7 "Have milk, *maas* or yoghurt every day": a food-based dietary guideline for South Africa

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Abstract

A national working group recently reached consensus that a guideline message for milk consumption should form part of the set of revised food-based dietary guidelines (FBDGs) for South Africa. The message was formulated as: "Have milk, *maas* or yoghurt every day". This paper provides scientific support for this FBDG, based on the nutrition and health profile of South Africans; addresses concerns about possible detrimental effects of milk consumption, such as lactose intolerance, saturated fat and trans-fat content, milk allergies and dental caries in children; and identifies barriers to increased consumption. The guideline refers to milk, *maas* and yoghurt, and not all dairy products. This is based on the nutrient contribution of these products to a healthy diet. Milk (and some dairy products) has a low sodium-to-potassium ratio, as well as bioactive peptides, which may protect against the development of noncommunicable diseases. There is some evidence that the calcium in milk and dairy plays an important role in the regulation of body weight and bone mineral content in children. Available data show that milk and calcium intake in South Africans is low. Identified barriers include perceptions about lactose intolerance, taste, price, lack of knowledge on the nutritive value of milk and milk products, and possibly cultural taboos. As a result, increasing the consumption of milk, *maas* and yoghurt of South Africans will require active, multifaceted and multilevel promotion.

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Introduction

The first set of food-based dietary guidelines (FBDGs) for South Africa,[1] published in 2001, did not include a separate FBDG for milk and other dairy products. At the time, the rationale focused on cost and affordability by a large section of the population. Milk and dairy products were part of the FBDG on animal foods, which included meat, chicken, fish and eggs. Another reason for this decision was concern about lactose intolerance in Africans and the low prevalence of osteoporosis in elderly South Africans. It was also argued at the time that since the guidelines were formulated for people older than seven years of age, other food sources could contribute the nutrients needed for an adequate diet.

However, in the light of consistent reports of low calcium and potassium intakes by the South African population,[2-4] and the high prevalence of hypertension[5] and other noncommunicable diseases (NCDs),[6] a national working group that revised the South African set of FBDGs recommended a separate FBDG for milk for South Africans.

The national working group examined the milk and dairy guidelines of 56 different sets of FBDGs in Africa, Asia, Europe and the Americas,[7] and recommended that the FBDG should specifically promote milk, either fresh or powdered, and the traditional fermented milk product *maas* (also known as *amasi*), as well as unsweetened yoghurt, to prevent an increase in the intake of saturated fatty acids (SFAs), sodium and sugar, which are found in many highly processed dairy products. Cheeses are not included in the guideline, and are also not featured in the South African food guide. The guide only shows examples of foods in the food groups that must be eaten regularly to meet nutrient needs. If questions are raised about where cheeses should fit into the different food groups, it should be noted that their origin, protein and fat content makes it suitable for them to be classified as food products from animals, as are fish, chicken, meat and eggs. Blends and non-dairy creamers are explicitly omitted.

The aim of this paper is to provide a rationale for the FBDG on milk for South Africans. This was achieved by discussing the nutrient composition and other attributes of milk and dairy products, which led to an overview of the evidence of the health benefits associated with milk and dairy product consumption, and a discussion of the perceived and possible adverse health effects of milk and dairy. A review of current milk consumption patterns in South Africa is followed by an examination of barriers to increased milk and dairy consumption, and lastly, recommendations on how these barriers should be addressed in the implementation of this FBDG. The ultimate purpose is to improve the nutritional status and health of all South Africans.

South Africa has separate paediatric FBDGs for infant and child feeding,[8] which are also currently being revised. The present guideline[8] includes detailed advice on breastfeeding, in which international guidelines on exclusive breastfeeding for six months are followed, with continued breastfeeding for two years and beyond.[9] FBDGs for the general population are recommended for children aged five years and older. Because of separate technical report papers on infant feeding, the advantages of breastfeeding and milk consumption by children younger than five years of age will not be covered in this paper, other than to reiterate that because of the rapid growth and high energy needs of infants under two years of age, reduced-fat milk is not recommended as the main source of milk food for this age.

The health benefits of milk and dairy consumption

The main purpose of FBDGs is to guide the population to choose healthy diets, meaning diets that are adequate, which meet all nutrient requirements and which also protect against diet-related NCDs. There is no doubt that historically, the production and consumption of milk and dairy products played an important role in human development and well-being.[10] In order to make a responsible recommendation on milk and dairy consumption and its role in health and disease prevention in contemporary South Africa, its nutrient contribution and attributes and the role that it plays in the development of NCDs should be taken into account, as well as any possible adverse effects associated with milk and dairy consumption. These aspects will now be considered, using the most recent evidence.

The nutrient composition of milk and dairy products

The nutrient composition of milk of varying fat content and some selected dairy products, as detailed in the South African food composition tables,[11] is summarised in Table I. These products and nutrients were included in the table to illustrate that milk and dairy products are excellent sources of several micronutrients, as well as being relatively low in sodium and high in potassium.

Milk is a good source of high-quality protein, and contains useful amounts of all the indispensible (essential) amino acids.[12] Milk can be used to complement foods with lysine-deficient protein, such as maize and wheat. Adding milk or other dairy products to these foods results in a meal with all the amino acids, and is beneficial in populations where maize and bread are staples.

The 400-500 ml low-fat milk per day recommended for adults will provide 480-610 mg calcium, which is 48-61% of the recently revised dietary reference intake for calcium. On average, 1 000 mg of calcium is appropriate for women aged 19-50, and men up to the age of 70 years.[13]

Table I: Summary of the nutrient composition of selected dairy products (per 100 g)[11]

Nutrient	Unit	Fresh milk (full fat)	Fresh milk (2% fat)	Maas/ fermented milk	Yoghurt (plain, low-fat and unsweetened)	Yoghurt (fruit, fat-free and sweetened)	Cottage cheese (fat-free)	Cheddar cheese
Energy	kJ	262	213	270	254	375	266	1 646
Protein	g	3.2	3.3	3.3	4.3	3.8	10.5	24.7
Fat	g	3.4	2.0	3.7	1.9	1.5	0.1	32.3
SFAs	g	1.90	1.28	2.35	1.16	0.94	0.09	18.43
Cholesterol	mg	10	7	11	8	7	1	115
CHO	g	4.8	4.9	4.5	6.5	15.0	4.9	1.8
Iron	mg	0.10	0.10	0.10	0.10	0.10	0.60	0.07
Calcium	mg	120	122	162	149	145	120	788
Potassium	mg	157	152	190	194	197	185	82
Sodium	mg	48	46	71	66	74	161	487
Vitamin A	µg RE	47	24	40	22	25	2	390
Thiamine	mg	0.02	0.02	0.02	0.02	0.02	0.04	0.04
Riboflavin	mg	0.16	0.16	0.15	0.19	0.15	0.21	0.36
Niacin	mg	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vitamin B_{12}	µg	0.4	0.4	0.4	0.5	0.3	0.7	0.8
Vitamin D	µg	0.03	0.01	0.03	0.01	0.01	0.08	0.25

CHO: total carbohydrates (including added sugar), RE: retinol equivalents, SFAs: saturated fatty acids

The same amount of low-fat milk will provide 608-760 mg potassium, which is 30-38% of the recommended adequate intake of 2 000 mg potassium per day.[14] The substantial contribution of milk to potassium intake is important for the nutrient adequacy of populations that do not meet the vegetable and fruit intake recommendations. The sodium content of milk is relatively low (46 mg per 100 ml for low-fat milk). A daily intake of 400-500 ml contributes 184-230 mg sodium, which is 9.2-11.5% of the maximum of 2 g/day recommended for the prevention of high blood pressure.[15]

Table I further shows that the energy content of sweetened yoghurt, and the energy and sodium contents of cheeses (except cottage cheese), is increased through a concentration effect, or by the addition of sucrose and fruit, justifying the focus of the new FBDG on milk, *maas* and yoghurt alone. The reason why cottage cheese was not included in the formulation of the FBDG was to avoid possible confusion why some, but not all, cheeses may replace milk, *maas* or yoghurt. Low-fat products should be considered in situations in which overweight and obesity are of concern, for example South African adults.[16]

Other attributes of milk and dairy

In addition to a unique nutrient composition, milk and some dairy products have attributes that are not reflected in traditional food composition tables. These include bioactive peptides, specific fatty acids, the low pH of fermented milk, and the low sodium-to-potassium ratio of milk and *maas*. These attributes may be responsible for some of the health benefits associated with milk consumption.

Bioactive peptides

The bioactive peptides are defined by Choi et al[17] as "hydrolysates with specific amino acid sequences that exert a positive physiological influence on the body. They are inert within the native protein, but once cleaved from the native protein by microbial or added enzymes and/or gastrointestinal enzymes during the digestive process, they apply their beneficial traits. Dairy products, particularly fermented products, are potential sources of bioactive peptides". One of these beneficial traits is that they act as inhibitors of angiotensin 1-converting enzyme, which may explain the protective effects of milk on raised blood pressure.[18,19]

Calder at al[20] reviewed dietary factors that influence low-grade inflammation in relation to overweight and obesity, and concluded that dairy consumption has beneficial effects on markers of low-grade inflammation (C-reactive protein and adiponectin) in obese subjects. They speculated that possibly, these effects may be explained by the actions of the casein-derived bioactive tripeptides in milk.

Specific fatty acids in milk

Milk fat is a complex natural fat. Its triacylglycerols are synthesised from 400 different fatty acids.[21] In addition to the monounsaturated fatty acids (approximately 25% of the total), and the SFAs (roughly 60% of the total), milk fat contains several other fatty acids with possible beneficial effects against the risk of acquiring NCDs. These include the short-chain fatty acid, butyric acid, and the sphingolipids. The trans-fatty acids and rumenic and vaccenic acids in milk need to undergo more biological research before a judgement on their beneficial and/or detrimental effects can be made. These fatty acids are thought to be anticarcinogenic and anti-atherosclerotic, and may play a role in the prevention of obesity.[22-24]

Fermented milk (*maas)*

Milk products that are soured in calabashes, clay pots, milk sacks, stone jars or baskets are part of traditional South African cuisine. *Maas (amasi)* is the common name for the most popular fermented milk, originally prepared by storing unpasteurised whole cow's milk in these containers, seeded with a microbial inoculum for fermentation. Lactic acid bacteria, especially *Leuconostoc*, *Lactococcus* and *Lactobacillus*, dominate the microflora.[25] *Maas* is also produced commercially by fermentation with *L. lactis* and *L. lactis cremoris*, after which it is pasteurised. It has a shelf life of 21 days at 4°C and is an ideal vehicle for the delivery of probiotics.[26] The incorporation of probiotics in fermented milk has beneficial health effects, such as the improvement of lipid profiles.[27] Haug et al[28] reviewed the health benefits of bovine milk in human nutrition, and mentioned that the low pH of fermented milk may help to delay gastric emptying, with a resultant beneficial effect on glycaemic responses and perhaps also on appetite regulation. The perception that dairy is acid producing has no scientific foundation. Milk and dairy products do not produce acid upon metabolism, they do not cause metabolic acidosis, and systemic pH is not affected by diet.[29]

The low sodium-to-potassium ratio in milk and *maas*

The high potassium and relatively low sodium content of milk and *maas*, which leads to a low sodium-to-potassium ratio, is important in the light of emerging evidence that this ratio may be important for the prevention of hypertension and cardiovascular disease.[30-33] The World Health Organization (WHO) recommends an increase in potassium intake and a decrease in sodium intake to reduce blood pressure, cardiovascular disease, stroke and coronary heart disease and improve bone density.[34]

Milk, dairy products and calcium in NCDs

For many years, the consumption of milk and dairy products were suspected to contribute to NCDs, based on their SFA content. However, during recent years, many publications have emerged that have indicated that milk and dairy intake may actually protect against some NCDs.

Cardiovascular disease and cancer

Alvarez-Leon et al[35] critically reviewed the epidemiological evidence that dairy consumption is associated with the risk of several NCDs. They selected 14 meta-analyses or systematic reviews from 85 000 articles on dairy consumption. Of these, six were on dairy and cancer, six on cardiovascular disease and two on bone health. The authors concluded that there is an inverse association between dairy intake and colorectal cancer, hypertension and stroke. They found no evidence that dairy intake relates to breast cancer, but found some evidence that a high intake of dairy is associated with an incremental risk of prostate cancer.

Bone health

The same review[35] also reported that at this stage, evidence of a protective relationship between dairy and bone health is weak, and recommended that more prospective studies should be carried out to examine this relationship. Nevertheless, in the latest revision of dietary reference intakes, the Institute of Medicine[36] concluded that available scientific evidence supports the importance of calcium and vitamin D in skeletal health, consistent with a cause-and-effect relationship. A systematic review and meta-analysis of 21 randomised controlled trials designed to determine the impact of the dietary intake of calcium, dairy-associated nutrients and dairy products on bone mineral content in children, revealed that an increased intake of these nutrients and products, with and without vitamin D, significantly increased total body and lumbar spine bone mineral content. In all likelihood, calcium and dairy intake has a much more profound impact on bone accretion in children than presently appreciated, particularly in those with dietary intakes below currently recommended levels.[37]

A review of numerous intervention and observational studies in many countries showed that milk intake reduced morbidity in stunted children in developing societies, whereas its long-term consequences were less clear in well-nourished children.[38] Clearly, the relationship between dairy intake and bone health is very complex, resulting in discordant publications.[39] This confirms the need for more well-designed studies, particularly in countries with a high prevalence of stunting. Nevertheless, overall, the consumption of milk and other animal-source foods by undernourished children in low-income countries improves their anthropometric indices, cognitive performance and levels of physical activity, while simultaneously reducing micronutrient deficiencies. This results in lower morbidity and mortality.[40]

Hypertension

Approximately 50% of the reduction in blood pressure associated with the Dietary Approaches to Stop Hypertension (DASH) diet has been attributed to dairy. Conversely, the low consumption of milk in the National Health and Nutrition Examination Survey (NHANES) I study was associated with a high incidence of hypertension.[41] The calcium in dairy offers several potential mechanisms with which to explain the positive effect on blood pressure,[19] particularly in people with low dietary intakes of calcium.[42]

Overweight and obesity

Evidence from prospective cohort studies suggests that dairy intake may have a protective effect on the development of overweight and obesity.[43] Whey protein and other bioactive components of dairy could induce satiation and satiety.[44,45] An emerging body of literature suggests that dietary calcium may play a role in the regulation of body weight and body fat, and the development of the metabolic syndrome.[46,47] These beneficial effects may be linked to dairy specifically, although methodological and other challenges hinder the ability to draw final conclusions.[48]

Metabolic syndrome

Metabolic syndrome is a group of metabolic disorders characterised by abdominal obesity, hypertension and dyslipidaemia. In a meta-analysis by Elwood et al that links dairy to morbidity and mortality from metabolic disease,[49] the conclusion was reached that the relative risks of developing metabolic syndrome and myocardial infarction in high milk intake groups were 0.74 [95% confidence interval (CI): 0.64-0.84] and 0.84 (95% CI: 0.66-0.99), respectively. In prospective studies, the relative risks of stroke and ischaemic (coronary) heart disease in the high milk intake group were 0.79 (95% CI: 0.75-0.82) and 0.84 (95% CI: 0.76-0.93), respectively, where "milk intake" referred to low-fat milk in the latter. The relative risk in the high milk intake group was 0.92 (95% CI: 0.86-0.97) for incident diabetes mellitus.[49] This provides evidence of an overall survival advantage associated with milk and dairy intake.

The intricate relationship between dairy products and metabolic syndrome is illustrated in Figure 1. It shows that many interlinked mediators are present, some with promoting and others with protective effects. On the one hand, dairy as "exposure" can refer to specific nutrients, foods or other compounds, individually or in interaction. On the other, metabolic syndrome as an "outcome" is a disorder that is characterised by a complex interaction among many risk factors.

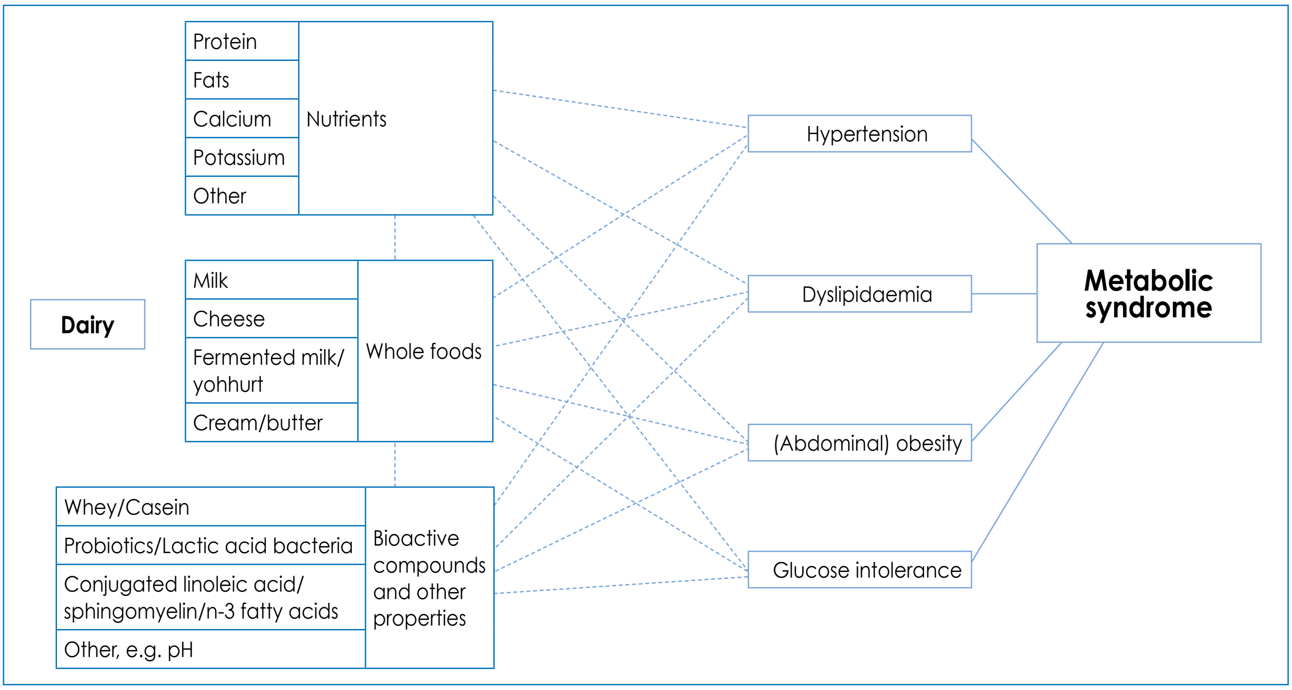

Figure 1: Dairy products and metabolic syndrome

Health concerns about dairy consumption: possible negative effects

Lactose intolerance

Lactose or "milk sugar", the dipeptide carbohydrate in milk, is digested to the monosaccharides glucose and galactose by the enzyme lactasephlorizin hydrolase,[50] which is reduced by up to 90-95% in individuals with lactase non-persistence, a condition known as lactose intolerance. These individuals, mainly from South-East Asia, the Middle East and parts of Africa, cannot digest lactose in the small gut, which results in the fermentation of lactose by bacteria in the large gut. This is associated with symptoms such as flatulence, diarrhoea, abdominal bloating and pain.

Lactase persistence is common in people of European ancestry, probably because of a genetic mutation that maintains the functionality of lactase production into adulthood. Itan et al[51] examined the conservation of the responsible lactase gene, haplotype, and found that the derived allele is recent in origin, that it has a strong positive selection, and that lactase persistence possibly co-evoluted with dairy farming in Europe in the last 5 000-10 000 years.

Lactose intolerance is often given as a reason for non-compliance with recointakes of milk and dairy, making it very difficult to meet calcium needs. Therefore, several groups have studied the consequences of milk ingestion by lactose-intolerant individuals. Savaiano et al[50] conducted a meta-analysis of studies in which this phenomenon was examined, and concluded that the intake of one cup (250 ml or equivalent of other dairy products) was not a major cause of symptoms in lactose maldigesters. Keith et al[52] determined self-reported lactose intolerance and its influence on dairy consumption in African American adults, and found that it was lower than commonly reported. Beyers and Savaiano[53] reiterated that lactose-intolerant individuals can consume at least one cup of dairy without experiencing symptoms. Tolerance can be improved by consuming milk with a meal, by choosing yoghurt or other fermented milk or hard cheese in which lactose has been digested, by consuming lactose-reduced milk, or even by using lactase supplements. Lawrence[21] advises that up to two cups of milk a day can be consumed by lactose-intolerant individuals if taken with food at separate meal times. She also mentions that tolerance improves with regular milk consumption. Unfortunately, no recent data on lactose intolerance in South African population groups are available. Given the above, as well as the fact that *maas* or fermented milk can replace fresh milk, it is unlikely that lactose intolerance should pose a real problem to milk consumption in South Africa.

Saturated fatty acids in dairy

It is accepted that dietary SFAs with a chain length of 12-16 carbon atoms increase serum low-density lipoprotein (LDL) cholesterol, and thus the risk of coronary heart disease. However, Griffin[18] pointed out that "there has always been a lack of evidence to link dairy foods with cardiovasular diseases, and that there is rather evidence of a protective effect of dairy". The protective effects of dairy on LDL cholesterol and high-density lipoprotein (HDL) cholesterol, as well as blood pressure, are now thought to relate to the calcium and biopeptides in milk.

Lorenzen and Astrup[54] showed an attenuation of the effect of SFAs on serum lipids by milk in a clinical trial, probably because the calcium in milk binds and sequesters SFAs and bile acids in the gut, similar to the mechanism of action of cholesterol-lowering drugs and some dietary fibre. Givens[55] emphasised that simply reducing milk and dairy intake to limit SFA intake is unlikely to have an effect on serum lipids and NCD risk.

It has been established that the fatty-acid profile of milk can be changed by feeding cows[56] and sheep[57] modified diets, creating the possibility that milk with less SFAs can be produced if required or demanded.

Trans-fatty acids in milk

The trans-fatty acids in milk are sometimes used as an argument to avoid dairy products. Trans-fatty acids are known to have adverse effects on health and increasing the risk of NCDs. These include increasing the total HDL cholesterol ratio, lipoprotein(a), cardiovascular disease risk, systemic inflammation, abdominal obesity, weight gain, insulin resistance, and type 2 diabetes, and adverse effects on haemostasis.[58,59] However, there is evidence, reviewed by Tardy et al,[59] that the origin of trans-fatty acids may result in different biological effects. Industrial trans-fatty acids, produced by partial hydrogenation of vegetable oils, differ from ruminant-derived trans-fatty acids that are found in milk. More information is needed before conclusions can be reached on the effects of ruminant trans-fatty acids on human health. Given the overwhelming evidence of the beneficial effects of milk consumption, it is unlikely that these trans-fatty acids have major detrimental effects in the amounts consumed with the recommended milk intake.

The WHO scientific update on trans-fatty acids[60] specifies that "there is convincing evidence that trans-fatty acids from commercial partially hydrogenated vegetable oils increase coronary heart disease risk factors and coronary heart disease events", but more research is needed on ruminant trans-fatty acids.

Milk allergies

Cow's milk allergy, an adverse reaction that is mediated by an immunoglobulin E mechanism upon exposure to milk allergens, is the most common food allergy in children. It affects 2-5% of children in the first three years of their lives,[61] and could be a major cause of inadequate nutrient intake and retarded growth in small children.[62] Only children with a milk allergy that was confirmed by a double-blind, placebo-controlled food challenge should avoid dairy proteins.[63] Treatment consists of total avoidance of exposure to the allergens through elimination diets, and replacing cow's milk with soy or rice milk. Children often outgrow cow's milk allergy by 3-5 years of age, but symptoms may persist beyond childhood in some.[61]

Dental caries

In a recent review, Aimutus[64] mentioned that lactose cariogenicity has been debated for many years, "but the buffering capacity and potential bioactive components present in food that contains lactose offer tooth enamel protection from cariogenicity". In breastfed infants, dental care practices contribute more to dental caries than breast-milk *per se,* and improved parental personal and oral hygiene could mitigate potential problems. However, regularly putting children to bed with a bottle of milk is discouraged.[65] The role of nutrition in oral health, including dental caries, in children under five years of age is reviewed by Naidoo[65] in this issue of the journal.

The consumption of milk and dairy products in South Africa

In the motivation of milk consumption as part of the FBDG on animal foods, the 2001 technical support paper[66] reviewed milk consumption in South Africa, and concluded that although milk and dairy products are consumed by many South Africans from all ethnic groups, mean intakes for adults in six different studies from 1988-1989 were low, with mean intakes far below the 400 ml per day recommended for adults.

The mean baseline intakes of rural and urban African adults participating in the 12-year Prospective Urban and Rural Epidemiological (PURE) study are shown in Table II (Wentzel-Viljoen E, personal communication, 14 November 2012). These values confirm the previously reported low intake and emphasise the need for active promotion of the milk guideline. The table shows that fresh milk (all types, including *maas*) was consumed by the most people and in the largest quantities. In the Transition and Health during Urbanisation of South Africans (THUSA) study,[67] mean intakes varied from 133 g/day for men in informal settlements to 375 g/day for women living on commercial farms. Non-dairy creamers and milk powder blends were popular and used by men and women in both urban and rural areas. Women and, to a lesser extent, men, from the urban areas, regularly consumed a variety of dairy products (e.g. cheese, yoghurt, custard, milk drinks and ice cream), but consumption of these in rural areas was low, and probably related to availability and affordability.

Barriers against increased consumption of milk, *maas* and other dairy products

The perceived negative effects of milk and dairy are often reported as barriers to adequate consumption. Concerns about low calcium intakes have motivated research on

Table II: Average intakes in g/day of milk and other dairy products by urban and rural subjects who participated in the Prospective Urban and Rural Epidemiological (PURE) study*

Group	Fresh milk (all types)	Milk powder (all types)	Canned milk (all types)	Cheese (all types)	Non-dairy creamers and milk blends	Yoghurt (all types)	Milk products (custard and milk beverages)	Ice cream (all types)
Urban men**	354	5	4	88	68	80	93	66
Average	143.6	7.4	17.9	3.1	6.8	27.2	9.8	
SD	123.2	5.3	14.8	10.1	7.9	27.9	30.8	
Urban women**	556	7	3	168	101	209	224	155
Average	146.1	6.6	24.0	3.0	6.8	29.1	7.8	18.2
SD	119.1	6.2	33.7	4.5	8.0	27.3	14.2	24.4
Rural men**	170	1	0	3	155	0	1	0
Average	106.9	4.0	-	2.3	6.4	-	3.6	-
SD	131.7	-	-	0.9	4.5	-	-	-
Rural women**	317	5	1	4	304	3	7	0
Average	91.4	16.3	35.7	2.4	7.6	21.4	73.4	-
SD	108.8	17.5	-	2.0	7.7	19.9	118.6	-

SD: standard deviation
* Reported intakes from a validated quantitative food frequency questionnaire during baseline in 2005 (unpublished, data provided by the PURE research team)
** Number of consumers [1 397 subjects, n = 524 (men) and n = 873 (women)]

these barriers.

Jarvis and Miller[68] found that a low intake of milk and dairy in African Americans related to perceived lactose intolerance, but that culturally determined food preferences and dietary practices learned early in life played a bigger role. Zablah et al[69] interviewed 90 African American women in a grocery store and found that perceived negative taste and association with digestive problems, and the belief that they were already achieving adequate calcium intakes, were the main reasons for low milk intakes. Substituting soft drinks for milk was mentioned as a barrier to adequate calcium intake.[70]

A New Zealand study[71] that examined barriers to milk consumption in adult men and women showed that consumption related to what was important in the lives of the respondents. Concern about the fat content of milk was the main barrier for the women. There was less awareness by the men of the nutritional benefits of milk, and therefore less appreciation of its value in their diets.

A study on the acceptance of milk by 8- to 16-year-olds[72] showed that within the flavoured milk category, children preferred lactose-free cow's milk, rather than soy-substitute beverages.

The price of milk and dairy may be a barrier to consumption in developing countries. In the 2001 technical paper that supported the South African FBDG on animal foods,[66] the reasons why milk and dairy products were relatively expensive in South Africa were discussed. These were based on deregulation of the dairy industry and the fact that the industry is only protected by import tariffs. However, the price of milk and dairy, compared to that of other commodities, should be calculated based on its nutrient content. For example, when the price of 100 mg of calcium from different sources was calculated, it was found that this amount of calcium (provided by whole fresh milk) was R0.62, compared with R1.27 from by canned pilchards in brine, and R5.74 from frozen broccoli. This comparison was made using prices in June 2011, obtained from a "middle-priced" supermarket by the working group, in order to motivate the need for a separate FBDG for milk during the national consensus meeting.

Another barrier to consumption relates to culture and religious taboos and practices, also discussed in the previous technical support paper.[66] For example, consumption is affected by the fasting practices of different religions. Although milk, and especially fermented milk, have always been a favourite food of black South Africans, numerous taboos influenced consumption in the past. Only small children and the elderly drank fresh milk. A man could only drink milk in his own household, or in that of a paternal or maternal relative. A woman could only drink milk from her husband's herd after she had been accepted by her husband's family. "Impure" women (menstruating or having had a miscarriage) had to avoid all milk and milk products.

Adequate calcium intake is difficult to achieve with dairy-free diets, even when other nutrient recommendations are met.[73] Furthermore, milk is a good source of the so-called "shortfall nutrients" of many consumers.[74] To meet calcium requirements and benefit from other health attributes of milk, it is necessary to promote increased consumption of milk and *maas* in South Africa.

Barriers to consumption must be overcome in order for South Africans to realise that "milk matters". A start could be made by explaining the core nutrient contribution of dairy,[52] but should also address salient misconceptions and perceptions,[75,76] as well as recent research findings. The promotion of dairy intake has to come from many angles, employing multiple techniques and involving all stakeholders; from producers, industry and government, to health professionals, caregivers and consumers.

Conclusion

The inclusion of milk (especially calcium and potassium) in the diet is essential in order to meet the nutrient needs of most South Africans. In addition, milk, *maas* and yoghurt have many other attributes which recent studies have indicated may be protective against some NCDs, including overweight and obesity. As stated in the introduction paper of this series of technical support papers to the South African FBDGs,[77] the nutrition-related NCDs are already responsible for unacceptable high rates of morbidity and mortality in South Africa, justifying efforts to improve the dietary intake of the population. Milk, *maas* and yoghurt can play an important role in meeting this objective, yet concerted promotion efforts, which must also address concerns about milk and dairy consumption, are still required.

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