized for their potential benefits in reducing cognitive decline, supporting cardiovascular health, and improving immune function in older adults. The review suggests that higher intakes of omega-3 PUFAs may be beneficial for maintaining cognitive function and overall health [21].

Vitamin E: The recommended daily intake is 4 mg for men and 3 mg for women. Vitamin E is known for its antioxidant properties, which help shield immune cells from oxidative damage. It can boost immune responses, such as enhancing delayed-type hypersensitivity (DTH) and reducing oxidative stress markers. However, high doses of vitamin E may increase bleeding risk and interact with certain medications, so monitoring is essential [16].

Vitamin C: To prevent deficiency, a daily intake of 40 mg is recommended. Vitamin C acts as an antioxidant by neutralizing reactive oxygen species (ROS) and helps regenerate vitamin E. It also enhances nitric oxide availability, which is important for endothelial health [5].

Glutathione: This antioxidant plays a key role in detoxification and immune function. Supplementing with glutathione may restore its levels, potentially improving immune responses and reducing cancer risk. Further research is needed to determine optimal dosages and long-term effects. [16].

β-Carotene: This antioxidant may reduce oxidative stress and support immune health, but its benefits are not as well-established as those of vitamin E and glutathione. High doses of β-carotene, particularly in smokers, can increase the risk of lung cancer, so caution is advised [16].

Probiotics and Prebiotics: Probiotics are live bacteria that provide health benefits to the host when taken in sufficient amounts. Common types of probiotics include Lactobacillus acidophilus, Lactobacillus delbrueckii var. bulgaricus, Streptococcus salivarius var. thermophilus, Lactobacillus plantarum 299v, and Bifidobacterium lactis Bb12. These beneficial bacteria are commonly found in yogurt and other fermented foods.[11]. However, prebiotics support the growth of helpful bacteria in the digestive system. Examples of prebiotics include lactulose, inulin, fructooligosaccharides (FOS), and galactooligosaccharides (GOS). They act as dietary fibers that provide nutrients for probiotics, helping to enhance their positive effects on gut health. [11].

Evidence-Based Benefits of Nutritional Supplements

Protein Supplements: Studies show that protein supplements alone can slightly increase muscle mass in older adults. However, combining protein supplements with exercise leads to much better results, especially in improving muscle strength. Supplements rich in Essential Amino Acids (EAAs), like leucine, are particularly helpful in promoting muscle growth among the elderly. [13,15,28].

Calcium and Vitamin D: Taking calcium and vitamin D supplements has been shown to lower the risk of osteoporosis and weak bones significantly (osteopenia) in older adults. Vitamin D, in particular, helps reduce the chances of hip fractures and falls, which are common issues among the elderly. [13,47].

Folate, Vitamin B6, and B12: These vitamins are found to lower homocysteine levels in the blood, which might help slow down cognitive decline, especially in people with mild memory issues. However, taking these supplements for short periods didn't show much improvement in brain function. [13, 35, 36].

Omega-3 polyunsaturated fatty acids (PUFAs): Brain Function and Cognitive Health, **Cognitive Improvement:** Research on the impact of omega-3 polyunsaturated fatty acids (PUFAs), especially DHA, on cognitive performance has shown mixed results. DHA supplementation has been improving memory, verbal recall, and cognitive function in older adults with mild cognitive impairment (MCI) and age-related cognitive decline [24, 25, 26]. However, other studies have found no significant effect on cognitive performance in healthy older adults [19].

Depression: Omega-3 supplementation has been linked to a reduction in depressive symptoms. Higher levels of EPA in the blood were associated with fewer depressive symptoms, particularly in individuals also taking antidepressants [30]. However, some studies found no significant improvement in mental well-being from omega-3 supplements alone [19].

Cardiovascular Health: Atherosclerosis: Omega-3 supplements may benefit cardiovascular health by affecting the balance between omega-3 and omega-6 PUFAs. Low levels of DHA are linked to a higher risk of coronary atherosclerosis, while supplementation can impact plaque buildup and inflammation [19].

Arrhythmias: Omega-3 PUFAs have shown potential in improving heart rate variability and reducing irregular heartbeats. Supplementation can enhance heart autonomic regulation and decrease abnormal heart contractions [19].

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Immune Function

Inflammation: Omega-3 PUFAs can influence inflammation. Short-term fish oil supplementation has been effective in reducing inflammatory markers and improving immune responses in critically ill patients and during recovery from surgery [19].

Immune Cell Function: Omega-3 PUFAs affect immune cell activity and proliferation. Supplementation can influence the growth of lymphocytes and the production of cytokines, although results may vary.[19].

Muscle Mass and Function

Sarcopenia: Omega-3 PUFAs may help counteract age-related muscle loss and improve muscle protein synthesis. Supplementation has been associated with increased muscle mass and strength, although results can differ [19].

Bone Health

Bone Density: A higher intake of omega-3 PUFAs is linked to better bone mineral density. Conversely, a higher ratio of omega-6 to omega-3 PUFAs has been associated with lower bone density, emphasizing the importance of omega-3 intake for maintaining bone health. .[5].

Antioxidant Supplements: Antioxidants like vitamin E and glutathione have demonstrated benefits in improving immune function and mitigating age-related health issues. Vitamin E supplementation can enhance immune responses and lower oxidative stress markers, which may improve immune health in older adults. However, high doses of vitamin E can lead to risks such as bleeding and interactions with medications, so careful monitoring is necessary [16].

Vitamin C: Supplementing with vitamin C has been shown to reduce endothelial dysfunction associated with cardiovascular diseases (CVDs). For example, a study revealed that taking 2 grams of vitamin C daily for 4 weeks improved blood vessel function in patients with diabetes and coronary artery disease. Another study found that 500 mg of vitamin C per day for 1 month reduced blood pressure and arterial stiffness, though other studies did not confirm significant effects on blood pressure. Vitamin E's benefits are often linked to its regeneration by vitamin C, with evidence suggesting it helps reduce oxidative stress and inflammation. However, the standalone impact of vitamin E on health outcomes is mixed [5].

Glutathione: This antioxidant helps restore its levels and can enhance immune responses. Nonetheless, more research is needed to determine safe and effective dosing guidelines for glutathione supplementation

. β-Carotene: As an antioxidant, β-carotene may help reduce oxidative stress. However, its specific benefits for immune function in older adults are not well-established. High doses of β-carotene, especially in smokers, are linked to an increased risk of lung cancer, so it is generally better to obtain β-carotene from dietary sources rather than high-dose supplements.

Overall, while these supplements hold promise for boosting immune health, their use should be individualized, weighing both potential benefits and risks [16,35].

Probiotics and Prebiotics: Probiotics may help address malnutrition, particularly in children and elderly individuals. Specific strains such as Lactobacillus acidophilus and Bifidobacterium lactis have shown promise in improving nutritional status and aiding recovery from malnutrition.

Lactose Intolerance: For those with lactose intolerance, fermented dairy products like yogurt, which contain Lactobacillus delbrueckii var. bulgaricus and Streptococcus salivarius var. thermophilus, are often better tolerated than unprocessed milk. This is due to the lactase enzyme produced during fermentation, which helps break down lactose.

Constipation: Probiotics and prebiotics are effective in relieving constipation, a common issue among the elderly. Bifidobacteria and prebiotics such as fructooligosaccharides (FOS) and galactooligosaccharides (GOS) can enhance stool frequency and ease bowel movements. For instance, yogurt with Bifidobacterium has been associated with increased stool frequency, while lactulose and GOS) have improved defecation frequency [34,35].

Antibiotic-Associated Diarrhea

Saccharomyces boulardii, a type of probiotic, is effective in preventing and treating diarrhea caused by antibiotics. Although results in elderly populations have been mixed, further research is needed to understand its benefits [34].

Immune System: Probiotics can boost the immune system, which often weakens with age (a process known as immune senescence). Strains like Lactobacillus rhamnosus and Bifidobacterium lactis have been found to improve immune function in older adults, including increasing lymphocyte counts and enhancing natural killer (NK) cell activity [34].

Other Potential Uses: Probiotics may contribute to cancer prevention by influencing gut enzyme activity and enhancing immune responses. Some epidemiological studies suggest that regular probiotic consumption might be linked to a lower incidence of certain cancers.[13].

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Considerations for Supplement Usage in the Elderly

Personalized Recommendations: Nutritional needs vary among the elderly from one person to another based on health conditions, dietary preferences, and lifestyle. Recommendations should be tailored to individual needs. [14,22].

Monitoring and Assessment: Regular assessment of nutrient intake and levels is important to prevent deficiencies and avoid excessive supplementation, especially with fat-soluble vitamins [15].

Professional Guidance: Consulting with healthcare providers or dietitians is crucial before starting any supplement to ensure it aligns with personal health goals and conditions [6].

Risks and Safety Concerns

- Potential Side Effects: Discuss common adverse reactions to supplements, such as gastrointestinal issues or kidney stones from excess calcium.
- Drug-Supplement Interactions: Highlight interactions with common medications used by the elderly, such as anticoagulants and antihypertensives.
- Over-Supplementation: Explore the risks of excessive intake of fat-soluble vitamins (A, D, E, K) and minerals.
- Individual Variability: Consider the impact of gender, genetic predispositions, and pre-existing conditions on supplement use.

Conclusion

In conclusion, addressing the nutritional needs of the elderly requires a nuanced and individualized approach due to the complexity of their physiological and health challenges. Essential nutrients such as protein, vitamins, minerals, and omega-3 fatty acids are crucial for maintaining physical health and cognitive function in older adults. Deficiencies in these nutrients can lead to a range of adverse outcomes, including worsened health conditions, increased infection risks, and decreased quality of life. Effective nutritional management extends beyond supplementation, incorporating a thorough understanding of factors like malabsorption and medication effects. Personalized nutrition plans, regular assessments, and professional guidance are necessary to address individual needs and prevent both deficiencies and over-supplementation. Integrating these strategies with other health interventions, such as physical activity, can further enhance outcomes. Thus, a comprehensive, tailored approach is essential for optimizing the health and well-being of the elderly.

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الملخص

يُمثل التحول الديموغرافي العالمي نحو شيخوخة السكان تحديات كبيرة في مجال الصحة الغذائية لكبار السن. تناقش هذه المراجعة البحوث الحالية التي تتحقق من دور المكملات الغذائية في معالجة نقص العناصر الغذائية الشائعة ودعم صحة كبار السن. مع توقع تضاعف عدد الأفراد الذين تبلغ أعمارهم 60 عامًا فأكثر بحلول عام 2050، يُعد فهم تأثير التغيرات الفسيولوجية المرتبطة بالعمر على التغذية أمرًا بالغ الأهمية. يواجه كبار السن خطرًا متزايدًا للإصابة بنقص العناصر الغذائية الضرورية لصحة الجسم بسبب انخفاض الشهية، وضعف الامتصاص، والأمراض المزمنة. تشمل أوجه النقص الرئيسية التي غالبًا ما تُلاحظ نقص عنصر الكالسيوم، وفيتامين د، والزنك، والحديد، وفيتامين ب، وأحماض أوميجا 3 الدهنية. تُعد هذه النواقص أساسية لصحة العظام، ووظيفة المناعة، والقدرات الإدراكية، والحفاظ على العضلات. تُقيّم هذه المراجعة الأدلة المستمدة من الدراسات المُراجعة من قِبل الأقران والتجارب السريرية، مُسلّطةً الضوء على فعالية وسلامة مختلف المكملات الغذائية في التخفيف من هذه النواقص. بالإضافة إلى ذلك، تستكشف دور أخصائي التغذية في إدارة الرعاية الغذائية لكبار السن، مُشددةً على ضرورة اتباع استراتيجيات غذائية مُخصصة. تُؤكد النتائج أهمية التدخلات الغذائية المُستهدفة والمكملات الغذائية لتعزيز صحة كبار السن وجودة حياتهم.

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