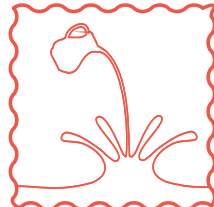




STAYING STRONGER FOR LONGER

The role of dairy in a balanced diet for the elderly



More than five million South Africans are older than 60, and more than half (61%) of this aging population are female.¹ The ageing index is the number of elderly people (60 years and older) per 100 youths under the age of 14 in a population. In South Africa, the ageing index rose from 30 per 100 people in 2017 to 33 per 100 people in 2022.² As people age, the risk of malnutrition, frailty and health problems related to reduced appetite and poor energy and protein intake increases, which can leave them vulnerable to illness or disease, even after minor stressor events. Fragility fractures are furthermore also common in the aged and are expected to more than double over the next 30 years in South Africa.³

Poor health outcomes associated with frailty and malnutrition are of clinical and public health concern owing to the increased risk of morbidity and mortality.⁴ For example, falls in the elderly are associated with pressure sores, impaired wound healing, delayed recovery from illness and longer hospital stays, which translate to higher healthcare costs and poorer outcomes. Paying attention to lifestyle factors such as diet and exercise to manage and prevent poor health such as obesity, cardiovascular disease, hypertension and type 2 diabetes in geriatric patients is therefore warranted.^{5,6}

The study of individual nutrients has given way to examining the impact of whole foods on human health in the field of nutrition science in recent years. The associated health impacts or outcomes are not always predicted by the nutrient composition of various foods. Foods are made up of a wide variety of nutrients and components (bioactive molecules and non-nutritive components) that are arranged in intricate physical structures that can be solid, semi-gel, fluid or spoonable. The "food matrix" explains a food's composition of nutrients, physical makeup, and their interactions. This is particularly valid for dairy products like yoghurt, milk and cheese. Studies are beginning to

acknowledge that dairy products have health benefits that extend well beyond the specific nutrient benefits. Dairy, as a food, is more than the sum of its parts. Its numerous health advantages stem from the special way that its nutrients combine, known as the dairy matrix.⁷

Consistent evidence supports the role of dairy products in improving the nutritional status and health of older adults. Dairy products are important sources of protein, vitamins (A, E, D*, K, and B) and minerals (Ca, Mg, Na, K, P, Fe and Zn) – nutrients commonly lacking in the diet of the elderly and important for maintaining bone strength. More specifically, there is evidence of the beneficial role of dairy in the management and treatment of chronic disease conditions that often affect the elderly population, such as obesity,^{8,9} cardiovascular disease,^{10,11} hypertension,¹² sarcopenia¹³ and type 2 diabetes.^{14,15} Furthermore, dairy has a critically important role in gut health.^{11,16} This review will provide a broad overview of the role of dairy in promoting bone health and muscle mass, and provide practical guidance on increasing dairy consumption in the elderly.

BONE HEALTH THROUGHOUT LIFE

Understanding how bone density changes over the course of someone's life is a critical aspect to consider when looking at bone density throughout life. Bone development begins before birth and continues through childhood and adolescence, with peak bone mass being reached in early adulthood (typically around 30 years of age). Since adolescence is the time when bones enlarge and strengthen, it is a crucial stage in the building of the skeleton and lays the groundwork for future skeletal health.¹⁷ After this stage, a maintenance phase of bone mass occurs during young to middle adulthood. After the bone mass maintenance stage, bone mass gradually declines owing to factors such as hormonal changes, reduced physical activity, and age-related changes in bone turnover; a period of time referred to as the bone-loss phase. In older adults, bone loss becomes more pronounced, leading to conditions like osteopenia and osteoporosis, which increase the risk of fractures and other skeletal complications. Calcium, found abundantly in dairy products (and also vitamin D, if products are fortified), are crucial to bone health, as these nutrients support bone mineralisation and maintenance.

Consuming dairy throughout life has been shown to be beneficial for bone health. Ganpule et al.¹⁸ found

that at 18 weeks after birth, increases in total bone mineral content (BMC), total bone mineral density (BMD) and spinal BMD were linked to a mother's consumption of dairy products during pregnancy.¹⁸ At 28 weeks after birth, total and spinal BMD were linked to the mother's dairy intake, but not total BMC. At six years of age, children's total body BMD was higher based on the mother's frequency of milk consumption during her pregnancy. Bone growth and mineralisation during infancy, childhood and adolescence are important for optimising peak bone mass (PBM) and may influence the risk of osteoporosis in later life. A 10% increase in PBM in females was estimated to delay the onset of postmenopausal osteoporosis by up to 13 years.¹⁹

From a prospective cohort study with a two-year follow-up period in children aged 3 to 10, Goulding et al.²⁰ reported that avoiding cow's milk or calcium-rich food replacements was linked to an increased fracture frequency.²⁰ Over a 12-year follow-up period, Moore et al.²¹ observed positive effects of dairy consumption in teenagers between the ages of 15 and 17.

THE ROLE OF DAIRY IN PROMOTING BONE HEALTH AND MUSCLE MASS IN THE ELDERLY

Dairy products can provide up to 60% of the recommended daily allowance (RDA) of calcium in an adult diet.²² This supports the recommendation, following from the South African food-based dietary guidelines (FBDG), that you should consume dairy daily which is essential to support key areas of health in the elderly, namely to lower the risk of osteoporosis and sarcopenia.^{23,24}

Osteoporosis, sarcopenia, falls and fracture risk

Osteoporosis is a disease in which bone tissue is lost and the bones subsequently become brittle and weak; this is usually the result of hormonal changes, a calcium or vitamin D shortage, or both.²⁵ Osteoporosis causes around nine million fractures a year, with over half of the cases occurring in North America and Europe. Reduced BMD and increased bone fragility are symptoms of osteoporosis, which is one of the world's biggest public health issues. BMD starts to decrease from the age of 30–39 in males and from the age 40–49 in females (see figures 1 and 2).²⁶

Bone mineral density changes by age²⁶

The best way to prevent osteoporotic fractures later in life is to maximise bone mass during childhood and adolescence and ensure that the maximum peak bone mass is reached at the end of the skeletal maturation period. While genetics accounts for more than 60% of the variation in peak bone mass, modifiable lifestyle factors also come into play.

These factors include doing weight-bearing physical exercise regularly and consuming a diet rich in dairy products, calcium and vitamin D.²⁷

Matthews et al.²⁵ reported that adults consuming more than 30 servings of dairy products each month can reduce the risk of osteoporosis by 62%.

In addition, consuming one more cup of dairy per day was found to lower the incidence of fractures by 40%.⁴ These and other findings support the role of dairy in bone health.^{4,28,29}

The burden of fragility fractures increases as a population ages, with an estimated nine million fragility fractures occurring worldwide every year. Falls and fractures in the elderly are related to the concomitant higher prevalence of chronic illnesses, loss of skeletal muscle mass, frailty and osteoporosis. A loss of independence raises the proportion of patients requiring long-term institutional care, and long-term institutional care is the cause of an estimated 30% of community hip fractures.³⁰

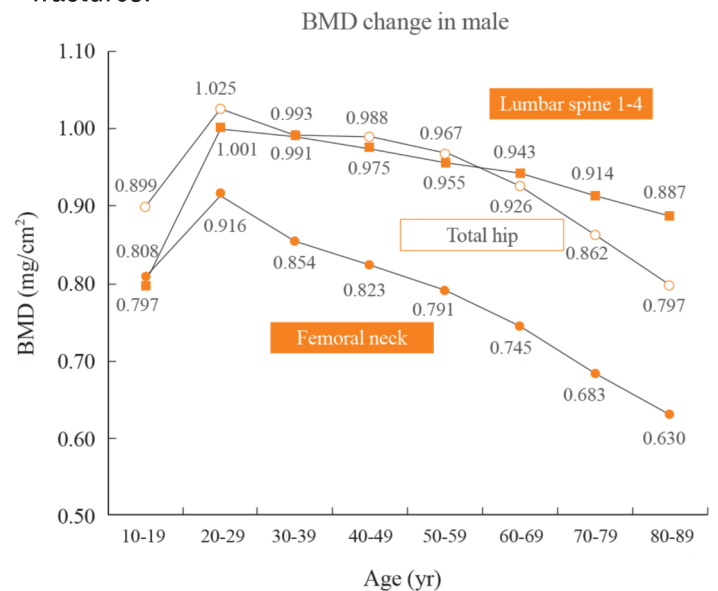


Figure 1: Bone mineral density changes by age (males)²⁶

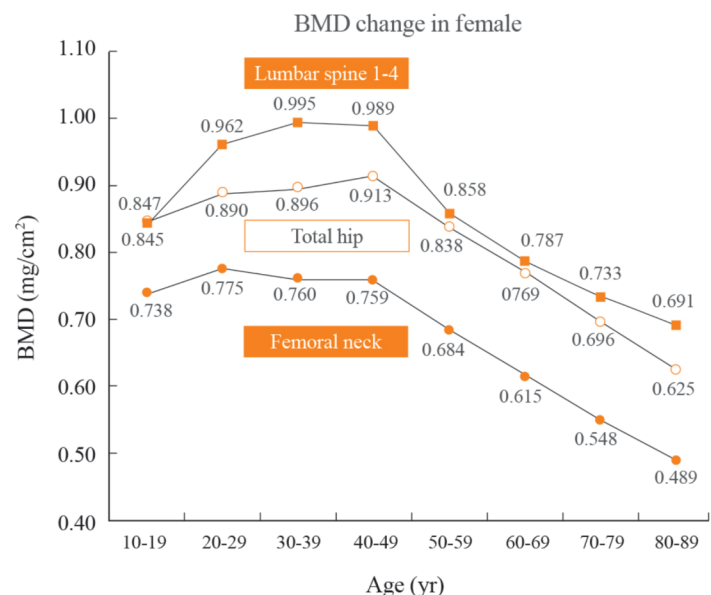


Figure 2: Bone mineral density changes by age (females)²⁶

Owing to the frequency of hip fractures in the community-dwelling elderly, and high medical expenses associated with treating these patients, the widespread use of medication to manage community hip fractures is unlikely to reduce this fracture burden. This supports research into dietary and other lifestyle factors in the prevention of falls and fractures in the elderly.

Sarcopenia is a condition characterised by the chronic loss of muscle mass and strength with age.³¹ Malnutrition in the elderly population is an important risk factor for sarcopenia. Statistics from 12 countries, including South Africa, have shown that nearly 14% of elderly individuals residing in nursing homes and nearly 6% of community-dwelling elderly individuals were malnourished.³²

The role of dairy in bone health and muscle mass

Calcium is essential for the mineralisation of the skeleton. Bone is a mineralised connective tissue, primarily composed of calcium, which gives bones their strength and structure.³³ Calcium is necessary for healthy bone growth and metabolism, and this need varies with age. It is well known that older people often have an insufficient intake of calcium and protein.²² Studies have shown that calcium from dairy foods has greater effects on BMD than the equivalent calcium supplements on BMD. Therefore, calcium in the dairy matrix has a greater effect than to calcium in other forms.²⁰

According to a prospective two-year cluster-randomised controlled trial by Baek et al.³⁴ hip fractures affect 30% of the Australian population and are more common in elderly receiving aged care. In this trial, participants received 3.5 servings of milk, cheese or yoghurt per day (69 g protein; 1142 mg calcium). Results showed that eating a diet richer in calcium and protein decreased the risk of fractures. In addition, the intervention translated to a healthcare and residential cost saving for each fracture that was prevented. Scaling up the benefits of the intervention, approximately ±R780 million could be saved in healthcare costs in a year.³⁴

Iuliano and colleagues³⁰ conducted a prospective, two-year, cluster-randomised controlled trial in institutionalised older adults (n=7195) in 60 facilities in Australia. The aim was to establish whether achieving the recommended daily intakes of 1300 mg calcium and 1 g protein per kilogram body weight would reduce the risk of fragility fractures and falls in participants with adequate vitamin D levels. In the 30 control facilities, the usual menu was maintained (i.e. 700 mg calcium per day and 0.9 g protein per kilogram body weight). The remaining 30 facilities were randomised to provide residents with additional dairy products (milk, yoghurt and cheese) to achieve the recommended daily intakes of calcium

and protein per kilogram of body weight.

Results showed that the intervention was associated with a 33% risk reduction in all fracture risk ($p = 0.02$), a 46% reduction in the risk for hip fractures ($p = 0.005$) and an 11% reduction in the risk for falls ($p = 0.04$). At three and five months' follow-up, the risk for both falls and hip fractures had significantly reduced ($p < 0.05$). Mortality risk was unchanged. Dairy is widely available, palatable and well liked as a food group. The authors thus concluded that dairy, if integrated into existing menus at facilities caring for the elderly, may be a readily accessible intervention to improve calcium and protein intake and so reduce the risk of falls and fractures.

Calcium, phosphate, vitamin D and protein are key nutrients in establishing muscle mass and quality. Dairy products are rich in calcium, phosphates and good-quality protein, all of which are included in the dairy matrix, supporting recommendations for including dairy products in a balanced and varied diet for the elderly. Whey protein has been shown to be particularly effective in reducing muscle loss.³⁵

In most populations, dairy products are familiar to the elderly population, palatable, inexpensive and widely available. In 2023, a randomised controlled study in an elderly population in Australia ($n = 654$; mean age 86.7 ± 7.2 years) investigated whether supplementing the participants' diet with high-protein dairy foods (milk, cheese and yoghurt) for 12 months would prevent malnutrition. Participants were assessed at baseline and at 12 months, using the Mini Nutritional Assessment, an 18-item validated tool to assess nutritional status.

The study found that energy intake was unchanged in both groups, although the additional 11g protein resulting from 3.5 servings of high-protein dairy foods preserved participants' nutritional status whereas it deteriorated in controls ($p < 0.001$). The researchers concluded that the consumption of high-protein foods can be used as a pragmatic approach to maintaining good nutritional status in older adults.³⁶

Other research confirms that the daily consumption of milk and milk products was inversely associated with functional disability, which is the acquired difficulty in performing basic everyday tasks or more complex tasks needed for independent living, in older men.³⁷ In women, participants who consumed dairy products had a greater whole-body lean mass and better physical performance than those who did not.³⁷ Adherence to a Mediterranean diet, which is a diet that emphasises plant-based foods and healthy fats, with moderate consumption of dairy products (up to 200 g/day), has also been associated with a lower risk of frailty, lower levels of inflammatory makers, decreased fat mass and a lower body mass index.³⁷⁻³⁹

Engaging in regular physical activity is essential for older adults to fully benefit from increased dairy intake. Physical activity, particularly weight-bearing and resistance exercises, significantly enhances bone health by promoting calcium absorption and increasing bone density, thereby maximising the benefits of calcium and vitamin D found in dairy products.^{40,41} Additionally, regular exercise helps maintain muscle mass and strength, which is vital for the elderly as they utilise the high-quality protein in dairy more effectively for muscle repair and growth. Physical activity also supports cardiovascular health, weight management and cognitive function, ensuring that the elderly reap the comprehensive health benefits of a balanced diet that includes adequate dairy.

PRACTICAL CONSIDERATIONS TO INCREASE DAIRY CONSUMPTION

Guiding the elderly to make healthy food choices requires an understanding of their unique needs and preferences. Small, gradual changes, and increased variety in food choices, can greatly contribute to overall energy and nutrient intake.

Recommendations are that the elderly should consume 2–3 servings of dairy per day. One serving of dairy constitutes 250 ml of milk, 200 ml of yoghurt or amasi, or 40 g of cheddar or gouda cheese.

Some practical considerations, linked to age-related symptoms such as dry mouth and loss of appetite, are listed below:

- Dry mouth is a common symptom in aging. Offering nutrient-dense liquids such as milk may be well received. Milk and yoghurt can be enjoyed plain or blended into smoothies with fruit such as bananas, strawberries or mango. In addition, milk can be added to soften oats and cereals.
- Loss of appetite, related to medication, hormonal changes and decreased physical activity, can lead to rapid and unintended weight loss and wasting in the elderly. Dairy products can be flavoured using herbs and spices, such as cinnamon in milk, cocoa powder mixed into yoghurt or curry powder mixed with cottage cheese, to make intake attractive. Also, flavoured dairy may be more appetising than unflavoured options, which can be helpful in periods of loss of appetite.
- Offering dairy foods such as yoghurt cups with fruit as snacks between meals can help ensure the person is consuming protein and other dairy nutrients. Furthermore, offering a dairy-based dessert such as custard, rice pudding or frozen yoghurt may also assist in periods of appetite loss.

- When appetite is poor or wasting is a concern, opt for full-cream milk or double-cream yoghurt to provide energy-dense dairy in smaller volumes.

Conclusion

Evidence supports a beneficial role of dairy and specifically the dairy matrix in the diet of the elderly to help meet nutrient intake gaps. Dairy can contribute to the nutritional content of the diet, contributing protein, calcium, vitamin D, magnesium and other micronutrients.*

In addition, the consumption of dairy products may help to protect against chronic illness, including type 2 diabetes, osteoporosis, hypertension, cardiovascular disease and sarcopenia.

Dairy products are easily accessible, versatile and nutrient dense, and can be part of a healthy, balanced diet to help manage or address many chronic diseases and conditions. This lends support to South Africa's food-based dietary guidelines' recommendation that adults should consume milk and milk products daily.²³

* In South Africa milk is not typically fortified with vitamin D and is therefore not a source of vitamin D



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