Dairy-based nutrition

Information for Health Professionals

An Initiative by the Consumer Education
Project of Milk SA

Contents

The South African Food Based Dietary Guidelines

The South African Food Based Dietary Guidelines (FBDG) are aimed at promoting healthy eating in all people of South Africa. This is also in line with the vision and mission of the Association for Dietetics in South Africa (ADSA). The development of the South African FBDG was driven by the Nutrition Society of South Africa, with valuable input from stakeholders such as ADSA, representatives from the food industry, UNICEF and the Department of Health. The final FBDG were adopted by the Department of Health in 2003.

The FBDG were reviewed in 2012 and a summary of the updated version is shown to the right. Although most guidelines have only been reworded to reflect current evidence more accurately or increase clarity, a separate guideline to promote the intake of dairy has been added.

Scientific evidence shows a positive relationship between a healthy lifestyle and the prevention and management of diseases. This includes adopting good eating habits, regularly engaging in physical exercise, managing stress and refraining from smoking. In our modern age, fresh foods and freshly produced foods are easily replaced by processed or convenience foods. The latter generally provide more energy and salt per portion and should be limited.

It is important to remember that the FBDG do not focus on the nutrients in foods, but rather serve as a guideline to eat healthy and cultivate good eating habits. There is no classification of good or bad eating habits.

2012 Updated Food Based Dietary Guidelines

- Enjoy a variety of foods
- Make starchy food part of most meals
- Fish, chicken, lean meat or eggs could be eaten daily
- ***Have milk, maas or yoghurt every day***
- Eat plenty of vegetables and fruit every day
- Eat dry beans, split peas, lentils and soya regularly
- Use salt and food high in salt sparingly
- Use fat sparingly; choose vegetable oils rather than hard fats
- Use sugar and food and drinks high in sugar sparingly
- Drinks lots of clean, safe water
- Be active!

The nutrition challenge facing South Africa

The National Food Consumption Survey has shown that most South African children do not consume enough vitamin A, B6, B12 and C, thiamine, niacin, riboflavin, calcium, iron and zinc.[1] Lack in dietary variety, and low intakes of fruit and vegetables, legumes and animal-source foods are singled out as reasons.[2] At the same time the South African population experience high rates of diet-related non-communicable diseases.[3] Thus, under- and over-nutrition both threaten the nutritional well-being of the nation.

Dairy nutrition: Scientific evidence

International and local investigations have shown that the unique composition of dairy foods helps to address both current nutrient deficiencies and the risks for developing chronic diseases. Yet dairy intakes of South Africans are well below the recommended daily intake of about 500–750 ml of milk; hence the formulation of a new dairy guideline.

Milk is a good source of high-quality protein, supplying the amino acids needed to build muscles and other tissues. Dairy furthermore significantly contributes to the intake of vitamin A and B12, riboflavin and zinc amongst South African children.[2]

Calcium is well known for its role in bone health, which emphasises the importance of dairy for optimal growth in children and adolescents. However, many South African children are stunted, meaning they are short for their age.[1] A diet without dairy is unlikely to satisfy the recommended calcium requirements for optimal growth.[4] Adequate milk intake could, however, reduce the problem.[5]

In recent years, it has become clear that calcium, and particularly dairy-based calcium, plays an important role in the prevention of non-communicable diseases. About 50% of the beneficial effect of the DASH diet, recommended for lowering blood pressure, is attributed to the dairy component of the diet, likely facilitated by calcium. A food-based approach to increase calcium intake rather than supplementation (pills) is, however, recommended.[6] Calcium also appears to play a role in regulating body weight, body fat and the development of metabolic syndrome [7] – clearly a finding with particular relevance for South Africa, where high blood pressure and obesity are rising dramatically. 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.

Dairy fat has many faces. More than 400 different fatty acids, each with different effects, form 'milk fat'.[8] Since a healthy diet should not provide more than 30% energy from fat, the emphasis should remain on consumption of low-fat dairy. However, scientific evidence increasingly suggests that the quality (type) and food source of dietary fat may be as important as, or even more important than, the total amount of fat. The type of fat in milk and the matrix (i.e. the dairy environment) in which it occurs in particular seem to be critical. For example, whilst industrially produced trans fats are clearly detrimental to health, this may not hold true for vaccenic acid, which occurs naturally in dairy.[9] Similarly, conjugated linoleic acids have remarkable biological properties.[10] Milk may furthermore also play down the effect of saturated fat on blood fat levels.[11]

Fermentation of milk (as used to produce maas or yoghurt) may have additional health effects. This may be related to the lower pH, which affects the rate at which the stomach is emptied, thereby reducing the glycaemic response (i.e. the effect on blood sugar level).[12] Alternatively, the beneficial effects may be due to bioactive peptides present in fermented dairy. These substances have been linked to improvement of cardiovascular symptoms (e.g. high blood pressure) and low-grade inflammation (evident in obesity).[13]

The solution

Increasing dairy intake amongst South Africans should start during childhood. By consistently offering milk to children, we can ensure that milk consumption becomes a lifelong habit. To achieve intake of three servings of dairy daily, include a variety of dairy products in everyday meals.*

Remember:

- Start the day with a glass of fresh milk.
- Top cereals with milk, maas or yoghurt.
- Prepare cooked porridges such as oats or instant oats with hot milk.
- A warm glass of milk before bedtime may help with a good night's rest.
- A glass of milk, flavoured milk or drinking yoghurt before or after sports training is a good way to restore energy and strength.
- Swop cold drinks for milk, flavoured milk or drinking yoghurt.
- Prepare sauces and soups with milk or buttermilk.
- Add cheese to a white sauce to increase the calcium content.
- Stir smooth cottage cheese into soups or add it to a salad dressing.
- Add cubed cheese to a fresh garden salad.
- Spread cottage cheese on wholewheat bread or biscuits.
- Enjoy a platter of fresh fruit and cheese.
- Use cheese as sandwich filler.
- Offer cheese and yoghurt as snack options.
- Suggest yoghurt and fresh fruit as a breakfast choice.
- Prepare a fruit smoothie with fresh fruit and yoghurt for a light meal, snack or breakfast-in-a-glass.

*Powdered milk can be used when cost or refrigeration needs to be considered.

Conclusion

The aims of the FBDG are to promote a healthy lifestyle, guide meal planning and place the focus on balance and moderation to ensure nutritional health for all South Africans. To support the FBDG a practical food guide has been developed to illustrate the food guidelines visually. This is a useful tool for nutrition education.

The Food Guide:

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Nutrient components of dairy

As one of the core food groups, dairy plays a key role in a balanced diet. Dairy products are convenient, cost effective and tasty and naturally contain more than ten essential nutrients, including protein, carbohydrates, vitamin A, riboflavin, vitamin B12, calcium, potassium, phosphorus, magnesium and zinc.[1,2,3] As a result of new technologies in genetics, molecular biology and analytical chemistry, a number of milk constituents with physiological benefits beyond milk's traditional package of nutrients are being recognised.[4] Milk is the primary ingredient of dairy products and the nutrients found in milk are therefore discussed first. Fresh, full-cream cow's milk is a liquid food (87.5% water) and it contains an average of 12.5% total solids of which 9% are non-fat solids.[5,6] Refer to Figure 1 for a schematic diagram of the major components of milk.

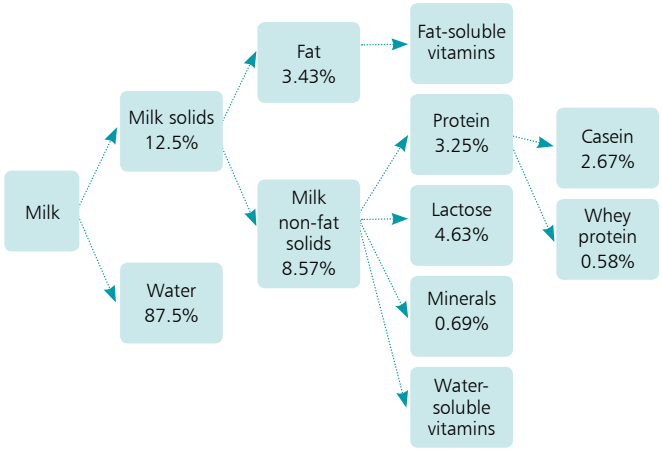

Figure 1: Major components of milk, adopted from Miller (2007)[1,2]

Energy

The energy (kilojoule) content of milk and other dairy products varies widely and depends mostly on the fat content of the product. However, the addition of non-fat milk solids, sweeteners and other energy-yielding components to dairy products contributes to the total energy provided by the selected food.[7] Milk is considered to be a nutrient-rich food, providing a meaningful amount of nutrients relative to its energy content.[8]

Protein

Cow's milk is recognised as an excellent source of high-quality protein.[9,10] Cow's milk contains about 3.25% protein, of which 82% is casein and 18% is whey protein. Each of these proteins has unique characteristics and biological functions. Whey protein concentrates and isolates are used as ingredients in a number of formulated food products.[5,11,12]

Nutritionally, cow's milk protein is considered to be a 'complete protein', because it contains, in varying amounts, all nine essential amino acids required for growth and which cannot be synthesised by the body.[7,13]

Carbohydrates

Lactose, the principal carbohydrate in milk, is synthesised in a cow's mammary glands. Lactose accounts for approximately 54% of the total non-fat solids of milk and contributes about 30% of the energy of full-cream milk.[1] Cow's milk contains about 4.63% lactose, which translates to 12 g lactose per 250 ml.[5,14]

Minor quantities of glucose, galactose and oligosaccharides are also present in milk. Glucose and galactose are the products of lactose hydrolysis by the enzyme lactase.[15]

Fat

Milk fat contributes unique characteristics to the appearance, texture, flavour, and stability of dairy products. It is a source of energy, essential fatty acids, fat-soluble vitamins, and several other potential health-promoting components.[5]

Milk fat, the most complex of dietary fats, exists in microscopic globules in an oil-in-water emulsion in milk. Milk fat is unique amongst animal fats, because it contains a relatively high proportion of short-chain and medium-chain saturated fatty acids.[16]

The composition of milk fat varies somewhat according to the breed of the cow, stage of lactation, season, geographical location and feed composition.[16]

In full-cream milk, approximately 56% of the fat is in the form of saturated fatty acids, 25% is monounsaturated fatty acids, and 3% is polyunsaturated fatty acids.[7]

Although saturated fatty acids generally contribute to an increase in blood cholesterol levels, individual saturated fatty acids differ in their blood cholesterol-raising effects. Long-chain saturated fatty acids, such as lauric, myristic and palmitic acids, raise total and low-density lipoproteins (LDL) blood levels, whereas stearic acids and short-chain saturated fatty acids, such as butyric, caproic, caprylic and capric acids have either a neutral effect or may lower blood cholesterol levels. Oleic acid is the main monounsaturated fatty acid in milk fat. Polyunsaturated fatty acids, such as arachidonic acid, are present in trace amounts.[5,17]

Omega-3-linolenic acid and its products, eicosapentaenoic acid (EPA) and docosahexa-aenoic acid (DHA), are also present in small but significant amounts.[5,18] Current dietary recommendations advise moderation in total fat intake (20–35% of total kilojoules), with less than 10% of kilojoules from saturated fatty acids, and keeping intake of trans fatty acids as low as possible. When selecting milk or milk products, low-fat or fat-free choices are recommended.

Vitamins

Almost all of the vitamins known to be essential to humans are found in milk. Vitamin A, D, E and K are associated with the fat component of milk. Vitamin A plays an important role in vision, gene expression, cellular differentiation, embryonic development, growth, reproduction and immunocompetence.

Both vitamin A and its precursors – principally beta-carotene – are present in variable amounts in milk fat.[15]

Milk and milk products are an important dietary source of vitamin A. Three servings of full-cream dairy consisting of 250 ml milk,

200 ml yoghurt and 40 g cheese will provide 29% and 36% of the RDA for vitamin A for adult males and females, respectively. Cow's milk is a good source not only of vitamin A, but also of beta-lactoglobulin, the major protein component of bovine milk whey, which may enhance vitamin A absorption.[7,19]

Vitamin D, a fat-soluble vitamin that enhances the intestinal absorption of calcium and phosphorus, is essential for the maintenance of a healthy skeleton throughout life.[1,20] Vitamin D is present in low concentrations in South African milk as it is unfortified, but exposure to sunlight should provide adequate vitamin D for most people living in South Africa.

Vitamin E is an antioxidant, protecting cell membranes and lipoproteins from oxidative damage by free radicals. This vitamin helps to maintain cell membrane integrity and stimulate the immune response. Vitamin E is present in low concentrations in full-cream milk (109 μg per 100 g).[8,13,21]

In addition to the essential fat-soluble vitamins, milk and other dairy products contain all of the water-soluble vitamins in varying amounts required by humans. Thiamine (vitamin B1), which acts as a coenzyme for many reactions in carbohydrate metabolism, is found in milk. Three servings of dairy provide about 8% and 10% of the thiamine recommended for adult males and females, respectively. Milk is also an excellent source of riboflavin, or vitamin B2. This vitamin functions as a precursor for certain essential coenzymes important in the oxidation of glucose, fatty acids, amino acids and purines. The average riboflavin content of full-cream milk is about 0.158 mg/100 g.[5]

Niacin functions as part of a coenzyme in fat synthesis, tissue respiration and utilisation of carbohydrates. This vitamin promotes healthy skin, nerves and digestive tract, and aids digestion and the fostering of a normal appetite. The average amount of niacin in milk is 0.107 mg/100 g.[7,22]

Milk is also a good source of pantothenic acid, a component of the coenzyme A involved in fatty acid metabolism. Folate, found in milk, is a growth factor and functions as a coenzyme in the transfer of nucleotides necessary for DNA synthesis. Cow's milk contains a high-affinity folate-binding protein (FBP), a minor whey protein that promotes retention and increases the bioavailabilty of folate by slowing the rate of absorption.

Adequate folate nutrition is especially important for women of childbearing age and can reduce the risk of neural tube defects in infants. Three servings of dairy would supply approximately 9% of the 400 μg folate recommended per day for adults.[7,22]

Dairy is very high in vitamin B_{12}, which is necessary for growth, maintenance of nerve tissue and normal blood formation. Milk provides 0.44 μg vitamin B_{12} per 100 g.

Minerals

Milk and other dairy products are a good source of readily bioavailable calcium, providing approximately 300 mg per serving.[5,16,23,24]

It is also an important source of other minerals, such as phosphorus, magnesium, potassium, and trace minerals such as zinc.[1,5,7]

Phosphorus is an essential mineral that plays a central role in metabolism and is a component of lipids, proteins, and carbohydrates. Magnesium, a required cofactor for more than 300 enzyme systems in the body, is related to calcium and phosphorus function. This mineral activates many of the body's enzymes, participates in the synthesis of protein from amino acids, and plays a role in the metabolism of carbohydrates and fat. Because magnesium is widely distributed in foods, particularly those of vegetable origin, a deficiency of this nutrient is rare.[5,15]

Potassium contributes to the transmission of nerve impulses and helps to control skeletal muscle contraction. Accumulating scientific evidence supports the beneficial role of potassium in blood pressure control as well as the prevention of hypertension. Milk contains about 157 mg potassium per 100 g and is ranked as the top food source of potassium.[7,15]

Milk and other dairy products contain many trace elements or nutrients needed by the body at levels of only a few milligrams per day, such as zinc, selenium and iodine. Trace elements in cow's milk are highly variable and depend on the stage of lactation, season, milk yield, amount of trace elements in each cow's diet, post-pasteurisation handling of milk and storage conditions.[5]

Zinc is essential for growth and development, wound healing, immunity, and other physiological processes. Zinc is also a regulator of gene expression and helps maintain the integrity of cell membranes. Dairy products such as milk, cheese, yoghurt and maas are a source of zinc.[19]

Iodine, which is naturally present in milk, is an essential component of the thyroid hormones, which regulate growth and metabolism. The iodine content of cow's milk varies widely, depending on the geographical area and iodine intake of the cow.[7,15]

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Calcium: the essential mineral

What is calcium and what does it do?

Calcium is a mineral element that is essential for the body.[1,2] It is one of the key elements for building the skeleton and maintaining bone mass throughout life. Almost 99% of the calcium in the body is contained in the bones. The remaining 1% of calcium plays an essential role in a number of vital functions in the body, namely coagulation of the blood, muscle and heart activity, arterial blood pressure, transmission of nerve impulses to muscle, the function of a number of enzymes, etc.[3]

The level of calcium in the blood (calcaemia) must remain constant. Every day some calcium is removed via urine, faeces and sweat. If the supply of calcium is insufficient, the body will draw on the reserve that the skeleton represents to maintain calcaemia and ensure that the body performs its vital functions. Hence, the importance of adequate consumption of calcium is evident.[1]

Bones are living organs and are formed before birth. In the course of life a person 'remakes' the skeleton four or five times. At birth the skeleton contains approximately 30 g calcium. At the start of adolescence it contains about 400 g calcium, and reaches between 1.0–1.2 kg in adulthood.[1,5]

Where does calcium come from?

Calcium cannot be synthesised by the body and thus has to be obtained from food. The foods that are the richest source of calcium are dairy products. Other foods such as sardines, certain fruit (e.g. figs) and vegetables (e.g. cabbage and broccoli), almonds and some natural mineral waters also contain calcium.[2]

Calcium absorption

In order to be absorbed by the intestine, calcium must be in a water-soluble form. Absorption takes place essentially in the first third of the small intestine (duodenum and jejunum), with active transport controlled by vitamin D and various hormones, such as the parathyroid hormone.

Absorption also takes place to a minor extent in the ileum, where transport is passive.[5] One third of the calcium in milk products is in a water-soluble form. The rest, which is bound to casein, is made readily available by enzymes in the stomach and intestine. Milk contains phosphopeptides and lactose, which are components that facilitate the absorption of calcium.[2,5]

Most plant materials (except kale, cabbage and broccoli) contain substances that render the calcium insoluble in water and therefore its absorption is limited. These substances are:[6,7]

- phytates found in bran, cereals, soya and beans
- oxalates found in spinach, rhubarb, cress and sorrel
- tannins in tea.

Vitamin D in its active form (1,25-dihydroxyvitamin D) is also called calcitriol and it stimulates the absorption of calcium. It is synthesised in the skin, especially when exposed to the sun. Vitamin D synthesis diminishes with age but is increased in certain physiological conditions such as pregnancy or during the course of adolesence.[8,9] Phosphopeptides have been identified as calcium transporters and have been shown to increase the absorption of calcium in animals.[10,11] Lactose in milk acts by extending the duration of calcium absorption in the lower intestine, especially when there is insufficient vitamin D.[5,12] The relative absorption of calcium in humans from the following products is approximately:[1]

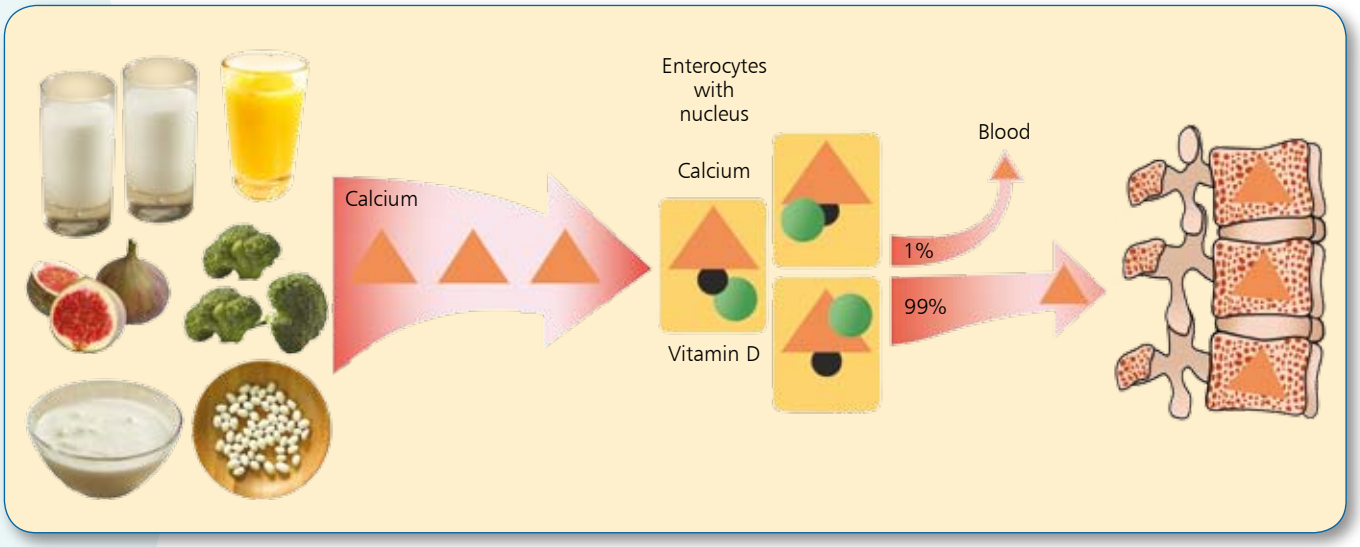
• Milk	32%
• Cheese	33%
• Yoghurt	25%
• Spinach	5-13%
• Kale	29-32%
• Calcium-containing natural mineral water	32%

The bioavailability of calcium

The bioavailability of calcium is defined as the fraction of dietary calcium that is potentially absorbable by the intestine and can be used for physiological functions, particularly bone mineralisation, or to limit bone loss.[5]

Intestinal absorption of calcium does not necessarily reflect its bioavailability. Calcium must be soluble in the acid medium of the stomach before it can be absorbed. The potential absorbability of calcium depends on the type of food in which it appears, whereas absorption depends on the absorptive capacity of the intestines. The absorptive capacity is affected by physiological factors such as calcium reserves, hormonal regulation or previous calcium supply.[11,13]

Bioavailability depends on absorbability and the incorporation of absorbed calcium into the bone. Hence, it also depends on the urinary excretion and faecal loss of endogenous calcium. Certain types of food increase the likelihood that absorbed calcium will be incorporated into the bone, whereas others result in calcium being mainly excreted in the urine.[5] Certain anions, such as sulphate and chloride, organic ligands (chelators) and excess protein or sodium all increase the loss of calcium in the urine and thus hinder its incorporation into bone.[5]



Dietary factors influencing intestinal absorption of calcium

Phytates found in bran and most cereals and seeds, oxalates in spinach, rhubarb, walnuts and sorrel, and tannins in tea can form insoluble complexes with calcium, thereby reducing its absorbability. The effect of fibres and phytates has been examined in several reviews.[14] A relative excess of phosphate has been thought to increase the faecal excretion of calcium. However, in contrast to this widely held view, excess phosphate does not reduce calcium absorption, at least if calcium intake is adequate.[7,15]

Lipids, especially milk fats, are thought by some to form insoluble soaps with calcium, reducing its bioavailability. In practice lipids do not interfere with calcium absorption. The dietary soaps are dissociated at the low pH of the stomach and cannot reform until they reach the ileum, which is beyond the main area of calcium absorption.[14]

Other constituents of food, like lactose, proteins and phosphopeptides in milk, are thought to favour the intestinal absorption of calcium and to keep it in a soluble form until it reaches the distal intestine. Phosphopeptides facilitate the absorption of calcium by passive diffusion and whey proteins, such as alpha lactalbumin and beta lactoglobulin, bind calcium.[10] Lactose, like other slowly absorbed sugars, must be at the site of the absorption so that it prolongs the passive, vitamin D-independent absorption of calcium in the ileum. Lactose acts on the intestinal mucosa to increase its permeability. All high-osmolarity solutions double or triple the passive diffusion of calcium. Lactase deficiency does not prevent the calcium in milk from being absorbed.

Dietary factors influencing the excretion of calcium in urine

All dietary factors that have an effect at kidney level in general increase urinary loss of calcium by reducing tubular reabsorption. The exception to the rule is the simultaneous intake of phosphorus, which should not be confused with the meal effect (all common foods are rich in phosphorus) and certain constituents that raise the pH (e.g. bicarbonate and potassium salts).[16]

Phosphorus has a direct effect by increasing the reabsorption of calcium in the distal part of the nephron or by enhancing the uptake of absorbed calcium into bone. The simultaneous absorption of calcium and phosphorus increases the uptake of calcium by bone, thereby decreasing its loss in urine.[5]

Excess protein generally leads to an increase in the amount of calcium lost in the urine, which may be masked by the opposing effect of excess phosphorus (from dietary components rich in both protein and phosphorus). Sulphate ions also bind calcium, preventing its tubular reabsorption and even its incorporation into bone. Chronic metabolic acidosis due to excessive intakes of sulphate and chloride anions leads to higher losses of calcium in the urine.[2]

It has long been known that the renal clearance of calcium could be linked to that of sodium. For every extra two grams of dietary sodium, the urinary calcium excretion increases by an average of 30 to 40 milligrams.[5]

Dietary factors affecting the amount of calcium lost in the urine have major influences on calcium balance, and may even be more important than those that influence the intestinal availability of calcium.[2] Calcium recommendations are calculated to take most of these losses into account.

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Calcium recommendations and food sources

The recommended dietary allowances (RDAs) for specific nutrients were established by the Food and Nutrition Board (FNB) of the National Research Council of the USDA in 1943 and have been reviewed a number of times since then. The initial guidelines were aimed at achieving optimal health by avoiding nutrient deficiencies. However, the distinct trend of more recent recommendations has been towards the prevention of nutrition-related diseases. In other words, the RDA for a nutrient is not determined by a specific industry, but is based on the most recent research at the time of the review.[1] In 1993, the FNB initiated another revision of the RDAs. As a result, the FNB proposed a framework for the development of future nutrient recommendations known as dietary reference intakes (DRIs).

Dietary reference intakes

The DRIs comprise several reference values that relate to the concept of distributed requirements and distributed intakes. The different values are tools for assessing and planning diets and are most applicable to groups of people because the exact nutritional requirements of an individual cannot be known[1] (also see 'Dietary reference intake components').

Dietary reference intake components[1]

- Estimated average requirement (EAR): Reflects the estimated median requirement and is particularly appropriate for applications related to planning and assessing intakes for groups of people.
- Recommended dietary allowance: Derived from the EAR and meets or exceeds the requirement for 97.5% of the population.
- Tolerable upper intake level (UL): The UL is the highest average daily intake that is likely to pose no risk of adverse effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects may increase.
- Adequate intake (AI): This value represents the average intake level based on observed or experimental intakes. It is used when an EAR or RDA cannot be determined.

The Institute of Medicine issued the first set of DRIs in 1997.[2] In 2011, the Institute of Medicine Committee published the updated DRIs for calcium (Table 1) and vitamin D. These include consideration of chronic disease indicators (e.g. reduction in risk of cancer) and other, non-chronic disease indicators and health outcomes. The available scientific evidence supports a causal role for calcium only in skeletal health, providing a sound basis

TABLE 1 Dietary reference intakes for calcium according to life stage (amount/day)[1]

Life stage group	AI	EAR	RDA	UL
Infants				
0–6 months	200 mg	—	—	1.000 mg
6–2 months	260 mg	—	—	1.500 mg
Children				
1–3 years	—	500 mg	700 mg	2.500 mg
4–8 years	—	800 mg	1.000 mg	2.500 mg
Men				
9–13 years	—	1.100 mg	1.300 mg	3.000 mg
14–18 years	—	1.100 mg	1.300 mg	3.000 mg
19–30 years	—	800 mg	1.000 mg	2.500 mg
31–50 years	—	800 mg	1.000 mg	2.500 mg
51–70 years	—	800 mg	1.000 mg	2.000 mg
> 70 years	—	1.000 mg	1.200 mg	2.000 mg
Women				
9–13 years	—	1.100 mg	1.300 mg	3.000 mg
14–18 years	—	1.100 mg	1.300 mg	3.000 mg
19–30 years	—	800 mg	1.000 mg	2.500 mg
31–50 years	—	800 mg	1.000 mg	2.500 mg
51–70 years	—	1.000 mg	1.200 mg	2.000 mg
> 70 years	—	1.000 mg	1.200 mg	2.000 mg
Pregnant women				
14–18 years	—	1.100 mg	1.300 mg	3.000 mg
19–30 years	—	800 mg	1.000 mg	2.500 mg
31–50 years	—	800 mg	1.000 mg	2.500 mg
Lactating women				
14–18 years	—	1.100 mg	1.300 mg	3.000 mg
19–30 years	—	800 mg	1.000 mg	2.500 mg
31–50 years	—	800 mg	1.000 mg	2.500 mg

AI = Adequate intake
EAR = Estimated average requirement
RDA = Recommended dietary allowance
UL = Tolerable upper intake level

for DRIs. However, no compelling evidence exists yet to show that calcium is causally related to non-skeletal health outcomes or that intakes greater than the DRIs have health benefits.[1,3]

Food sources high in calcium

Calcium is classically associated with dairy products. Milk, yoghurt and cheese are good sources of calcium, providing the major portion of calcium from foods in the general diet of North Americans.[1]

Although consuming the recommended number of servings of dairy products is the easiest way to meet calcium needs, a number of non-dairy products, such as sardines with bones, green leafy vegetables like broccoli, beans (pinto, red and white), sweet potatoes, rhubarb and corn tortillas naturally contain calcium. However, these foods generally either contain less calcium per serving or have a lower calcium bioavailability than milk and other dairy products. Therefore, larger servings of many non-dairy products containing calcium may be needed to equal the calcium intake from a typical serving of milk or other dairy product. However, the high absorbability of calcium from a particular food cannot overcome its low calcium content.[4]

The contribution of a food to meeting calcium needs depends on its calcium content, calcium bioavailability and the frequency and quantity of consumption.

TABLE 2 Comparison of foods providing 300 mg of calcium

Food product	Serving size required
Milk[4]	250 ml (1 cup)
Yoghurt[4]	200 ml (2 small tubs)
Cheese[1]	40 g (2 slices)
Baked beans[10]	882 g (3 cups)
Broccoli, cooked[9]	835 g (7 cups)
Cabbage, cooked[9]	1035 g (9 cups)
Spinach, cooked[9]	275 g (2 cups)

TABLE 3 Sources of calcium (Ca) per 100 g and their bioavailability

Food product	Bioavailability of Ca	Ca content (mg/100 g) Ca	Calculated bioavailable (mg/100 g)
Cauliflower, cooked[9]	≥ 50%	12	6
Brussels sprouts[9]	≥ 50%	47	24
Broccoli[9]	≥ 50%	36	18
Cabbage[9]	≥ 50%	29	15
Pilchards in tomato sauce[10]	≥ 50%	360	180
Sardines, in tomato sauce, with bones[10]	≥ 50%	240	120
Cheddar cheese[11]	≈ 30%	788	236
Gouda cheese[11]	≈ 30%	806	242
Feta cheese[11]	≈ 30%	386	116
Maas[4]	≈ 30%	162	49
Plain yoghurt[4]	≈ 30%	149	45
Fruit yoghurt[4]	≈ 30%	145	44
Buttermilk[4]	≈ 30%	144	43
Low-fat milk[4]	≈ 30%	122	37
Full-cream milk[4]	≈ 30%	120	36
Cottage cheese, fat-free[11]	≈ 30%	120	36
Cottage cheese, full-fat[11]	≈ 30%	111	33
Almonds, dry roasted, no salt[11]	≈ 20%	194	39
Sweet potatoes, boiled, no skin[9]	≈ 20%	9	2
Baked beans, canned[10]	≈ 20%	50	10
Spinach, boiled[10]	≤ 5%	109	5
Fortified super maize meal – porridge, soft[7]	Unknown	2	
Fortified super maize meal – porridge, stiff[7]	Unknown	2	
Fortified special maize meal – porridge, soft[7]	Unknown	5	
Fortified special maize meal – porridge, stiff[7]	Unknown	4	
Fortified white bread[8]	Unknown	16	
Fortified brown bread[8]	Unknown	14	

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3-A-DAY™ dairy

How to obtain 3 servings of dairy a day

Calcium from milk has three major advantages:[1]

- it is particularly well absorbed
- it is bioavailable
- most dairy products contain calcium in significant quantities.

In addition, the interaction between the calcium and other components in milk confer specific health effects. Dairy products represent a unique source of nutrients and bioactive components that act synergistically as well as independently. It is an integrated food system of structure-specific proteins, lipids and carbohydrates that have beneficial physiological properties beyond the content of essential vitamins, minerals and macronutrients.[1]

To enjoy the health benefits of dairy, three servings are recommended as part of a daily diet. A serving size of dairy is calculated to provide 300 mg of calcium per serving. Combining three servings of dairy per day will help you to achieve at least 900 mg of the recommended daily requirements of calcium.[2]

Choose 3 every day!

The average daily requirement of calcium for individuals four years and older is between 1000 and 1300 mg/day, which is based on the Dietary Reference Intake (DRI).

If you favour only one dairy product, make sure you get at least three servings of your favourite product every day.[3]

MILK
(250 ml)

$\frac{1}{3}$ CUP GRATED CHEESE
(40 g)

YOGHURT
(200 ml)

2 TUBS OF YOGHURT
(200 ml)

COTTAGE CHEESE
(275 g)

5 CUPS OF TEA WITH MILK
(250 ml)

2-3 PORTIONS OF PROCESSSED CHEESE
(40 g)

FLAVOURED MILK
(250 ml)

MAAS
(200 ml)

DRINKING YOGHURT
(200 ml)

DAIRY CUSTARD
(275 ml)

CHEESE ON BREAD
(40 g)

The RDA is the amount of a nutrient needed to meet the requirements of nearly all (97–98%) individuals in a group. The DRI applies where the RDA has been redefined and a new value has been established for a specific nutrient based on scientific data (1993).[3]

Milk is lower in fat than you think

Milk is catagorised according to its fat content. The different types of milk available on the South African market are full-cream milk, low-fat (2%) milk and fat-free milk. Excess fat in the diet is not recommended; however, the body still needs some fat for cell structure, protection of nerves and to absorb and store fat-soluble vitamins such as vitamin A. When the fat content of milk is reduced (through cream separation or centrifugation), some vitamin A is lost. The content of the water-soluble vitamins and minerals, however, remains unchanged.

The differences in the nutritional composition of fresk milk are presented below.

Full-cream milk	Low-fat milk	Fat-free milk
		
Fat content	**Fat content**	**Fat content**
Contains typically 3.4% fat	Contains typically 2% fat	Contains typically 0.5% or less fat
Energy	**Energy**	**Energy**
Typically 650 kJ	Typically 520 kJ	Typically 365 kJ

Other nutrients in milk (per 100 g) include:

	Full-cream milk	Low-fat milk	Fat-free milk
Protein (g)	3.2	3.3	3.4
Carbohydrates (as lactose) (g)	4.8	4.9	4.9
Calcium (mg)	120	122	123
Potassium (mg)	157	152	166
Vitamin A (µg)	47	24	1
Vitamin B_{12} (µg)	0.4	0.4	0.4
Vitamin B_2 (µg)	0.16	0.16	0.14

The nutrient composition of ultra-high temperature (UHT) and extended shelf life milk (ESL) is similar to that of fresh milk.

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Dairy: the backbone of sustained skeletal health

Key points

In childhood and adolescence bone development and peak bone mass and stature are determined by dairy intake and the nutrients in dairy. Apart from calcium and phosphate, the classical bone health duet, dairy also contains protein, which is important for bone health. These nutrients are all bioavailable and occur in optimal proportions in dairy.

In adulthood calcium balance and optimal nutrition, which includes dairy, remain critical, as osteoporosis has become a major public health problem. Increased dairy consumption can reduce the burden of osteoporosis. Health economists have calculated that increased dairy intake can achieve considerable reduction in health care costs related to osteoporotic hip fractures.[2]

Introduction

The skeleton is literally the backbone of the human body. In the absence of skeletal health, well-being is hard to imagine. The accumulation of bone mass is one of the outstanding features that accompany a child's longitudinal and cross-sectional growth. About one quarter of a child's adult bone mineral content is laid down during the two years of peak bone mineral accretion, which is between the age of 12 and 13 years for girls, and at about 14 years for boys.[3] Apart from hereditary factors, many environmental factors influence the acquisition and maintenance of bone mass, including physical activity and nutrition.[1,3] Since most environmental factors are modifiable, they should be the primary focus of bone health promotion.

Osteoporosis is a skeletal disorder in which compromised bone strength predisposes a person to an increased risk of fracture. Bone strength is reflected by bone density and bone quality – the micro-architecture of the skeleton.[4,5]

Osteoporosis has become a major public health concern world-wide. About 200 million people are affected.[2,4] In the United States of America osteoporosis is responsible for almost 1.5 million bone fractures annually. It is primarily a disease of midlife and the elderly. Since it is typically invisible until the sixth decade of life, it has been called a paediatric disease with geriatric consequences. Paediatric osteoporosis, which is mainly secondary to longer survival of chronic diseases and skeletal toxic treatments, is, however, increasingly seen at younger ages.[3]

Micronutrients: Calcium, vitamin D and phosphate

The role of micronutrients such as calcium and vitamin D in bone health is well established, although some knowledge gaps still remain.[4]

- A meta-analysis of the impact of dairy products and dietary calcium on bone mineral content in children has shown that increasing dietary intakes of calcium or dairy products resulted in significant increases in total body and lumbar spine bone mineral content in children with low baseline intakes.[6] Amongst stunted children in developing countries, milk had a favourable effect on linear growth.[7] There is also some evidence that the height increase seen in the human population today is a result of dairy intake. Analyses estimate that a daily cup of milk could be associated with an additional 0.4 cm growth per year.[8]

Factors affecting bone health[10]

Modifiable factors that promote bone health	• A lifestyle that includes regular physical activity • Good eating habits • Adequate calcium intake • Adequate vitamin D status
Modifiable factors that increase the risk of bone loss	• Underweight and/or malnutrition • Inadequate calcium intake throughout the lifespan • Medication (some types of anti-convulsants or glucocorticoids) • Low levels of oestrogen in women and low levels of testosterone in men • Lack of exercise/a passive lifestyle • Excessive exercise with low energy intake • Cigarette smoking and alcohol abuse
Non-modifiable factors that increase the risk of bone loss	• Gender: women are at greater risk than men • Age: bone loss increases with age • Body size: small, thin women are more susceptible than larger women • Ethnicity and heredity: Caucasian and Asian women are at greater risk. African American and Hispanic women have a lower, but significant risk • Genetics: if a parent suffers from osteoporosis, it is likely that the children will also have reduced bone mass and increased risk

- A recent meta-analysis could not show a significant specific effect of vitamin D supplementation on bone outcomes in healthy children,[9] but the importance of vitamin D in the absorption of calcium is undisputed.
- During growth and in adulthood, a calcium-phosphate ratio close to that found in dairy leads to positive effects on bone health. The close interplay between calcium and phosphate has been called the bone health duet.[1]

Macronutrients: Protein

A growing body of scientific evidence indicates that dietary protein may be as important as calcium and vitamin D for sustained bone health. Protein constitutes about 50% of bone volume. Bone maintenance requires a continuous supply of dietary protein since several amino acids released during bone resorption cannot be recycled during protein synthesis owing to their existing cross-linking.[11]

However, the net effect of protein intake on bone health is complex and includes factors such as overall food intake, dietary protein level, the source of protein, calcium intake, weight loss, dietary acid/base balance and the interactions between protein and other nutrients.[10] Milk is a unique protein source as it contains about 36 mg calcium per gram protein,[11] which means both protein and mineral requirements for bone health are provided by a single food.

A number of studies – focusing on older individuals – confirm the importance of adequate dietary protein intake for bone health.

- Elderly men and women who consumed 70–83 g and 66–81 g (animal) protein per day, respectively, appeared to be protected against the loss of bone mineral density.[12]
- Amongst post-menopausal women (aged between 55 and 69 years), the intake of dietary protein was associated with a reduced incidence of hip fractures.[13] The intake associated with this effect was an average of 1.085 g/kJ, of which 0.796 g/kJ was from animal sources.
- A randomised control feeding study of healthy post-menopausal women (aged between 50 and 80 years) showed that calcium absorption from a low-calcium diet improved slightly following a moderate increase in dietary protein intake (increased from 10% to 20% of total energy intake).[14]
- Amongst elderly women, a higher protein intake (more than 87 g/day) was associated with optimised bone mass.[15]
- A higher protein intake (17.0% of total energy for women; 15.3% of total energy for men) was associated with a reduced risk of hip fracture in individuals between 50 and 69 years.[16]
- Increased total and animal protein consumption (71.2 g/day ± 24.8 g/day) by women between 55 and 92 years was significantly associated with improved skeletal health.[17] Diet and exercise-induced weight loss programmes that included a high dairy and protein content (30% of energy) affected bone health biomarkers in premenopausal women favourably.[18]

Studies without specific age focus have also investigated the relationship between protein intake and bone health. The major findings are as follows:

- Low-protein diets (1.0 g/kg or 66.5 g/day ± 2.3 g/day) may cause a reduction in intestinal calcium absorption. The finding suggests that a high-protein diet (2.1 g/kg or 136.4 g/day ± 4.9 g/day) may significantly improve intestinal calcium absorption, as gauged by the fraction of urinary calcium of bone origin.[19]
- The combination of increased daily protein intake (increased from 0.78 g/kg to 1.55 g/kg) and reduced carbohydrate intake may result in elevated bone growth factor levels and reduced bone resorption. This favourable effect may be attributed to the stimulating effect of dietary protein on insulin-like growth factor 1, which is a hormone that stimulates bone formation.[20]
- Protein supplementation (with the supplement containing 90% milk proteins) is associated with improved healing of fractures and the prevention of bone loss in patients who suffered recent hip fractures.[19]
- A recent systematic review and meta-analysis has found that a common concern that dietary protein results in an acid load which promotes osteoporotic bone disease seems unfounded.[21]

Conclusion

In addition to calcium, vitamin D and phosphate, adequate intake of dietary protein is recommended for the promotion of bone health and the prevention of osteoporosis. This must start in childhood and continue throughout life. Owing to the interaction between calcium and protein, both should be consumed in adequate amounts to optimise the beneficial dietary effects on bone health.[4]

Dairy products – especially milk – have optimal nutrient proportions for bone health, particularly with regard to the high calcium – protein ratio. Without dairy intake, it is difficult to meet calcium requirements and some of the beneficial effects of this mineral appear to be dairy specific. Individuals and nations should strive to increase the consumption of dairy as it has a health-economic impact: millions in health care costs related to hip fractures can be saved annually if dairy intake is increased.[2]

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Dairy products and hypertension

In view of the high prevalence and major implications of hypertension, attempts to decrease blood pressure are justified.[1,2,3,4] A large evidence base has confirmed an association between consumption of dairy products and reductions in blood pressure.[1,2,3,4] The beneficial effect of dairy consumption on blood pressure appears to be derived from the complete nutritional profile of dairy products and not solely from calcium.[3,4] The combination of minerals, vitamins, proteins and essential fatty acids, as well as the specific peptide sequences of dairy contribute to this effect. Fat-free and low-fat dairy products, especially milk, appear to have an even more significant lowering effect on blood pressure than other dairy products.[1,3]

Although pharmacological treatment of hypertension is effective in many patients, it might be inconvenient, expensive and accompanied with adverse effects in others.[5] Based on the evidence, increased consumption of low-fat dairy foods are recommended in an effort to prevent hypertension or reduce blood pressure.

The evidence

The most well-known randomised controlled trial related to diet and hypertension is the DASH trial, which showed that dietary interventions can effectively impact on blood pressure, to the same extent or more as single-drug therapy.[6] A diet rich in fruit, vegetables and low fat dairy products combined with lower intakes of total and saturated fats over a period of eight weeks, resulted in a significant decrease in blood pressure compared with that of subjects on a typical American control diet (5.5 mmHg systolic blood pressure and 3.0 mmHg diastolic blood pressure).[7]

In South Africa, a study by Charlton *et al*., conducted amongst 325 men and women from three different ethnic groups in Cape Town, found that dietary calcium intake was inversely associated with both systolic and diastolic blood pressure.[8]

A systematic review by McGrane *et al*. covered recent, randomised controlled trials and cohort studies.[1] The authors found significant inverse associations with hypertension for high versus low intake of total dairy, low-fat dairy, and fluid dairy foods.

Ralston *et al*. undertook a meta-analysis of five cohort studies involving nearly 45 000 subjects of which 11 500 had elevated blood pressure.[3] Their analysis showed significant inverse associations of total dairy, low-fat dairy and fluid dairy foods (milk and yoghurt) with blood pressure.[3]

Soedamah-Muthu et al., performed a dose-response meta-analysis of prospective cohort studies evaluating dairy intake and risk of hypertension in 57 256 subjects (of which 15 367 were hypertensive) who were followed up for between two and 15 years.[4] In their analysis, total dairy, low-fat dairy and milk were all linearly associated with a lower risk of hypertension.[4]

Mechanisms

The association between dairy products and blood pressure is stronger than the association between calcium intake and blood pressure, suggesting that other components in dairy products also play a role in this association.[1,9]

Dairy products are usually low in sodium (cheese excluded) and rich in protein, minerals (calcium, magnesium, potassium and phosphorus), vitamins (cobalamin and riboflavin), and trace elements (iodine, selenium and zinc), which may reduce blood pressure individually or in combination.[1,2] The blood pressure-lowering effects of single nutrients may be too small to detect in primary clinical trials, but when consumed together, their combined effect may be sufficient to be detected and provide protective effects. It is also possible that there may be some unrecognised ingredients in dairy products that may affect blood pressure.[10]

The bioactive milk peptides in dairy, such as lactotripeptides, may also contribute to the protective effect of dairy on blood pressure. These bioactive peptides are released from dairy products after fermentation during food processing or digestion in the small intestine[2,3,11,12] and are hypothesised to inhibit the action of angiotensin 1-converting enzyme (ACE), and in so doing prevent blood vessel constriction. ACE is a key participant in the renin-angiotensin system, which is a primary regulator of blood pressure and fluid and electrolyte balance in the body. ACE converts inactive angiotensin I to angiotensin II, which increases blood pressure by constricting vascular smooth muscle.[12] ACE inhibition lowers the production of angiotensin II, which inhibits the release of aldosterone (which conserves sodium, increases potassium loss and increases water retention) and so decreases blood pressure.

Conclusion

The benefits of low-fat dairy consumption on blood pressure justify recommendations to increase consumption of these foods.

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Dairy: an over-emphasis on saturated fatty acids

Milk and other dairy products can be eaten daily without increased risk of cardiovascular disease and may even have a cardio-protective effect. Analytical epidemiological studies suggest that the different saturated fatty acids (SFAs) found in dairy have different effects on serum lipid fractions.[1] Furthermore, several recent systematic reviews and meta-analyses fail to support previous studies that showed dairy to be associated with cardiovascular disease.[2]

Introduction

Many South Africans follow diets high in fat and SFAs and tend to exclude milk from their diet in pursuit of lower fat choices.[3] Dairy consumption is further compromised by the perception that regular consumption of these products is unhealthy, particularly owing to its saturated fat content.[4] In contrast, some recent studies report beneficial effects of milk and dairy products with regard to cardiovascular health.[5]

Different SFAs, different effects

The main SFAs implicated in cardiovascular disease, namely stearic, palmitic, myristic and lauric acid, differ in their effects on serum lipid profiles. Stearic acid, for example, has a neutral effect on total, low-density lipoprotein (LDL-C) and high-density lipoprotein (HDL-C) cholesterol, while lauric acid and myristic acid can cause a greater total cholesterol increase than palmitic acid would. Lauric acid has a beneficial effect on plasma lipids by decreasing the total-to-HDL cholesterol ratio because of an increase in HDL-C.[1] (Also see table below.)

Effect of individual SFAs on lipid* profiles[6] and contribution of these fatty acids to total SFA content of milk[7]

SFA	Total cholesterol	LDL-C	HDL-C	Triglycerides	Total-to-HDL cholesterol ratio	Milk	
						Fresh full-cream (g/100 ml)	Fresh low-fat/2% (g/100 ml)
Stearic (18 : 0)	Neutral	Neutral	Neutral	⇩	Neutral	0.4 (21%)	0.28 (22%)
Palmitic (16 : 0)	⇩	⇩	Neutral	⇩	Neutral	0.8 (42%)	0.53 (41%)
Myristic (14 : 0)	⇩⇩	⇩	Neutral	⇩	Neutral	0.3 (16%)	0.21 (16%)
Lauric (12 : 0)	⇩⇩	⇩	⇩	⇩	⇩	0.09 (5%)	0.07 (5%)

*Isoenergetic replacement of 1% dietary energy from carbohydrates with SFA.

The total SFA content of fresh full-cream milk is 1.93 g and of low-fat milk (2%) 1.30 g per 100 ml. Dairy products contribute relatively little to the SFA composition of the diet compared to other products of animal origin.

Milk or other dairy product consumption and cardiovascular health

Milk and other dairy have been linked to cardiovascular disease risk by increasing SFA intake and serum cholesterol levels. This association is now being increasingly questioned:

- Dairy intake does not conclusively lead to coronary heart disease. A systematic review of prospective cohort studies found no consistent support for the notion that dairy consumption is associated with a higher risk of coronary heart disease.[9] Mente[10] also reported that insufficient evidence exist for an association between milk consumption and coronary heart disease after a systematic review of evidence that suggest a causal link between various dietary factors and coronary heart disease. Similar findings were reported by German[2], whose review on prospective cohort studies showed no association between dairy intake and cardiovascular disease in seven of the twelve cohorts. Three of the studies even reported positive relationships between dairy foods and cardiovascular disease.[2]
- Dairy consumption may reduce the risk of ischaemic heart disease and stroke. Two meta-analyses of prospective studies on the consumption of milk and dairy foods and the incidence of vascular disease indicated an estimated 8% and 16% reduction in ischaemic heart disease and a 21% reduction in stroke events in subjects reported to consume the most milk, relative to those drinking the least milk within each cohort.[5]
- Milk fat is associated with a lower risk of first myocardial infarction (MI) and stroke. Warensjö[12] investigated the association between serum milk fat biomarkers and a first MI and stroke. Milk fats were estimated by using plasma milk fat. Results showed that milk fat biomarkers were associated with a lower risk of developing a first MI and stroke, especially in women.

From the old hypothesis to a new view

Earlier reports of positive associations between SFA intake and the incidence of coronary heart disease led to the so-called 'cholesterol hypothesis', which implies that all food containing SFAs of any kind increases the risk for cardiovascular disease. However, a recent meta-analysis of well-designed prospective epidemiological studies found no significant evidence for an association between dietary SFAs and increased risk of coronary heart disease, stroke or cardiovascular disease.[8]

Conclusion

Recent literature show no conclusive evidence for milk and other dairy as a food group being associated with increased risk for coronary heart disease. Dairy products in general, as well as their specific components, have furthermore been shown to have a positive effect on non-lipid cardiovascular disease risk factors such as blood pressure, inflammation, insulin resistance and type 2 diabetes, obesity and metabolic syndrome. These findings suggest cardiovascular benefits of dairy foods that go beyond blood lipids.[2,5,13] Milk and other dairy products can therefore be eaten every day as recommended by the South African Food Based Dietary Guidelines, without increased risk of cardiovascular disease and possibly even fulfilling a cardio-protective role.

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Weight management with dairy

Dairy intake and calcium from dairy have desirable links with weight management. Protection against weight gain, lower total and central body fat, favourable metabolic profiles, effects on energy balance and appetite, and maintenance of lean body mass during weight loss efforts are part of the intricate interaction.

Obesity in South Africa

South Africa is not exempt from the international epidemic of obesity. According to the most recent South African Demographic and Health Survey (2003)[1] and the National Food Consumption Survey of 2005[2] more than 50% of adult women are overweight or obese. The problem is also emerging amongst South African children and adolescents,[3] although the overall prevalence differs amongst population groups and regions. The well-known association between obesity and non-communicable diseases of lifestyle (including hypertension, coronary heart disease, type 2 diabetes and metabolic syndrome) highlights the burden that overweight and obesity place on the well-being of the nation.

The role of dairy in weight management

Many studies have investigated the association between aspects of dairy intake and body weight management. In recent years, these individual studies have been systematically reviewed and analysed to establish the strength of the evidence. Some conclusions from these comprehensive reviews are summarised below.

Dairy and dairy calcium limit weight gain[4,5,6]

Findings suggest that people who consume milk or dairy are protected from weight gain and tend to be able to maintain a healthier weight. This suggests a negative association between dairy intake and weight gain: an increase in dairy intake is associated with a decrease in body mass index. Increasing calcium intakes from 400 mg per day to 1200 mg per day is associated with a decrease in body mass index from 25.6 kg/m^2 to 24.7 kg/m^2.

Calcium (Ca) content of selected dairy products[7,8,9]

Product	Ca content (mg/100 g)
Gouda cheese	806
Cheddar cheese	788
Feta cheese	386
Maas	162
Plain yoghurt	149
Fruit yoghurt	145
Fat-free milk	123
Low-fat milk	122
Full-cream milk	120
Fat-free cottage cheese	120

Intake of calcium from dairy is associated with lower body fat or smaller waist circumference[10]

Consumption of calcium from dairy is linked not only to lower body weight but also to lower percentages of total body fat and fat in the abdominal area. It is well known that body composition and body fat distribution may be a more important risk factor for the development of non-communicable diseases than body weight.

Dairy calcium enhances weight loss and body fat decrease during energy restriction[4,6,11]

Dairy has been found to have a beneficial effect in weight loss treatments. Dairy not only facilitates weight loss when it forms part of an energy-restricted diet but also appears to maintain lean tissue in overweight people on weight loss diets. It has been suggested that there is a possible threshold effect, with more than 600–800 mg calcium needing to be consumed to promote fat loss. This effect seems to be specific to dairy calcium (as opposed to calcium supplements).

Mechanisms[10,12]

The mechanism to explain the link between dairy intake and weight management is not yet clear. But it is possible that dairy and/or the calcium from dairy:

- forms faecal, insoluble soap-like fatty acid complexes that reduce fat absorption
- regulates energy metabolism (e.g. through increased energy expenditure)
- affects fat metabolism as suggested by the 'calcium hypothesis' (e.g. lipolysis of adipocytes and fatty acid oxidation)
- increases satiety and stimulates food regulatory mechanisms (e.g. dairy protein such as whey may reduce spontaneous food intake).

Conclusion and recommendations

The health-promoting effects of dairy as part of a diet in line with the Food Based Dietary Guidelines are undisputed. Despite many unanswered questions with regard to the mechanism governing the link between dairy and weight management, research indicates that the mix of nutrients found in dairy products, especially calcium and protein, may play an important role in weight management. As dairy products naturally contain calcium, protein and other essential nutrients, consuming three servings daily may not only contribute to weight management but will also improve the overall nutritional quality of the diet.

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Dairy and sport

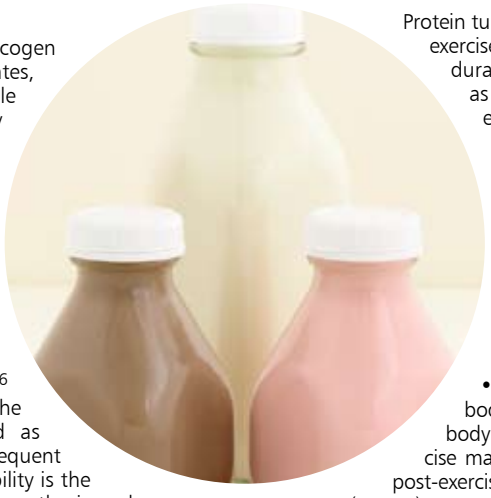
Nutrition is important for optimal sport and exercise performance as well as for optimising adaptation to training. Research has not only established the type and amount of nutrients necessary for optimal performance but also investigated the timing of nutrient intake to optimise adaptation. The nutrient composition and timing of especially the post-exercise meal has been shown to influence the recovery and adaptation from endurance and resistance training.[1]

Which factors affect post-exercise nutrition goals?

The timing and composition of post-exercise food intake depend on various factors, e.g. the type, length and intensity of the exercise session and the timing of the next intensive workout.[2,3]

What are the nutrient recommendations for the recovery meal after endurance exercise?

Carbohydrates



Athletes have to replenish their bodies' glycogen stores during and after exercise. Carbohydrates, stored in the body in the form of muscle glycogen, are the most important readily available source of energy for muscles during strenuous exercise. During moderate and high-intensity aerobic exercise lasting longer than one hour (e.g. long distance running/cycling/rowing), fatigue occurs when muscle glycogen stores are depleted. Fatigue can be defined as an inability to sustain a given power output or speed during physical activity.[1] Glycogen depletion can lead to reduced performance and eventual exhaustion.[2,4,5,6] Efficient recovery of glycogen stores in the post-exercise period has been identified as an important strategy to enhance subsequent exercise performance. Carbohydrate availability is the key factor affecting post-exercise glycogen synthesis and rate of recovery.[7]

Timing of food intake following an endurance activity is not important if another exercise session is not planned for within 24 hours.[8] However, the timing and composition of post-exercise meals are particularly important for athletes participating in multiple intense exercise sessions in order to optimise their recovery between sessions and subsequent performance.[3]

- Athletes should consume 1.0–1.2 g carbohydrates for every kilogram body weight within an hour after exercise,[2,10,11] followed by 0.8–1.5 g carbohydrates per kilogram body weight per hour for at least 3–4 hours thereafter.[7]
- The type of carbohydrate source (liquid or solid) does not influence the rate of recovery. However, if an athlete experiences reduced appetite after exercise, the consumption of a carbohydrate-rich beverage is recommended, followed by a high-carbohydrate meal or snack.[8,11,12] (See examples later.)
- The glycaemic index (GI) describes the effect of a food on an individual's blood sugar levels, which is directly linked to the rate at which food is digested and converted into glucose (energy) within the body.[13] The intake of medium- to high-GI foods or snacks up to six hours after exercise is recommended for athletes training intensely.[2,9,11] These foods are especially important during the first 20–30 minutes after intense exercise.[12]

Protein

Protein turnover is typically increased during and after exercise. Protein breakdown is influenced by the duration, intensity and type of exercise, as well as the training status of the athlete. During endurance exercise there is an increase in protein breakdown to sustain energy metabolism, especially when muscle glycogen stores are depleted. A positive nitrogen balance is needed to allow for net protein synthesis as required for muscle repair, recovery and adaptation. Protein synthesis and muscle repair after exercise have been shown to increase in response to adequate energy availability and the presence of amino acids.[14]

- Co-ingestion of protein (0.2–0.4 g/kg body mass) and carbohydrates (0.8–1.0 g/kg body mass) immediately after resis-tance exercise may improve net protein balance in the early post-exercise period and enhance the rate of glycogen (energy) storage.[8] Low-fat, high-quality protein, such as that provided by fat-free milk, is particularly important.[15]

Fluid

Another goal of post-exercise recovery is to promote rehydration through the replacement of fluid lost during exercise.[8]

- Fluid should be consumed at a volume that provides at least 150% of lost body weight to achieve and maintain a positive fluid balance.[8]

How can dairy products help with post-exercise recovery?

Dairy products, especially milk, have become popular amongst sports people owing to their role in rehydration, muscle building and recovery. Milk and milk products represent a very good source of proteins, carbohydrates, lipids, amino acids, vitamins and minerals, which can enhance recovery and adaptation.[1]

- The carbohydrates in milk (lactose) appear in amounts similar to that in many commercially available sports drinks, which contain mainly glucose and maltodextrin.[1]
- The 3:1 ratio of casein and whey proteins in milk provides for slower digestion and absorption of these proteins, resulting in sustained, elevated blood amino acid concentrations.[1,16,17,18]
- Whey protein also contains a large proportion of branched-chain amino acids, which have an integral role in muscle metabolism and protein synthesis.[1,16,17,18]
- Milk has high concentrations of electrolytes, which are lost through sweating during exercise. The high concentrations of these electrolytes should aid in fluid recovery following exercise.[1]

List of products that provide 25 g carbohydrates* per serving and the related protein content[22]

Product	Serving size to provide 25 g carbohydrates	Protein provided per serving
Full-cream milk	500 ml	16.25 g
Low-fat milk	500 ml	16.30 g
Fat-free milk	500 ml	17.05 g
Flavoured yoghurt	175 ml	6.63 g
Flavoured drinking yoghurt	200 ml	5.70 g
Flavoured milk	250 ml	8.53 g
Bread, brown	50 g (3 slices or 1 large roll)	4.30 g
Rice, brown, cooked	90 g (190 ml or ¾ cup)	2.34 g
Potato, cooked	130 g (1 medium or 4 baby potatoes)	2.47 g
Pasta, cooked	110 g (190 ml or ¾ cup)	5.28 g
Baked beans	135 g (125 ml or ½ cup)	6.48 g
Fruit, any	1 large (200–250 g)	-
Fruit juice	200 ml	-

*Remember: You need at least 1 g carbohydrates/kg body mass

Examples of post-exercise dairy snacks

Dairy products are often recommended as part of post-exercise snacks.[19,20] Examples include:

- flavoured or plain milk
- drinking yoghurt
- a fruit milkshake or smoothie
- a cheese sandwich
- a potato topped with cottage cheese.

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Dairy allergies and lactose intolerance

Cow's milk allergy (CMA) is a complex and often misunderstood disorder. The general public frequently confuses CMA and lactose intolerance.[1] A true food allergy occurs when there is an abnormal reaction of the immune system to one or more proteins present in food.[2] This type of reaction results in the formation of antibodies, which can trigger immediate symptoms. Food intolerance is different from a food allergy and does not involve the immune system. It occurs when a person has an enzyme deficiency or experiences a non-immune reaction to either natural or artificial substances in foods.[2,3]

Facts on dairy allergies

- CMA is an inflammatory response to milk proteins and is distinct from lactose intolerance.[1-3]
- CMA is more prevalent in infants (2–6%) than in adults (0.1–0.5%) and the dominant immunological factors driving allergic reactions change with age.[1,4,5]
- The prevalence of self-diagnosed CMA and lactose intolerance in the community is substantially higher than the incidence reported in blinded and controlled challenge trials, suggesting that a proportion of the population is unnecessarily eliminating dairy products.[1,2,6,7,8]
- Breastfeeding is the best preventative strategy for preventing CMA, although it cannot eliminate the risk of allergic sensitisation in infants.[2,5,6]
- Management of CMA involves avoidance of dairy products for the duration of the condition. Appropriate nutritional advice is therefore important to prevent nutritional deficiencies.[1,5,6]

Lactose intolerance

Lactose is a carbohydrate that is found naturally in mammalian milk and is hydrolysed by the enzyme lactase in the small intestine.[4] When digested, lactose is split into two smaller sugars, namely glucose and galactose.[9] When someone has insufficient lactase to break down all the ingested lactose, they are said to be lactose intolerant. The undigested lactose passes through the small intestine to the colon, where naturally occurring bacteria ferment the lactose and produce acids and gas. The consumption of quantities greater than 12 g lactose (the amount typically found in 250 ml milk) may result in symptoms that include abdominal pain, bloating, flatulence, cramps and diarrhoea.[4,9]

Lactose content of various dairy products[3]

Dairy product	Lactose content (g)	
	Per 100 g	Per portion
Butter	0.06	0.01 (20 g)
Cream	3.13	7.8 (250 ml)
Cheese, cream	3.21	1.3 (40 g)
Cheese, Cheddar	0.23	0.1 (40 g)
Maas	3.68	7.4 (200 ml)
Milk, condensed	7.24	3.6 (50 ml)
Milk, full-cream	4.80	12.0 (250 ml)
Yoghurt, fruit	3.67	7.3 (200 ml)
Yoghurt, drinking	3.47	8.7 (250 ml)

Lactase activity declines exponentially around weaning (introduction of solids) to about 10% of the neonatal value. Even in adults who retain a high level of lactase, the quantity of lactase is about half of that of other enzymes that digest sugars.[4] The level of lactase present in the small intestine, the dose of lactose consumed from food and other products and the conditions under which it is consumed all affect an individual's level of tolerance.[3,6]

The likelihood of developing lactose intolerance later in life is influenced by a range of factors such as:

- **Ethnic disposition**
  The tendency to produce less lactase with age is more common in people of Asian, southern European and African heritage.
- **Medical conditions**
  Temporary lactose intolerance may occur as a response to malnutrition or gastrointestinal infections, or after surgery.[10]

Occurrence

In South Africa the true prevalence of CMA is hard to ascertain. It is believed that 2% of children under the age of two years are truly allergic to cow's milk, and in adults CMA is rare. The prevalence of lactose intolerance in South Africa is estimated at 11.03%.[11]

The treatment for cow's milk allergy and lactose intolerance

Once an allergy has been diagnosed by a qualified health professional, the offending food(s) should be eliminated from the diet. Even trace amounts can cause severe symptoms. So, if cow's milk protein is the problem, avoid all milk and dairy products, e.g. milk, cheese, yoghurt,

The difference between cow's milk allergy and lactose intolerance[1,3,10]

Food condition	Cause of condition	Common symptoms	Required action
Cow's milk allergy	Abnormal immune system reaction	Urticaria (hives), vomiting, diarrhoea, colic, rhinitis, gastroenteritis	Must avoid all dairy products
Lactose intolerance	Not a reaction of the immune system, but a deficiency of the enzyme lactase resulting in the inability to digest milk sugar	Loose, slimy, frothy and acidic stools; flatulence	Total avoidance is not necessary, but some dietary adjustments will be required

butter, ghee, ice cream, buttermilk, cultured milk, milkshakes and flavoured milk. Read all food labels to check for ingredients such as milk, milk powder, milk solids, casein and whey.[3,4,5,12,13]

CMA persists in only a minority of children. The prognosis depends on the patient's age and specific IgE count at the time of diagnosis. The overall remission rate is approximately 45–50% at one year of age, 60–75% at two years of age, 85–90% at three years of age, 92% between five and ten years of age, and 97% at 17 years of age.[2,4]

Infants with CMA should be re-examined regularly by their doctor and dietitian. Periodic rechallenges should be conducted to monitor tolerance (every six to 12 months). In case of IgE-mediated CMA, milk-specific IgE levels should also be monitored periodically. Declining levels of specific IgE correlate well with development of tolerance to foods. A specific IgE level for milk protein of 2 ku/ℓ predicts a 50% chance of passing a challenge test.[2,4,13]

Recent research shows that placing small amounts of milk under the tongues of children who are allergic to milk can help them overcome their milk allergies.[14] This approach, known as SLIT (sublingual immune therapy), involves giving children small but increasingly higher doses of the food they are allergic to until their immune systems 'learn' to tolerate the food without triggering an allergic reaction or only mild symptoms. A similar approach known as oral immunotherapy can also successfully treat children with milk allergies. Unlike SLIT, oral immunotherapy involves consuming milk protein rather than merely placing it under the tongue. Researchers caution that both therapies can lead to violent allergic reactions in some patients and should always be done with a doctor's supervision.[14]

In the past, delaying the introduction of dairy until at least one year of age was considered a suitable strategy for timely introduction of potential food allergens. However, recent studies indicate that in the case of complementary feeding, it might be in the infant's best interest to introduce dairy earlier rather than later to prevent allergies. Introduction should, however, not be before 17 weeks of age, but at least challenged in the diet before 24 weeks.[15]

According to the US National Institute of Health (NIH), complete avoidance of milk and dairy products is unnecessary in most cases of lactose intolerance.[16] No treatment can improve the body's ability to produce lactase, but symptoms can be controlled through diet.[17]

Lactose-intolerant people can successfully add dairy to their diets if they keep the following in mind:[3,17]

- Milk should be used along with other foods, e.g. milk on cereal, and should not be consumed on an empty stomach.
- Build up tolerance. Start small and gradually increase milk consumption.
- Full-cream milk may be better tolerated than low-fat or fat-free milk.
- Yoghurt is better tolerated than milk.
- Cheese is very low in lactose and well tolerated. The NIH suggested Cheddar, Provolone and Mozzarella as suitable choices for lactose-intolerant people.
- Low-lactose milk or lactose-digesting preparations (available from chemists) can be used.
- A probiotic supplement can be used on a daily basis to improve the colonic microbiotic environment.

The dangers of unnecessarily removing cow's milk from the diet

Research shows that people with self-perceived lactose intolerance may be at risk of poor bone health and higher rates of diabetes and hypertension because of lower calcium intakes.[8]

The health benefits associated with calcium in dairy may not necessarily translate to equivalent efficacy in another food item or supplement, since variable factors influence the biological response to a bioactive component, such as the nature of the food matrix. Milk provides an easily accessible matrix, has a simple digestible protein with a balanced amino acid profile and is rich in a large variety of essential nutrients.[18] The latter observation is corroborated by the 2005 US Dietary Guidelines for Americans, which concluded that in addition to calcium dairy contributes more than 10% of the required riboflavin, vitamin B12, phosphorus, magnesium, zinc, potassium, protein and carbohydrate. Studies also show that the specific combination of calcium, phosphorus and protein makes the dairy matrix an almost indispensible part of the diet to build and maintain strong bones. Other health benefits beyond bone health include cardiovascular health, weight control, positive outcomes on metabolic syndrome and hypertension.[18]

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Why milk and other dairy products may be a safer option than calcium supplements

Adequate dietary calcium intake is needed for optimal bone health throughout life. Self-imposed restriction of milk has been associated with reduced bone mineralisation, increased risk of fracture and shorter stature. It is difficult to meet calcium recommendations when dairy intake is reduced, while still meeting requirements for other nutrients. Food, especially milk and dairy products, is considered the preferred source of calcium compared with supplements to meet calcium requirements.[1,2]

Why is it better to get calcium from dairy products than from supplements?

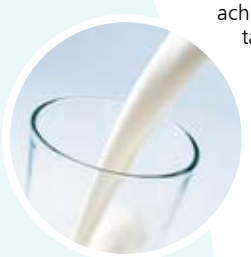
Calcium in milk differs favourably from calcium in other foodstuffs or supplements and these differences are important with regard to absorption in unfavourable physiological conditions.

- Prolonged absorption: Dairy calcium, which is bound to peptides and proteins, is more likely to remain in solution when the pH is unfavourable, such as achlorhydria (absence of hydrochloric acid in the gastric secretions of the stomach).[3]
- Alternative absorption: Dairy calcium can be absorbed in the absence of vitamin D, under the influence of lactose in the distal small intestine via the paracellular route.[3]
- Protected absorbability: Dairy products do not contain any substance likely to inhibit the intestinal absorption of calcium.[3]
- Meal effect: Milk and dairy products provide an almost complete diet, providing several additional essential nutrients for optimal bone health and human development. Low-calcium diets are therefore generally characterised by low levels of other essential nutrients as well, such as potassium and magnesium. By consuming dairy products, the overall nutritional quality of the diet is therefore improved.[1,3]

Supplements as a source of calcium

Calcium in supplement form is present in various compounds, including calcium carbonate, citrate, citrate malate, phosphate, gluconate, lactate and calcium from dolomite (calcium magnesium carbonate) or bone meal, with carbonate and calcium citrate the compounds of choice. The percentage of elemental calcium provided by these sources range from 9% (calcium gluconate) to 40% (calcium carbonate).[1,4] Calcium is best absorbed in doses of 500 mg or less, and taken in multiple doses (four times per day) to lower parathyroid hormone levels and decrease bone resorption.[4]

Calcium supplements are available as capsules, tablets, chews, wafers, powders and liquids. These supplements might be required by individuals who do not consume calcium-rich foods, either by choice or necessity. When considering calcium supplementation, the presence of achlorhydria, bioavailability of the calcium, number of tablets needed to achieve the desired dose, size of tablet, the calcium compound and cost should be considered.[4] However, the most important factor to consider, is the potential side effects and/or toxicity associated with calcium supplementation, especially with excessive intakes.



- Gastrointestinal side effects: constipation, gas, flatulence and bloating[4]
- Exposure to toxic metals due to contamination of bonemeal or dolomite supplements with cadmium, mercury, arsenic or lead[5]
- Kidney stones with calcium intakes close to 2000 mg/day[4]
- Increased risk for advanced and fatal prostate cancer at intakes >1500 mg/day[4]
- Hypercalcaemia in calcium intakes close to 2000 mg/day, especially with high vitamin D intakes (e.g. ingestion combined supplements of calcium and vitamin D)
- Excessive calcification in soft tissue, especially the kidneys, with an intake of ≥2000 mg/day[4]
- The increased risk of cardiovascular disease[7]
- Possible drug and nutrient interactions (as listed on www.rediscoverdairy.co.za under Health Professionals, calcium supplements).

Milk-based nutritional supplements

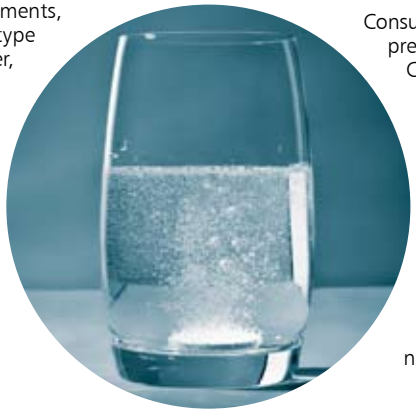
In addition to milk being a high-calcium food source, it has the additional benefits of being implemented as a vehicle for nutritional supplementation aimed at maternal and child nutrition, sport nutrition and oral nutritional supplements in the clinical setting. Oral nutritional supplements can improve or maintain the nutritional status of malnourished patients with cancer and other disease conditions.

The palatability of a high-energy oral supplement is an important factor in ensuring successful implementation and long-term compliance.

Milk-based nutritional supplements have been found to be preferred above non-milk-based supplements, including sweet and salty fruit-juice-type products amongst people without cancer, patients with gastrointestinal cancer and malnourished patients.[8,9]

How can calcium consumption be increased in the diet?

Calcium consumption is influenced by various psychological, physiological and environmental factors. Addressing the following potential problems could assist in meeting calcium requirements without risk of calcium toxicity or under-consumption of other essential nutrients:



- Substitution of milk with soft drinks.
- Eating away from home results in consumption of foods with a lower calcium density.
- Poor parental (and peer) influence could contribute to children making food decisions consistent with a reduction of calcium intake.
- Skipping meals, especially breakfast, may limit calcium intake and compromise overall diet quality.
- Poor knowledge and negative attitudes towards dairy. Addressing calcium's health benefits, recommendations and personal intake could result in a behavioural change to improve calcium intake.
- Weight and fat concerns as a result of the misperception that dairy products are fattening.
- Taste is the primary factor influencing the intake of dairy products. Raising the awareness of the wide variety of dairy products available in different forms and flavours to satisfy different preferences could contribute to higher calcium intakes.
- Lactose intolerance. Gradually increasing intake of lactose-containing foods can improve tolerance to lactose.

Guidelines for supplementation

Consumption of calcium-rich foods, specifically dairy, is the preferred manner to achieve optimal calcium intakes. Calcium supplements should be an addition to and not a substitute for foods naturally containing calcium.

Individuals who choose to meet their calcium requirements through calcium-fortified foods, which are usually characterised by a low density of other nutrients, and/or via calcium supplementation should ensure that their requirements for other nutrients are also met.[1] The adequate consumption of milk and other dairy products is an easy way of obtaining an adequate calcium intake, while also increasing the nutritional quality of the diet.

Conclusion

Consumption of calcium-rich foods, specifically dairy, is the preferred manner to achieve optimal calcium intakes. Calcium supplements should be an addition to and not a substitute for foods naturally containing calcium. Individuals who choose to meet their calcium requirements through calcium-fortified foods, which are usually characterised by a low density of other nutrients, and/or via calcium supplementation, should ensure that their requirements for other nutrients are also met.[1] The adequate consumption of milk and other dairy products is an easy way of obtaining an adequate calcium intake, while also increasing the nutritional quality of the diet.

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Have milk, maas or yoghurt every day

Milk, maas or yoghurt intake every day will reduce current nutrient gaps in the diets of most South Africans, and protect against chronic diseases in future.

The problem

The National Food Consumption Survey has shown that most South Africans do not consume enough vitamin A, thiamin, niacin, riboflavin, vitamins B6, B12 and C, calcium, iron and zinc.[1]

Lack in dietary variety and low intakes of fruit and vegetables, legumes and animal-source foods are singled out as reasons.[2] At the same time South Africa has high rates of the so-called chronic diseases of lifestyle – non-communicable diseases related to dietary factors. These include heart disease, high blood pressure and type 2 diabetes, which are all associated with overweight and obesity.[3] Thus, both under- and over-nutrition are rife in our country. It means 'double trouble' for nutritional growth and prosperity.

In-depth investigations internationally and in South Africa have shown that the unique composition of dairy products helps to address both current nutrient deficiencies and the risks for developing chronic diseases. Yet dairy intakes of South Africans are well below the recommended daily intake of about 500 ml (2 measuring cups) of milk. Hence the Department of Health formulated a new dietary guideline to promote intakes of specifically low-fat milk, maas and yoghurt.

The scientific evidence

Milk is a source of high-quality protein, supplying the amino acids that the body needs to build muscles and other tissues. Dairy furthermore should significantly contribute to South African children's intake of vitamin A, riboflavin, zinc and vitamin B12.[2]

The mineral content of dairy plays 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.

Without sufficient dairy intake, it is highly unlikely that consumers will meet their calcium requirements.[4]

Calcium is well known for its role in bone health, which emphasises the importance of dairy for optimal growth in children and adolescents. However, owing to the lack of protein and energy, many South African children are stunted, meaning they are short for their age.[1] In this group of children adequate milk intake, providing high-quality protein as well as calcium reduces the problem.[5]

In recent years it has become clear that calcium in general, but particularly the calcium from dairy, is also important in the prevention of non-communicable diseases. About 50% of the beneficial effect of the well-known DASH diet, which is recommended for lowering blood pressure, is attributed to the dairy component of the diet. The calcium in dairy offers credible explanations for the observed effect, and hence a food-based approach rather than supplementation (tablets), is recommended.[6] Calcium also appears to play a role in regulating body weight, body fatness and the development of metabolic syndrome.[7]

Clearly dietary calcium is important for the South African population, among whom high blood pressure and obesity are sky-rocketing.

The fat in dairy has many faces. Milk fat consists of more than 400 different fatty acids, each with different effects.[8] Since a healthy diet is one where the energy (i.e. kilojoules) from fat does not exceed 30% of the total energy intake, the emphasis should remain on consumption of low-fat dairy. However, increasing scientific evidence suggests that the quality (type) and food source of the fat may be as important as, or even more important than, the total amount of fat. The type of fat in milk, and in particular the matrix in which the fat occurs, appear to be critical. For example, whilst industrially produced trans fats are detrimental for health, this may not hold true for vaccenic acid, which occurs naturally in

dairy.[9] Similarly, conjugated linoleic acids have remarkable biological properties.[10] In addition, studies have shown that milk may actually play down the effect of saturated fats on blood fat levels.[11]

Milk in fermented form (as in maas or yoghurt) may have additional health effects. This may be related to the lower pH (acidity), which affects the rate at which the stomach is emptied and thereby reducing the glycaemic response (i.e. the effect on blood sugar).[12] Alternatively the beneficial effects may be due to bioactive peptides present in fermented dairy. These substances have been linked to improvement of cardiovascular symptoms (e.g. high blood pressure) and of low-grade inflammation (evident in obesity).[13].

The solution

- Encourage optimal use of milk, maas and yoghurt among consumers.
- Consistently offering milk as a beverage to children will ensure that drinking milk becomes a lifelong habit.
- The addition of milk, maas or yoghurt to cereals and porridges, as well as milk to coffee and tea can also make a difference.
- Do not forget milk in cooking, and yoghurt in the lunch box!

Having milk, maas or yoghurt every day packs a punch in the fight against both existing and future nutritional problems. It's a double deal.

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Important nutrients provided by dairy products

Nutrient	Units	RDA[1] for adults	% RDA in 250 ml milk			% RDA in 200 ml low-fat fruit yoghurt	% RDA in 40 g cheese	% RDA in 3 servings of dairy
			Full-cream	Low-fat	Fat-free			
Vitamin A	µg RE	♂ 1000 ♀ 800	11 14	5 7	0.5 0.6	4 5	14 17	29 36
Thiamin (vit B1)	mg	♂ 1.2 ♀ 1.1	4 4.5	4 4.5	8 8	3 4	1 1	8 9.5
Riboflavin (vit B2)	mg	♂ 1.3 ♀ 1.1	31 36	31 36	27 32	23 27	12 14	66 77
Niacin (vit B3)	mg NE	♂ 16 ♀ 14	1.7 1.9	1.4 1.6	1.4 1.6	1 1.2	0.2 0.2	2.9 3.3
Vitamin B6	mg	♂ 1.3 ♀ 1.3	7 7	7 7	8 8	8 8	2 2	17 17
Vitamin B12	µg/d	♂ 2.4 ♀ 2.4	46	48	40	36	14	96
Calcium	mg/d	1000[3]	30	30.5	31	29	31	90
Potassium	mg/d	2000[4]	20	19	21	20	2	42
Magnesium	mg/d	♂ 420 ♀ 320	7 9	7 9	7 9	7 9	3 4	17 22
Zinc	mg/d	♂ 15 ♀ 12	7 8	7 9	7 8	9 10.5	11 13	27 31.5
Phosphorus	mg/d	700	32	32	36	30	30	92
Proteins	g/d	♂ 63 ♀ 50	13 16	13 16	14 17	12 15	16 20	41 51
Carbohydrates	g/d	50 – 60% of total energy[5] ♂ ≈399 ♀ ≈302	 3 4	 3 4	 3 4	 9 12	 0.1 0.2	 12.1 16.2
Dairy fat	g/d	20 – 30% of total energy[5] ♂ ≈83g ♀ ≈63g	 10 14	 6 8	 0.5 0.7	 4 5	 15.5 20.5	 29.5 39.5
Omega-3 fatty acids	g/d	0.5 – 1% of energy or 1 – 2 g[6]	4	3	0.5	5	5	14
Omega-6 fatty acids	g/d	3 – 12% of energy or 5 – 10 g[6]	4	3	0.3	2	5	11
Cholesterol	mg/d	<300	8	6	2	5	15	28
Energy	kJ/d	♂ 12 180[7] ♀ 9 240	7 5	6 4	4 3	8 6	7 5	22 16

1. National research council RDA. Food and Nutrition Board. National Academy of Science. Revised 1989.
2. Values calculated based on 250 ml full-cream milk, 200 ml low-fat fruit yoghurt and 40 g cheese.
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7. RDA for energy. Average energy allowance for males and females age 25 – 50, respectively.

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