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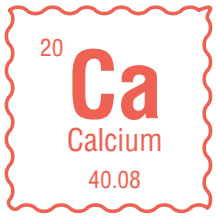
This review explores the role of milk and dairy foods in supporting healthy dietary patterns during adolescence.

A publication for health professionals

The role of milk and dairy foods *in adolescent health*



Adolescence represents a critical window of opportunity for nutrition interventions, as this period is marked by rapid growth and development alongside the development of lifelong dietary patterns. Milk and dairy products offer a unique combination of bioavailable nutrients essential for adolescent health, including calcium, high-quality protein and micronutrients that support bone development, muscle growth, cognitive function and immune health. Despite the proven benefits, dairy intake among South African adolescents remains low, contributing to inadequate calcium intake and increased risk for poor health outcomes. This review explores the role of milk and dairy foods in supporting healthy dietary patterns during adolescence, focusing on their nutritional composition, contribution to bone and muscle development, impact on weight regulation and body composition, and potential cognitive benefits. Practical recommendations are provided to promote adequate intake, with emphasis on dairy's nutrient density and alignment with national dietary guidelines. Ensuring access to and regular consumption of milk and other dairy foods may help bridge nutrient gaps and support long-term health and well-being among adolescents in South Africa.

Introduction

Adolescence, defined as the period between 10 and 19 years of age,[1] is a life stage characterised by major biological, psychological, emotional and social development. The rapid physical and cognitive change during this time is surpassed only by the growth experienced during infancy. Adolescence is therefore recognised as the second developmental period.[2] Consequently, the increasing nutritional needs mean adequate, healthy dietary intake is critical, not only to support rapid physiological growth and development but also to lay the foundations for good health later in life.[3] Milk and other dairy foods provide a unique package of bioavailable nutrients that are particularly beneficial during adolescence. These include: calcium, essential for bone mass accrual; high-quality protein to support lean muscle growth; and iodine, zinc and vitamin B12 to support cognitive and immune function.[4]

Despite the established nutritional benefits of milk and dairy foods, calcium intake remains low among South African adolescents.[5] As this life stage represents a second critical window of opportunity for nutritional intervention, including nutrient-dense foods like milk and dairy products can have a vital role in establishing optimal growth and long-term health.[6] This review aims to examine the contribution of milk and other dairy foods to adolescent health.

The role of milk and dairy foods in healthy diets during adolescence

Consistent increases in life expectancy mean that the youth of today are projected to live long and productive lives.[7] The adequacy and quality of diets during these formative years are therefore of great importance.[3] Rapid growth, changes in cognitive and emotional functioning and peer influence mean adolescents can be vulnerable to malnutrition of various forms, including undernutrition, overnutrition and micronutrient deficiencies.[6,8,9]

Therefore, establishing healthy dietary patterns during adolescence is important not only to promote health but also to help prevent diet-related non-communicable diseases (NCDs) later in life.

The World Health Organization defines a healthy diet as one that consists mainly of fruit, vegetables, legumes, nuts and whole grains, together with moderate amounts of eggs, dairy, poultry and fish, and small amounts of meat.[10] Intake of whole and

minimally processed foods is emphasised, while that of highly processed foods, often excessive in salt, saturated fats and sugars, should be restricted.

In line with this, Mente and colleagues[11] recently developed a healthy diet score to assess associations between diet quality and health outcomes across 80 countries. Their findings showed that diets high in fruit, vegetables, nuts, legumes, fish and whole-fat dairy were associated with lower risk of cardiovascular disease and mortality, particularly in lower-income countries, where the strongest association was observed. Milk and dairy foods, including maas, yoghurt and cheese, are recommended as part of healthy dietary patterns globally[12] and are promoted in South Africa through the South African food-based dietary guidelines.[13,14]

Nutritional composition of milk and dairy foods

Dairy foods are unique with regard to their nutrient content and structures, both of which differ across the dairy food category. Despite the varying physical structure of dairy foods – ranging from the liquid state of milk to the gel-like texture of yoghurt and the solid form of cheese – they are all good sources of high-quality protein, calcium, vitamins A, B12 and B2, potassium, magnesium, zinc and iodine.[15]

Calcium, the most abundant mineral in the body and known for its important role in bone health, is one of the key nutrients provided through milk and dairy foods. Although other food sources of calcium are available, they do not all offer the same bioavailability as dairy. For example, the amount of calcium absorbed from certain vegetables, legumes and nuts is often lower than that from dairy owing to the presence of compounds such as oxalates or phytates.[16] Milk is also a good source of high-quality protein, which supplies all the essential amino acids the body needs.

Fermented dairy products (e.g. yoghurt and maas) offer health benefits extending beyond their essential nutrient content. These foods are among the most effective dietary sources of naturally occurring probiotics and have been associated with an improved gut microbiotic profile, immune modulation and oral and gastrointestinal health.[17,18]

Milk and dairy products are among the most nutrient-dense foods, providing high amounts of essential nutrients relative to their energy content and cost, consistently shown by nutrient profiling models (a quantitative measure to assess the nutrient density of foods).[19,20] Recent research emphasises the importance of considering both nutrients and food groups when promoting dietary patterns that support diet quality and positive health outcomes.[20,21] Scientific interest also increasingly focuses on the unique physical structure of dairy foods – the so-called dairy matrix, which encompasses the interactions between the nutrient and non-nutrient components of dairy.[22] Although milk and dairy foods contain certain nutrients of which limited intake has historically been advised (e.g. saturated fat), the overall nutrient density and food matrix, especially when these foods are consumed as part of a balanced diet, support their inclusion in adolescent dietary recommendations.

Milk and dairy foods also offer considerable nutritional value per unit cost when considering nutrient density and affordability,[19] as shown locally in a recent study by Madlala and colleagues.[23] Their assessment of the nutrient density of commonly consumed foods relative to their cost showed that dairy products, specifically maas, milk (low fat and full cream) and plain, unsweetened yoghurt, ranked third among all food groups with regard to nutritional value per cost.

The role of milk and dairy in adolescent growth and health

Given their nutrient density and alignment with global and national dietary recommendations, milk and dairy foods have an important role in supporting nutritional requirements of adolescents, specifically as the nutrients found in milk and dairy foods are fundamental in supporting bone health, muscle functioning, cognition and overall health during adolescence.[4,6]

Bone health

A well-established role for including milk and dairy foods in adolescents' diets stems from the contribution to skeletal development, given their high calcium content. Because of accelerated muscular, skeletal and endocrine development, calcium needs reach a peak during these years, with up to 50% of bone mass acquired during puberty.[24]

Unfortunately, the calcium intake of many adolescents – especially girls – is below recommended amounts.[8] This is also true in South Africa, where according to a national desktop review,[5] the median calcium intake among adolescents ranges from 303 mg to 642 mg per

day, well below the estimated average requirement of 1300 mg for individuals aged 9–18 years.[25] Low intakes of dairy and its associated nutrients during times of active growth, especially if paired with physical inactivity, compromise the development of peak bone mass, which is considered the best protection against adolescent bone fractures and osteoporosis.[26] The risk is further heightened in cases of adolescent pregnancy, as the physiological demands of supporting foetal skeletal development may further deplete maternal calcium stores and place additional strain on already insufficient bone reserves.[27]

Increasing intake of milk and dairy foods in the diet of adolescents to meet the recommended dietary allowance for calcium (1300 mg per day) greatly increases bone density. Adolescents with higher dairy intakes consistently show improved bone outcomes, including greater bone mineral density and reduced fracture risk.[28]

Muscle development

The high-quality protein in milk and dairy foods, consisting of both casein and whey, is a source of essential amino acids that contribute significantly to lean body mass development and fat mass regulation.[29] This is especially important during adolescence, a time of increased muscle development, linear growth and physical activity. Milk is therefore an excellent complement to lysine-deficient staple foods such as maize and wheat, and can help to create a complete amino acid profile that supports muscle health.[14]

Weight regulation and body composition

Dairy consumption has been positively associated with body composition outcomes in adolescents. Studies indicate that higher intakes of dairy are linked to greater lean mass and lower body fat percentage, especially in girls.[29]

In addition, dairy products help to promote satiety, which can reduce adolescents' consumption of high-energy, nutrient-poor foods. Despite concerns about the fat content in some dairy products, current evidence does not show that reduced-fat dairy offers any clear advantage over whole-fat dairy for managing body weight.[30] Furthermore, the common belief that milk leads to weight gain is challenged by a recent meta-analysis of randomised controlled trials involving 2844 children and adolescents aged 6 to 18, which found that dairy consumption is more often linked with a leaner body type.[31]

Regular dairy consumption during adolescence may also help prevent diet-related NCDs. Although milk and other dairy foods do contain saturated fat and sodium, nutrients of which the intake should generally be limited, their overall effect on health is more nuanced owing to the unique interactions between the nutrient and non-nutrient components in the dairy matrix. Numerous prospective cohort studies and randomised trials have shown that milk intake generally has neutral or even protective effects on body weight and metabolic health in children and adolescents.[30] In addition, regular dairy intake has been linked to a lower risk of type 2 diabetes[32] and cardiovascular diseases.[33] Including milk and yoghurt as part of a balanced diet is also associated with reduced risks of being overweight or developing obesity.[34]

Cognitive function

Adolescence is a life stage marked by increased independence, including greater autonomy in food choices and dietary habits. With busy schedules filled with after-school, social and academic commitments, many adolescents develop irregular eating habits. They frequently skip meals and opt for quick food options, often displacing nutrient-rich foods with highly processed convenience choices. These behaviours contribute significantly to the deterioration of dietary quality during adolescence.[8] Regular meal consumption is essential for maintaining stable energy levels and nutrient availability, both of which are critical for concentration and cognitive performance.[35] Concentration underpins many of the skills adolescents need to succeed academically and thrive later in life. Nutrition and dietary behaviours play a key role in neurodevelopment, and the nutritional value of milk and dairy foods has long been recognised for providing sustainable energy along with high-quality protein and key micronutrients.[15] These nutrients support healthy growth, active lifestyles and brain development. Specifically, the high-quality protein and vitamin B12 found in milk contribute to cell replication and nerve function, which are essential for cognitive processes. Recent evidence also suggests that regular consumption of milk and dairy foods may support cognitive function, potentially owing to their neuroprotective nutrient profile.[36]

Dairy intake and adolescence

Poor dietary quality is common during adolescence.[37] In South Africa, adolescents frequently consume fast foods, salty snacks, confectionery and sugar-sweetened beverages.[38] These unhealthy food choices are further reinforced by the food environment. For example, in a study in Soweto, researchers found that sugar-sweetened beverages are aggressively marketed and sold near schools.[39] Furthermore, foods sold by school tuck shops and nearby food vendors are predominantly unhealthy options. Healthier options, when available, are often more expensive, particularly when compared by cost per unit of energy (R/100 kcal), making them less accessible to adolescents with limited purchasing power.[40,41]

The increasing availability, affordability and aggressive marketing of highly processed foods, such as sugar-sweetened beverages, contribute to the displacement of nutrient-dense foods such as milk and dairy in adolescent diets.[42] Data from the National Youth Risk and Behaviour Study[43] show that while almost half (43%) of participants reported consuming milk on more than four days in the preceding week, only two thirds (63%) consumed servings larger than one cup (250 ml). In comparison, half (49%) reported consuming sugar-sweetened beverages more than four times per week, and 48% consumed more than 250 ml per serving. Further evidence from Oldewage-Theron et al.[44] shows that among children aged 9 to 13 years in an urban South African setting, full-cream milk ranked 11th in frequency of consumption, with a daily average intake of 47 ml. In contrast, carbonated soft drinks and cordials mixed with water ranked 8th and 10th, with average daily intakes of 66 ml and 53 ml, respectively.

This low intake of milk among South African adolescents is concerning, especially when viewed alongside the mean calcium intake data.[5] Literature shows that milk and dairy intake begins to decline with adolescence,[45] with participants in studies citing cost, weight-related concerns,[8,46,47] family environments,[8,46] meal patterns,[48] taste preferences and lactose intolerance[49] as factors that influence their intake. In addition, peer influence, social media and the broader food environment further shape adolescents' dietary choices. Although dairy alternatives have gained popularity, many of these products do not provide the same levels of bioavailable nutrients and bone-supporting effects as traditional dairy products, and they are often more expensive.[50,51]

Milk and dairy products are nutrient dense and contribute significantly to overall dietary quality. As adolescents increasingly consume energy-dense, nutrient-poor foods, the regular inclusion of milk and dairy in their diets offers a valuable strategy to maintain nutritional adequacy and support healthy body composition.[4]

Recommendations and practical considerations

Dietary patterns formed during childhood and adolescence tend to track into adulthood.[52] Promoting adequate intake of milk and dairy foods during adolescence is therefore important for long-term health. To meet approximately 70% of their daily calcium requirements, adolescents should consume three portions of dairy per day. *This can include 250 ml of milk (fat-free, low-fat or full-cream options), 200 ml of maas, 400 ml of yoghurt, or 40 g of cheese per portion. The choice between full-cream, low-fat or fat-free dairy should be guided by personal preference and individual energy intake goals.

The following practical recommendations can help adolescents achieve this intake:

1. *Eat breakfast daily*.– Choose wholegrain options such as oats, bran flakes or wholewheat bread, and pair them with milk, yoghurt, maas or cheese.
2. *Keep nutritious, convenient foods on hand*.– Have foods such as cheese, cottage cheese, yoghurt, milk, lean meats, fresh fruit and chopped vegetables readily available for quick meals or snacks.
3. *Pack a healthy lunchbox or snacks.* – Include options such as wholewheat sandwiches, pitas, wraps or wholewheat crackers with cheese, cottage cheese and lean meats; drinking yoghurt, fresh fruit or vegetables with a yoghurt of cottage cheese dip; and nuts for school and after-school activities.
4. *Cook and prepare meals as a family*. – Involve adolescents in the kitchen and try new recipes that incorporate dairy products such as milk, yoghurt, maas, cottage cheese or cheese in sauces, dips or spreads.
5. H*ave a glass of milk as an evening snack*. – End the day with a glass of cold or hot milk. Adding a drop of vanilla or a sprinkle of cinnamon keeps it interesting.

*The portion sizes recommended (250 ml milk, 200 ml yoghurt, 40 g hard cheese) are based on the typical calcium content per portion (approximately 300 mg calcium), as determined using nutrient analysis from the South African Food Composition Tables (SAMRC, 2017) and confirmed using the USDA FoodData Central database. These portions are intended to support dietary calcium intake goals of approximately 1000 mg/day for adults and 1300 mg/day for adolescents, in alignment with international dietary recommendations. See: South African Medical Research Council. South African Food Composition Tables. https://safoods.mrc.ac.za/database.html; Consumer Education Project of Milk SA, Dairy Composition Tables, https://www.rediscoverdairy.co.za/dairy-composition-tables/.

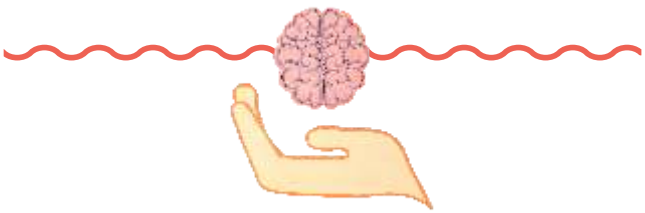
Conclusion

Milk and dairy products offer a unique package of essential, bioavailable nutrients. In addition to their nutrient density, dairy foods also provide functional properties, such as probiotics in fermented products, and play a protective role against the development of NCDs. These benefits position milk and dairy as important components of healthy dietary patterns.[14]

The body of evidence consistently demonstrates that adequate consumption of milk and other dairy foods supports a wide range of health outcomes during adolescence, including optimal bone mineralisation, lean body mass development, healthy weight regulation and cognition.[4,29] These outcomes are particularly important given that adolescence represents a second critical window of opportunity for nutrition interventions to establish long-term health and well-being.

While individual dietary needs may vary, adequate dietary intake of milk and other dairy foods can contribute significantly to meeting the nutritional requirements of adolescents during this critical phase of life. As Norris and colleagues[4] emphasise, improving access to and intake of milk and dairy, especially among vulnerable populations, is key to bridging micronutrient gaps and supporting public health goals.

Given its affordability, nutrient density and protective effects against overweight and NCDs, milk is a valuable contributor to adolescent nutrition in South Africa. Health professionals, parents and caregivers should be encouraged to support dairy consumption, ensuring that adolescents are equipped with the nutritional foundation needed for lifelong health and well-being.



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