Optimizing Bone and Muscle Health with Dairy Foods for Healthy Aging

Overview

With Americans living longer, evidence-based strategies to support healthy aging are increasingly important. Maintaining bone and muscle health throughout adulthood is crucial for healthy aging, lowering the risk of chronic diseases while promoting quality of life and longevity. A balanced diet that includes nutrient-dense foods can help older Americans meet their nutrition needs and, in turn, help slow age-related declines in bone and muscle mass and strength. Dairy foods like milk, cheese and yogurt across a range of fat levels are an affordable and accessible source of nutrition that meet a wide range of personal preferences and health needs throughout the lifespan. Dairy foods provide a unique package of up to 13 essential nutrients, including those that play a key role in helping support bone and muscle health like high-quality protein, calcium, vitamin D, potassium, phosphorus, iodine and zinc. The 2025-2030 U.S. Dietary Guidelines for Americans (DGA) recommends three daily servings of dairy foods for most adults following eating patterns of 1,600 calories or more. Evidence links consuming dairy foods with reduced risk of age-related conditions such as osteoporosis, characterized by decreased bone mineral density, mass and strength, and sarcopenia, which is the loss of muscle mass and strength. A healthy eating pattern that includes three daily servings of nutrient-dense dairy foods like milk, cheese and yogurt promotes nutritionally adequate diets and healthy aging among Americans.

Proper nutrition can help promote musculoskeletal health and quality of life throughout

As Americans live longer, there is growing emphasis on identifying evidence-based strategies to support healthy aging. Estimates suggest that the global population of people 60 years and older will double (2.1 billion people) while people 80 years and older will triple (426 million people) by 2050.[1] Healthy aging is multifaceted, and is

defined among both scientific literature and consumers as encompassing a range of physical, mental and social well-being measures that extend beyond chronological age to encompass overall vitality and quality of life.[89]

Consumer research indicates that healthy aging is a top health and wellness priority across the lifespan.[88] However, as adults age, risk for developing diet-related chronic diseases increases.[1,2] Many older adults face barriers to healthy eating including socioeconomic constraints and physiological changes associated with aging and prescription medication use, which can affect taste perception, chewing and swallowing, body composition and appetite.[3] These challenges can increase the risk of malnutrition and musculoskeletal diseases such as sarcopenia and osteoporosis, which subsequently increase frailty and mortality risk and diminish quality of life.[4] Because of these challenges, proper nutrition plays a key role in promoting healthy aging to enhance vitality and overall healthspan throughout life.[89]

Sarcopenia and osteoporosis are two common chronic diseases impacting older adults

Sarcopenia is defined by progressive loss of muscle mass and strength that is primarily caused by the aging process.[45] While differences in clinical measurement of this disease make it difficult to estimate its prevalence, sarcopenia is estimated to affect 13.8%-25.6% of all U.S. adults, and 26.3%-52.4% of U.S. adults 70-80 years old.[45]

Osteoporosis is a bone disease characterized by weakened bone mineral density, loss of bone strength and structural integrity.[16] Age is a primary risk factor for this disease,[16] with prevalence of osteoporosis estimated at 12.6% of U.S. adults 50 years and older. Prevalence is higher among women (19.6%) compared with men (4.4%).[90]

The negative impact of these diseases can also go beyond diminished bone and muscle health. Sarcopenia and osteoporosis can increase risk of frailty and mortality while diminishing vitality and overall quality of life. In addition, increased skeletal muscle mass is linked with markers of cardiometabolic health such as glucose metabolism, insulin sensitivity and regulation of inflammation and oxidative stress.[91] Healthy eating patterns across the lifespan can be a key strategy to reducing risk of these diseases while enhancing a person's lifespan and healthspan.[77]

Dairy foods are an important source of high-quality protein and bone-supporting nutrients

As part of a healthy eating pattern, dietary protein plays a vital role in maintaining healthy bones and muscle. In the U.S., many adults and older adults are not consuming adequate amounts of protein, with a 2024 study estimating that 31% of adults 51-71 years old and 37% of adults over 71 years old are not meeting protein requirements as recommended by the National Academies of Sciences, Engineering, and Medicine (0.8 g protein/kg body weight/day).[5] What's more, higher intakes of protein are often recommended for older adults to support their health.[6,7,77] The 2025-2030 U.S. Dietary Guidelines (DGA) recommends Americans consume 1.2-1.6 g protein/kg bodyweight/day (based on a 2,000-calorie eating pattern), adjusting based on individual calorie requirements.[77] The recommendations from the National Academies of Sciences, Engineering, and Medicine also note a wide range of acceptable protein intake (10%-35% of daily calories).[5] Dairy foods (i.e., milk, cheese and yogurt) provide up to 13 essential nutrients and are a good to excellent source of high-quality protein, meaning that the protein within dairy foods is highly bioavailable, digestible and contains all essential amino acids in sufficient amounts needed by

the body.[8] Incorporating dairy foods into an overall balanced, healthy eating pattern can help support bone health, maintain muscle mass and support physical function in older adults.[9,10]

Dairy foods across a range of fat levels provide a unique combination of bone-supporting nutrients that are challenging to obtain in similar amounts from non-dairy food alternatives.[11-13] Even at current consumption levels among Americans 51 years old and older, dairy foods contribute 16% of the total daily protein intake for Americans age 51 and older as well as critical amounts of total daily calcium (49%), vitamin D (47%), potassium (12%), phosphorus (25%) and zinc (15%).[14] Dairy foods can provide 8 g or more protein per serving at an economical price,[15,92] making them an accessible food-first strategy to help meet recommendations for dietary protein as well as other essential nutrients important for preserving bone and muscle health.

Dairy food consumption may decrease the risk of osteoporosis among older adults

Osteoporosis is characterized by decreased bone mineral density, bone strength and structural integrity, leading to an increased risk of fractures.[16] Of the recent systematic reviews and meta-analyses on research spanning 1989 to 2023, seven meta-analyses and two umbrella reviews found beneficial to neutral associations between dairy food consumption and fracture risk,[17-25] with yogurt consumption linked with benefits for fracture risk.[19,21,25] For example, a meta-analysis of 14 cohort studies in 363,383 older adults ages 50–77 found that higher yogurt consumption was associated with a lower risk of hip fracture, while milk and cheese were not associated with hip fracture risk.[19] An updated meta-analysis of four studies (230,678 participants) focusing on cheese consumption reported a 5% decrease in total fracture risk and a 14% decrease in hip fracture for each 30 g/day (~1 serving/day) increase in cheese consumption.[23] Conversely, two meta-analyses involving participants 16-99 years old predominantly from Western countries (with one study from Japan) reported detrimental associations, indicating a 7-9% increase in hip fracture risk for every 200 g (~1 cup serving) increase in milk intake.[25,26] However, among the 14 cohort studies analyzed, only the Swedish Mammography Cohort (women age 39-74) reported elevated hip fracture risks with higher milk consumption,[27] while the rest found beneficial to neutral effects.[25,26] Differences in sun exposure, geographic location and overall eating patterns may help explain the variable associations observed in these few studies.[25,27]

Observational studies published in the past five years report a beneficial or neutral relationship between dairy food consumption and fracture risk or osteoporosis risk.[28-44] One of the longest prospective cohort studies followed 103,003 pre- and post-menopausal women 30-55 years old over a 24-year period and found that consuming ≥2 servings of dairy foods per day (compared to <1 serving) was associated with a 26% reduction in total fracture risk.[43] Among postmenopausal women, consuming ≥1 serving of dairy foods daily was linked to a 12% lower fracture risk compared to consuming <1 serving of dairy foods daily. Higher dairy food consumption (≥1 serving daily vs. <1 serving daily) was also associated with a 17% reduced fracture risk in premenopausal women. Notably, higher calcium intake from non-dairy sources alone did not show a similar protective effect, highlighting the potentially unique benefits of dairy's nutrient-rich food matrix.

Dairy food consumption supports muscle health in older adults

Estimated prevalence of sarcopenia, the age-related progressive loss of muscle mass and strength, can vary widely given clinical measurements can differ for this chronic condition. Sarcopenia is estimated to affect up to 25.6% of all U.S. adults, with estimates even higher for older U.S. adults (up to 52.4% among 70-80-year-olds).[45] A systematic review of observational studies in 3,891 adults 60 years old and older indicated a link between solid dairy food consumption such as cheese and yogurt and greater muscle mass.[46] There was also moderate evidence suggesting these foods may help with muscle strength and sarcopenia risk.[46] Other recent observational studies

published since 2020 demonstrate beneficial to neutral associations between dairy food consumption and muscle mass, strength and function in aging adults.[47-59] The largest of these studies, a cross-sectional analysis of the Korea National Health and Nutrition Examination Survey (KNHANES) involving adults 19 years and older, found that those consuming ≥1 serving of milk per day had a lower prevalence of low skeletal muscle mass (in 16,173 adults) and stronger handgrip strength (in 13,537 adults) than those consuming <1 serving per day.[52] Specifically focusing on adults 50 years and older, seven out of nine cross-sectional and cohort studies reported beneficial associations between dairy food consumption and muscle strength, muscle mass or muscle function.[47-50,54,56,59] The two remaining studies reported no associations between dairy food consumption and functional disability or muscle mass.[53,55]

Muscle loss from sarcopenia can cause people to become weaker and more likely to fall, posing a serious health risk.[60] In observational research of adults 60 years old and older, studies have found beneficial to neutral associations with dairy food consumption and falls or frailty (six and three studies, respectively), while two studies reported poor outcomes related to cheese consumption.[61-69] In a retrospective study involving 469 Japanese adults 60-87 years old, higher milk and dairy food intake was linked with improvements in frailty, suggesting that dairy food consumption may contribute to reducing age-related muscle weakness.[65] A case-control study of 60-100 year olds (300 cases with falls, 590 controls without falls) reported an association between cheese consumption and an increased risk of falling, although cheese consumption levels were similar between the groups, suggesting the need for further investigation.[61] A prospective cohort study in women 60 and older found that higher consumption of low-fat cheese was significantly associated with increased frailty risk, while high-fat cheese consumption showed no link.[69] Unlike most studies using the Cardiovascular Health Study frailty index—the standard recommended by the International Conference on Frailty and Sarcopenia Research—this study employed the FRAIL scale, which includes physician-diagnosed illnesses from the past two years. This methodological difference may explain the contrasting results.

Few randomized controlled trials (RCTs) examine the effect of dairy food consumption on falls or frailty due to the long observation period required. However, a recent two-year RCT in 7,195 residents in aged care facilities showed 11% fewer falls, a 33% reduction in overall fractures and maintenance of muscle mass when increasing dairy food consumption to 3.5 daily servings.[70] Short-term RCTs (6 days to 12 weeks) report beneficial to neutral effects of dairy food consumption with or without exercise on muscle mass, strength and function.[71-76]

Study Spotlight: Dairy-rich diet reduced fall and fracture risk in older adults in a large-scale clinical trial

A 2-year RCT in 7,195 residents (mean age: 86 years old) in aged care facilities showed a 33% reduction in overall fractures, 46% fewer hip fractures, 11% fewer falls and maintenance of muscle mass following increased dairy food intake (from 2 to 3.5 servings/day) through additional servings of milk, cheese and yogurt.[70] Notably, these protective effects emerged within 5 months, suggesting that long-term dairy food consumption is required to observe meaningful changes to bone and muscle health in older adults.

Authoritative health organizations recommend dairy foods to help ensure healthy aging

Including dairy foods in overall balanced and healthy eating patterns can play an important role in supporting the health and well-being of Americans throughout mid-life and into older adulthood. The 2025-2030 DGA emphasizes the importance of consuming nutrient-dense dairy foods daily to support nutritionally adequate diets and promote bone health among older adults who may have fewer calorie needs. The DGA also recommends three daily servings of dairy foods for most adults following eating patterns of 1,600 calories or more.[77] The National Institutes of Health (NIH) echoes these recommendations, noting that dairy food consumption aligned with the DGA can help individuals meet their calcium needs critical for bone health.[78]

A 2010 NIH consensus statement on lactose intolerance (LI) discusses that avoiding dairy foods could lead to inadequate calcium and vitamin D intake, increasing the risk of low bone mineral density and related health issues.[79] LI does not have to mean avoiding dairy foods and missing out on the bone and muscle benefits that dairy foods provide. In 2024, as part of a robust evidence review on the role of dairy foods for Black Americans across the lifespan, the National Medical Association (NMA) recommends including dairy foods in the diets of individuals living with LI to help maintain bone health across the lifespan.[80] As part of this literature review, the NMA provided guidance for LI management, noting that lactose-free milk and lower-lactose dairy foods like yogurt, kefir and cheese offer nutrient-rich dairy options for those living with LI.

Conclusion

With a growing population of older Americans, ensuring adequate consumption of nutrient-rich foods is critical to support bone and muscle health and promote quality of life and vitality during aging. Dairy foods including milk, cheese and yogurt across a range of fat levels are readily accessible and affordable food sources of high-quality protein and offer a unique combination of bone-supporting nutrients. Observational and clinical research indicates that consuming dairy foods plays a beneficial to neutral role on fracture risk and can contribute to maintaining muscle mass and strength. Incorporating dairy foods within a balanced eating pattern is a practical and evidence-based strategy for promoting healthy aging.

Key Takeaways for Health & Wellness Professionals

- **Dairy foods can support healthy aging by helping maintain muscle and bone health**. By collectively providing high-quality protein and other key nutrients like calcium and vitamin D, milk, cheese and yogurt help protect musculoskeletal health – preserving strength, mobility and independence.[11-13,17-25,28-44]
- **Dairy foods offer a practical, food-first solution to help close protein gaps in older adults**. A significant proportion of older adults fall short of their daily protein recommendations, and dairy foods offer a convenient and affordable source of high-quality protein along with other important nutrients.[5,8-15,92]
- **Consuming dairy foods may help maintain muscle mass, strength and physical function**. Research shows beneficial to neutral associations between dairy food consumption and muscle health outcomes, with some evidence linking dairy-rich diets to reduced frailty and fall risk.[47-59,62-68,70-76]
- **Dairy food consumption is linked to lower osteoporosis risk**. Research indicates dairy food consumption is linked with a beneficial or neutral impact on fracture risk or osteoporosis risk, which can help support healthy aging and vitality.[17-25,28-44] The International Osteoporosis Foundation recommends dairy milk and dairy foods to help maintain strong, healthy bones.[83]

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