



Dairy nutrition for the elderly



The world is undergoing a demographic revolution, with a considerable increase in the number of people older than 60 years. The World Health Organization (WHO) predicts that the number of elderly citizens will have increased to about 2.1 billion by 2050, with the greatest increase expected to occur in developing countries. The ageing population is growing faster than all younger age groups.^{1,2} The growth of the elderly population is accompanied by many challenges associated with their specific requirements with regard to health, diet, care and accommodation. South Africa is no exception when it comes to increases in the number of senior citizens. The percentage of people older than 60 years increased from 7.3% in 2001 to 8.1% in 2015; this translates to about 4.1 million people.³ Life expectancy increased from 53.6 to 59.7 years among men, and from 56.6 to 65.1 years among women between 2002 and 2016, respectively.³

A growing elderly population

The increase in the number of elderly individuals in the global population is driven primarily by the main causes of death and disability changing from infectious diseases to the so-called non-communicable diseases (NCDs) and chronic conditions (obesity, various types of cancer, heart disease, hypertension, diabetes, lung disease, arthritis and dementia). This trend is seen in all countries of the world, regardless of income level.¹ Negative influences such as poor nutrition at various life stages and behaviour associated with health risks (obesity, lack of exercise, poor diets, exposure to toxic substances such as tobacco, alcohol and drugs, exposure to HIV and drug-resistant TB) during adult life have been identified as contributing to this heavy burden of disease in the elderly.¹

Data from the WHO Study on Global Ageing and Adult Health (SAGE)* for the period 2007–2010 show that the overall health status score for men was higher than for women, although women lived longer than men.¹ In South Africa, the percentage of adults with three or more major risk factors rose from 36% in 2007 to 50% in 2009, with increasing age representing the highest score for the six countries.

In addition, the number of South African women with moderate or severe hypertension rose from approximately 20% at ages 18–48 years to about 43% at the age of 80; this increase is higher than in any of the other SAGE countries.¹ The study therefore shows that South Africa has an ageing population (consisting mainly of women), who experience a multitude of disabilities and chronic diseases of lifestyle, and have the highest incidence of hypertension and three or more risk factors for ill health compared with countries such as India, Ghana and Mexico. This situation threatens to become an increasing burden and needs to be addressed at various levels, including improved medical and dietary care on public tax-funded health and social services in South Africa.

The role of nutrition in ageing

The South African diet – across all life stages – deserves attention. Various studies, across different ethnic and age groups, have shown that the majority of South Africans' diet do not include adequate amounts of protective, nutrient-dense foods such as vegetables, fruit, whole grains and dairy products (milk, *maas*, yoghurt and low-fat cheeses).^{4–6} Increasing the intake of these foods should be a priority to provide essential micronutrients and high-quality protein in a beneficial food matrix to improve diets that are generally high in fat, sugar, salt and refined carbohydrates. The goal is to increase the intake of nutrient-dense foods that can benefit the health of every generation in our country, including that of senior citizens.

To this end, the food-based dietary guidelines (FBDGs) for South Africa⁷ include a specific focus on dairy: 'Have milk, *maas* or yoghurt every day'.⁸ Vorster et al.⁷ emphasise that 'there are "critical periods" for focusing on calcium and dairy, e.g. adolescence for achieving peak bone mass, also pregnancy, infancy and early childhood, school-age children, young adults, the elderly', and it was recommended that additional nutrition education materials and FBDGs for groups with special needs, such as the elderly, be compiled.⁷ A working group subsequently developed the dairy-focused message 'Drink or eat milk, *maas*, cheese or yoghurt every day' specifically for the elderly and tested it for comprehension and cultural acceptability.⁹

Nutrients and health benefits of dairy products

Dairy products are good sources of calcium and high-quality protein and contribute notably to intakes of vitamin A, riboflavin, zinc and vitamin B₁₂. Vitamin B₁₂ is particularly important in the diet of the elderly as this age group is prone to deficiencies owing to poor absorption caused by a lack of stomach acid and the so-called intrinsic factor.¹⁰

The mineral content of dairy also has an important role in optimal health. The potassium content of milk is of particular importance for populations that do not meet the recommended fruit and vegetable intakes of 400 g per day.⁸

*The SAGE study follows people over 50 in six countries (China, Ghana, India, Mexico, Russia and South Africa) as they age.

Most elderly persons will not achieve the latter recommendation³ and are thus exposed to the risk of developing potassium deficiency. Potassium, an electrolyte, is necessary to maintain a balance with the sodium content of the body and to prevent oedema (fluid accumulation, particularly in the lower limbs), which is prevalent in the aged.¹¹

The general consensus among nutritionists and dietitians is that it is more beneficial for humans to obtain their nutrients from whole foods, like dairy, than from protein, vitamin and mineral supplements.

Calcium

Milk, *maas*, yoghurt and cheese are the richest source of bioavailable calcium in the human diet. For example, milk provides at least 1 mg of calcium per millilitre, which means that a 300 ml glass of milk contains at least 300 mg of calcium that is easily absorbed by the body. The high bioavailability of calcium in dairy products means that even in older adults who experience poor absorption due to reduced levels or a lack of stomach acid (hypochlorhydria and achlorhydria, respectively),¹⁰ calcium uptake is efficient, especially compared with uptake from other foods that may contain calcium in less absorbable forms. For example, plant foods generally contain calcium in a less bioavailable form, as it is generally bound to compounds such as phytates, tannins, other minerals or dietary fibre, which reduce availability.^{12,13}

Calcium is essential for maintaining a strong skeleton. The mature adult skeleton contains about 990 mg of calcium. Older adults tend to suffer from various forms of bone deterioration, including osteoporosis, which can lead to falling and bone fractures. Such conditions can have a particularly debilitating effect on mobility and quality of life in later years. It is important to keep in mind that osteoporosis not only affects postmenopausal women, but can also occur in men. During childhood, adolescence and young adulthood, a high intake of bioavailable calcium is important for so-called calcium accretion in the bones during growth. Unfortunately, studies have shown that calcium is a mineral that tends to be deficient in the diets of young people who have inadequate intakes of dairy products. Bone remodelling occurs throughout life to maintain body stores in the skeleton, but when bone formation and bone resorption no longer keep pace with each other as people age, calcium is lost from the skeleton, resulting in a concomitant loss of strength, agility and health.^{14,15}

Approximately 100 mg of calcium in the body is used for functions other than skeletal maintenance, such as muscle contraction, blood clotting, transmission of nerve impulses and blood pressure regulation.¹⁴ Calcium also has a role in the prevention and treatment of cardiovascular disease, cancers and obesity.⁴

The National Osteoporosis Foundation of South Africa (NOFSA) recommends a daily intake of 1200 mg calcium for the elderly.¹⁶ To achieve such an intake, at least three servings of milk (250 ml), *maas* (200 ml), yoghurt (200 ml) or cheese (40 g) should be consumed per day.

Muscle function and physical performance

Impaired muscle function has been demonstrated to be an important predictor of frailty and fracture among the elderly. Kim and Lee¹⁷ examined the association between the frequency of dairy consumption and functional disability in older (>65 years) Koreans (men and women). Frequent consumption of milk and milk products was inversely associated with disabilities of instrumental activities of daily living (IADL) in older men, with a reduced risk for IADL

compared with less than once a week. In women, consumption of dairy products was not significantly associated with physical disability.¹⁷

Among older women (70–85 years), dairy intake in the third tertile (≥ 2.2 servings/day) resulted in significantly greater whole-body lean mass, appendicular skeletal muscle mass and greater hand-grip strength compared with those in the first tertile of dairy intake (≤ 1.5 servings/day). These observations suggest a positive association between dairy intake and whole-body lean mass and physical performance in older women.¹⁸ Similar findings were observed among elderly women between the ages of 80 and 92 years. Compared with those in the first tertile of dairy intake, women in the third tertile had 5.7% greater total bone mass, principally because of an increase in cortical and subcortical bone mass, resulting in a 6.2% increase in total volumetric bone mineral density (vBMD). Trabecular but not cortical or subcortical vBMD was also higher. Dual-energy X-ray absorptiometry (DXA) assessment showed that women in the third tertile of dairy intake had greater appendicular bone mass and skeletal muscle mass compared with those in the first tertile. These results suggest a positive association of dairy intake with appendicular bone mineralisation and muscle mass in elderly women. Because many fractures in this age group are of the appendicular skeleton, often due to falls, dairy intake may be a modifiable lifestyle factor that can contribute to healthy ageing.¹⁸

A prospective cohort study further showed that a higher consumption of low-fat milk and yoghurt (>7 servings per week) was associated with a lower risk of frailty and, specifically, slow walking speed and weight loss.¹⁹ In a feasibility study at low-level aged-care facilities in Australia, menus were modified to include at least two additional servings of a dairy food per day for four weeks. Significant daily increases were found in mean energy intake, protein intake, proportion of energy from protein and proportion of estimated energy requirements, while the proportion of energy from fat decreased.⁵ Increases in mean daily intakes were seen for a number of micronutrients, including calcium, vitamin D, phosphorus and zinc. Two additional servings of dairy food can therefore significantly improve nutrient intake in aged-care residents.²⁰

An Australian study reported that elderly persons in care facilities consumed only about one serving of dairy per day. They also found that the number of dairy servings significantly increased mini nutrition assessment (MNA) scores, with a dairy serving being associated with a 1-point increase in the MNA score. If residents consumed the recommended four servings of dairy per day (addition of 3 points to the MNA score), they would achieve normal nutrition status, which may reduce malnutrition risk in institutionalised elderly.²¹

The use of a dairy-based protein, calcium and vitamin D supplement has been shown to reduce falls and femoral neck bone loss among Australian aged-care residents.²² Considering that dairy products are easy to eat for individuals who may experience problems with chewing and swallowing, common among the elderly, the lack of dairy foods on menus of retirement centres represents a missed opportunity. By adding milk, yoghurt or cheese to institutional diets, the protein and nutrient content of residents' diets can be improved dramatically.

Protein in dairy and the prevention of sarcopenia

Dairy products are also a source of easily absorbable high-

quality protein, which older adults require to maintain muscle mass and prevent sarcopenia. Sarcopenia is characterised by loss of lean muscle tissue and tissue wasting, which is characteristic of many elderly persons. Muscle wasting can lead to physical weakness, loss of agility and loss of independence. Elderly people who lose the ability to carry out daily activities may lose their quality of life and become so frail that they become wheelchair, house or bed bound. Sarcopenia can thus have a dramatic, debilitating effect on the life of older people.²³

Dietary intervention and exercise can combat sarcopenia. Doing regular daily resistance training (with weights) can stimulate the body to produce muscle protein, increase body strength and maintain the metabolic rate of the body and so reduce the risk of obesity.^{24,25}

Milk can make a special contribution to prevent sarcopenia. Milk contains three important components that have been shown to prevent sarcopenia, namely the proteins whey and casein and the amino acid leucine, which together boost muscle protein production.^{26,27} Research has shown that having a glass of milk after resistance exercise gives better muscle protein production results than drinking soy-based drinks, which are popular in the sports industry. Using milk after exercise produces nearly 40% more fat-free muscle mass and increases muscle strength by 33% in older subjects.²⁸

The intake of at least three servings of milk, *maas*, yoghurt or cheese a day (3-A-Day)TM can help to prevent this debilitating condition and promote fast recovery in frail and malnourished elderly individuals suffering from sarcopenia.

Role of dairy in cognition, dementia and Alzheimer's disease

One of the most serious conditions affecting the growing elderly population is dementia, particularly Alzheimer's disease. Emerging epidemiological evidence has linked dairy consumption with cognitive health, but has shown inconsistent results:

- Mixed results were reported for cognitive function outcomes in two cohort studies^{29,30} that investigated the association between milk or dairy intake and cognitive function among older French and US adults after 5–20 years of follow-up. In addition, a randomised controlled trial (RCT) comparing the effect of a high-dairy diet (four servings of reduced-fat dairy foods per day) with that of a low-dairy diet (one serving of reduced-fat dairy foods per day) for six months showed only one of nine cognitive function outcomes (working memory) to be significantly affected.³¹
- Three cohort studies^{32–34} investigated the associations between milk or dairy intake and cognitive decline or cognitive impairment among elderly participants after 4.8–13 years of follow-up. One cohort study found that the group who regularly consumed full-cream milk had a significant decrease in mental health ageing compared with the group who consumed full-cream milk only rarely.³⁴ The other two studies found no significant associations between milk and dairy consumption and cognitive decline.^{32,33}
- A cohort study of adult men and women reported that the group who consumed milk almost daily (compared with those who had an intake of less than four times a week) had a significantly reduced risk of vascular dementia after 22 years' follow-up.³⁵ Another cohort study showed non-significant associations between quartiles of milk and dairy intake and risk of vascular dementia among the elderly after 17 years of follow-up.³⁶



- One cohort study showed no significant associations between quartiles of milk and dairy intake and risk for developing all-cause dementia after 17 years of followup.³⁶

A recent systematic review and meta-analysis examined the effects of varying levels of milk intake alone or in combination with other dairy products on the outcomes of cognitive function and disorders in adults. The authors concluded that the current evidence, which includes the studies discussed earlier,^{29–36} is inadequate to draw a conclusion for the causal relationship between milk or dairy intake and cognitive decline or disorders in older adults owing to the insufficient number of high-quality studies and considerable heterogeneity across studies.³⁷

There is a natural decline of glucoregulation in the elderly, and according to Camfield et al.,³⁸ 'the overall evidence suggests that glucoregulation may exert direct (and long-term) effects on cognitive function so that those with poor glucoregulation demonstrate mild (chronic) cognitive deficits in comparison with those with good glucoregulation'. Several epidemiological studies have also identified type 2 diabetes as a significant risk factor for developing dementia. Camfield et al. conclude that 'dairy consumption, in particular low-fat dairy, is associated with a lowered incidence of the metabolic syndrome, with positive effects on cognition through improved glucose regulation and weight management associated with whey protein and calcium'.³⁸

Various other dairy components (e.g. bioactive peptides and α -lactalbumin) may affect physiological factors associated with ageing and dementia; however, the natural concentrations in dairy products may be too low to reach clinical significance.³⁸ Ano and Nakayama³⁹ reviewed clinical studies investigating the effects of fermented dairy products on the risks of dementia and the underlying mechanisms. Recent preclinical studies have identified oleamide and dehydroergosterol generated during fermentation as being responsible for those preventive effects through reducing microglial inflammatory responses and neurotoxicity.³⁹

Glutathione is a powerful antioxidant that has a key role in the brain's capacity for scavenging reactive oxygen species and free radicals involved in oxidative stress. Greater dairy consumption in older adults have been associated with higher cerebral glutathione concentrations. Although the mechanism is not yet established, dairy foods may serve as a good source of substrates for glutathione synthesis in the human brain.⁴⁰

Based on the current evidence, the regular intake of dairy products and their molecular or microbial components seems to have the potential to contribute to the prevention of dementia and cognitive decline.³⁹

Conclusion

Dairy products, including full-cream and low-fat milk, maas, yoghurt and cheese, can play a vital part in the diet of the elderly to ensure that our senior citizens are healthy and less debilitated by diseases associated with advancing age. To achieve greater intakes of dairy products by the elderly, a concerted effort should be made to educate seniors about the benefits of dairy in the diet.

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