THE ROLE OF DAIRY FOODS FOR HEALTHY AGING

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Abstract
Nutrition is a variable risk factor that may be associated with aging. As individuals age, they may experience various nutritional deficiencies and health issues related to inadequate and excessive nutrition. These can include problems with the musculoskeletal system, diminished immune function, metabolic disorders, and cognitive decline. The World Health Organisation has developed a model of healthy aging that focuses on optimizing many aspects of individuals’ intrinsic ability, such as cognition, psychological well-being, sensory function, vitality, and movement. Milk and dairy foods have the potential to help prevent physical and cognitive decline. Milk and dairy foods play a crucial role in providing a variety of essential nutrients, especially during specific stages of life. Dairy products have a significant opportunity to play a vital role in reducing geriatric malnutrition and the loss of muscle mass, bone strength, and functionality. This review aims to comprehensively analyze the potential health benefits of milk and dairy foods. By examining the evidence of associations between these products and the reduction in the incidence of chronic diseases, this study highlights the potential for older adults to lead longer and healthier lives.

Keywords: milk; dairy foods; healthy aging; musculoskeletal system; cognition.

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Key Messages for Research and Practice

• The process of ageing impacts both an individual’s physical capabilities and cognitive functioning.

• A healthy diet is essential for reducing the risk of diseases and enhancing overall well-being, particularly among older adults.

• Milk and dairy products are abundant in calcium, phosphorus, vitamin D, protein, and several vitamins and minerals.

• Consuming dairy foods is crucial for maintaining musculoskeletal and cognitive health in older people. Dairy foods also reduce blood pressure, the risk of type 2 diabetes, and cardiometabolic disease.
Introduction

Aging is a natural phenomenon characterized by the gradual physiological decline observed in all living organisms over time. Aging encompasses many changes during one’s lifespan, including physical, social, and physiological factors. Gerontologists define aging as a «biological process that involves the capacity to modulate, temporal continuity, and heterogeneity at the cellular, somatic, and molecular level.» There is a growing interest in the aging global population and an increased desire to lead a long, healthy life [1]. By 2050, the worldwide population of those aged 60 and beyond is expected to increase double, reaching 2.1 billion. As medical and health care advancement, the primary objective is to ensure the ongoing productivity and well-being of the aging population [2].

Nutrition is crucial in reducing the risk of diseases and improving optimal health, especially in older adults and persons of all ages [3]. Nutrition is a complex field that has seen a recent increase in research focusing on dietary patterns and their impact on health at the level of society. Dietary patterns include the quantities, proportions, and diversity of various foods and beverages included in the diet, as well as the frequency at which they are consumed [4, 5]. The United States Department of Agriculture (USDA) MyPlate Plan serves as a guide for individuals to plan a healthy diet. The USDA MyPlate Plan outlines the recommended daily food intake for a healthy and balanced diet. The basis of MyPlate for Older Adults is rooted in the 2015-2020 Dietary Guidelines for Americans. The MyPlate for Older Adults recommends increasing the intake of colorful fruits and vegetables, including herbs and spices for added flavor, reducing salt consumption, drinking plenty of liquids, and consuming more whole grains. It also recommends choosing a diverse range of protein sources, such as lean meats, poultry, legumes, nuts and seeds, fish, and low-fat dairy products, to meet the requirement for protein [6, 7].

Dairy products provide essential nutrients such as calcium, phosphorus, vitamin D, and protein in our diet [8]. Dairy products include nearly all of the essential nutrients that promote growth and development while maintaining the health of older adults. The effect of dairy consumption on the musculoskeletal system and cognitive function in the older adults is significant [9]. Furthermore, dairy products reduce blood pressure [10], the risk of developing type 2 diabetes [11], and cardiometabolic disease [12].

This research aimed to examine the efficacy of consuming dairy products in promoting healthy aging among the elderly population. This study examines both literature and clinical data to provide healthcare professionals with the necessary knowledge to help older adults make well-informed choices about the inclusion of dairy products in their balanced dietary patterns.

Search strategy

A search was conducted in the PubMed/MEDLINE and Web of Science databases. These keywords were included in the search: «aging,» «elderly,» «older adults,» «dairy,» and «dairy products.» English-language articles published in the previous five years were given precedence. Excluded from the review were case reports, study protocols, and congress abstracts. Furthermore, a comprehensive background was developed by compiling numerous articles and guidelines, utilizing extensive database searches and the author’s expertise in the field. Following Gasparyan et al.’s recommendations, a methodical strategy was employed [13].

Nutrient Content of Dairy Products

Milk and dairy products are dietary sources rich in proteins, lipids, lactose, oligosaccharides, fat-soluble vitamins (vitamins A, D, E, and K), riboflavin, Vitamin B12, and a variety of minerals including calcium, copper, magnesium, phosphorus, and zinc [14]. In addition, milk is rich in a wide range of bioactive peptides and fatty acids, including caseins, whey proteins, milk polar lipids, α-linolenic acid-conjugated linoleic acids, palmitic acid, and other minor constituents [15]. The nutritional composition of dairy products is shown in Figure 1.

The biological value of milk proteins is high due to their essential amino acid composition, high digestion, and bioavailability [16]. Triacylglycerols, present as globules surrounded by a membrane or milk fat globule membrane, constitute 98% of the fat content. Milk fat comprises about 72% saturated, 25% monounsaturated, and 3% polyunsaturated fatty acids [17].

The majority of the carbohydrates in milk are composed of lactose (>99%). Lactose facilitates calcium absorption in the intestines and can be broken down into galacto-oligosaccharides through enzymatic hydrolysis. These compounds are immediately utilized by bifidobacteria and help enhance digestive function [18]. Many individuals worldwide suffer from lactose intolerance;
nonetheless, the production of reduced lactose milk has been initiated since the 1970s. In cheese, yogurt, and other fermented dairy products, lactic acid bacteria enzymatically hydrolyze lactose into metabolizable glucose and galactose [19].

Milk is regarded as a significant dietary source of calcium when evaluated in terms of micronutrients. Milk and dairy products provide a significant amount of calcium and have a higher bioavailability than other food sources [20, 21].

Consumption of milk and dairy products in the recommended amounts specified in national recommendations is crucial for obtaining essential nutrients throughout all life cycle stages [22]. Several studies emphasize the advantages of including milk and dairy products in the diets of the older adults. When combined with physical activity, they show that these foods can increase muscle mass and function and lower the risk of sarcopenia and vertebral fractures [23, 24].

![Image](image.png)

Figure 1. The nutritional composition of dairy products

**Dairy in Musculoskeletal health**

Nowadays, osteoporosis affects over 200 million individuals globally, with estimates indicating a potential 30% rise in the years to come due to the aging population. Additionally, it is expected that 50% of women and 20% of males aged 50 and beyond may have an osteoporotic fracture in their later years [25, 26].

Skeletal muscle plays a crucial part in maintaining older individuals’ overall health and well-being. Approximately 40% of body mass is composed of muscle mass. Skeletal muscle quality and strength decline with age [27]. Hormonal fluctuations, inflammatory responses, reduced physical activity, and often associated with poor nutrition, are some of the reasons behind the decline in muscle mass and strength that occurs with aging. This condition is thought to be the onset of sarcopenia. Sarcopenia is a disease characterized by a gradual decline in muscle mass and function as individuals age. It typically starts to occur between the ages of 45 and 55 and is considered one of the significant clinical issues contributing to the onset of impairment in older adults [28, 29].

Research has demonstrated that milk has myoprotective effects by stimulating muscle protein synthesis [30, 31]. Consuming milk and dairy products is one of the best ways to obtain calcium, phosphorus, vitamin D, and protein in the diet. Calcium, phosphorus, and protein benefit muscle mass and function [32]. The branched-chain structure of 26% of the amino acids in whey protein, including immunoglobulins, β-lactoglobulin, α-lactalbumin, and lactoferrin, promotes muscle growth. Branched-chain amino acids, particularly leucine, are the primary amino acids that activate protein synthesis in skeletal muscle by the rapamycin (mTOR) pathway. The mTOR pathway regulates muscle protein synthesis in response to elevated levels of essential amino acids [33, 34].

Dietary protein is necessary to stimulate bone growth. Proteins can impact calcium, phosphorus, and bone metabolism due to their amino acid composition. Increases in the circulating level of Insulin-like Growth Factor-I (IGF-I), mediated by dietary proteins, improve the renal generation of 1,25(OH)D,
promoting intestinal absorption of calcium and phosphorus. Therefore, it has a beneficial impact on the process of bone mineralization [35, 36]. Research has indicated that inadequate vitamin D levels may inhibit the intestinal mucosa’s ability to absorb calcium and phosphorus effectively. This provides strong evidence for the significance of vitamin D [37-39]. A systematic review and meta-analysis found a significant correlation between consuming dairy products and milk and the risk of developing osteoporosis. Specifically, for every additional 200 grams of dairy intake, there was a 22% decrease in the risk of osteoporosis, while the same increase in milk intake was associated with a 37% lower risk.

Regarding hip fracture, milk consumption was found to be linked to a 25% lower risk of hip fracture, but only in cross-sectional and case-control studies. The overall relative risk was 0.75, with a 95% confidence interval of 0.57–0.99 [40]. The effect of protein, calcium, phosphorus, and vitamin D on the musculoskeletal system in the aging process is shown in Figure 2.

Dairy Products in Cognitive Function

With an increasing number of people growing older worldwide, public health has placed more importance on preventing cognitive decline and dysfunction [41]. The first sign of dementia is cognitive decline. The aging population is expected to result in a rise in both life expectancy and dementia rates [42].

With the ongoing rise in life expectancy, preserving optimal functionality among the older adults becomes increasingly significant. Prevention strategies that focus on modifiable factors are the most effective approach, as there is currently no treatment available to treat, delay or prevent aging. Diet, dietary patterns, and particularly the intake of dairy products have an impact on the prevention of cognitive decline associated with the older adults [43, 44].

Studies have indicated that dairy products, which are rich in vitamin B12, calcium, bioactive peptides, lactalbumin, and the methionine-homocysteine cycle, may positively impact brain aging through various pathways. Brain glutathione levels were discovered to correlate with the intake of dairy products [45, 46]. Another mechanism involves the beneficial effects of probiotics, which are present in fermented dairy products, on the gut microbiota, oxidative stress, inflammation, and mental health [47]. A large cohort study indicated that total dairy products, cheese, low-fat dairy products, and yogurt intake frequencies distinctively influence cognitive abilities related to problem-solving, verbal fluency, and memory [42]. The findings of the Maine Syracuse Longitudinal Study indicate that individuals who regularly consumed dairy products demonstrated better cognitive performance in fields such as global cognition, visuospatial memory, and executive function than those who consumed dairy foods seldom [48].
Consumption of dairy products has been found to potentially risk cognitive decline, either through direct effects or by positively impacting cardiometabolic health. There is a significant amount of literature discussing this association. However, the findings from various studies could be more conclusive [49]. The recommended daily intake of 250 g/day, as suggested by the EAT-Lancet reference diet, is equivalent to consuming one glass of whole milk. Based on existing evidence, this amount is considered suitable for preserving cognitive function in older individuals. However, the impact of consuming dairy products, especially among older adults, may vary depending on the quantity, variety, and fat content. Therefore, additional research involving diverse age groups is necessary [50].

Conclusion
Preserving autonomy in function and enhancing quality of life are critical concerns for older adults. A balanced diet reduces disease development, functional losses associated with aging, and the intensity and course of aging, even though aging is a predetermined and continuous process. Dairy foods meet the dietary needs of the aged by supplying essential nutrients, including calcium, phosphorus, and protein. They promote muscular health, contribute to maintaining skeletal muscle mass and function, hence aiding in the prevention of sarcopenia, and enhance cognitive performance. Dairy foods have been recognized for their nutritional value and are included in the dietary recommendations of numerous countries. Given the significant importance of nutrition and the global burden of chronic health issues, there is a need for additional research in nutritional science and the development of food industry products, particularly dairy products and milk-derived ingredients, to effectively promote public health.

REFERENCES


