Have **milk, maas or yoghurt** every day

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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 the scientific support for this guideline, 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 the barriers to increased consumption.

Introduction

The first set of food-based dietary guidelines (FBDGs) for South Africa[1], published in 2001, did not include a separate guideline message for milk and other dairy products. The rationale at the time focused on cost and affordability by a large section of the population. Milk and dairy products were part of the guideline on animal foods, which referred to meat, chicken, fish, eggs, milk and other dairy products. Another reason for this decision was a concern about lactose intolerance in Africans. It was also argued at the time that since the guidelines were formulated for people older than 7 years, 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 of the South African population[2-4] and the high prevalence of hypertension[5] and other non-communicable diseases (NCDs)[6] a national working group (NWG) on the revision of the South African FBDGs, recommended a separate milk guideline for South Africans.

The NWG examined the milk and dairy guidelines of 56 different sets of FBDGs in Africa, Asia, Europe and the Americas[7] and recommended that the guideline 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 intakes of saturated fatty acids (SFAs) and sodium, which are found in many highly processed dairy products. Cheeses are not included in the guideline. In the South African Food Guide, cheeses are shown as part of the meat (animal protein) food group. Equally, blends and non-dairy creamers are explicitly omitted.

The aim of this paper is to provide a rationale for the new milk guideline for South Africans. We do this by discussing the nutrient composition and other attributes of milk and some dairy products. This leads to an overview of evidence of the health benefits associated with milk (and some dairy products) consumption and a discussion of perceived and possible adverse health effects of milk and dairy. A review of current milk consumption 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 guideline. The ultimate purpose is to improve the nutritional status and health of all South Africans.

South Africa has a separate set of paediatric FBDGs for infant feeding,8 which includes detailed advice on breastfeeding, in which international guidelines on exclusive breastfeeding for 6 months are followed, with continued breastfeeding for 2 years and beyond.[9] For children 5 years and older, the FBDGs for the general population are recommended. Because of the separate technical report papers on infant feeding, the advantages of breast feeding and milk consumption by children younger than 5 years will not be covered in this paper, other than to reiterate that because of the rapid growth and high energy needs of infants under 2 years of age, reduced fat milks are not recommended as main milk food for this age.

The health benefits of milk and dairy consumption

The main purpose of FBDGs is to guide the population in choosing healthy diets, meaning diets that are adequate, meeting all nutrient requirements, but also protecting 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] To make a responsible recommendation regarding milk and dairy consumption and its role in health and disease prevention in contemporary South Africa, its nutrient contribution and attributes should be taken into account, the role that it plays in the development of NCDs, as well as any possible adverse effects associated with milk and dairy consumption. These aspects will now be considered, using the most recent evidence.

Nutrient composition of milk and dairy products

The nutrient composition of milk of varying fat-content and some selected dairy products as given in the South African Food Composition Tables[11] are 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 and relatively low in sodium.

Milk is a good source of high quality protein, containing 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 complete protein, beneficial to populations where maize and bread are staples.

The 400-500 mL low-fat milk/day recommended for adults will provide 480-610 mg calcium, which is 60-76% of the recently revised DRIs for calcium, recommending that on average 800 mg of calcium is appropriate for women aged 19 through 50 and men up to 72 years[13]. The same amount of low-fat milk will provide 608-760 mg potassium, which is 30-38% of the recommended adequate intake of 2000 mg potassium/day.[14] The substantial contribution of milk to potassium intake is important for nutrient adequacy of populations that do not meet 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 as 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 content of cheeses (except cottage cheese) are increased through a concentration effect or by the addition of sucrose and fruit, justifying the focus of the new guideline on milk, maas and yoghurt alone. In settings where overweight and obesity are of concern such as in South African adults,[16] low-fat products should be considered.

Other attributes of milk and dairy

In addition to a unique nutrient composition, milk and some dairy products have nutritional attributes not given in traditional food composition tables. These include bioactive peptides, conjugated linoleic acids (CLAs), the low pH of fermented milk, and the low sodium to potassium ratio of milk and maas. As will be seen in the discussion below, 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 al20 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 these effects may possibly be explained by the actions of the casein-derived bioactive tripeptides in milk.

Table I: Summary of the nutrient composition per 100 gram (g) of selected dairy products[10]

Nutrient	Fresh milk, full-fat	Fresh milk, 2%-fat	Maas/ fermented milk)	Yoghurt, plain, low-fat unsweetened	Yoghurt, fruit, fat-free, sweetened	Cottage cheese fat-free	Cheddar cheese
Energy kJ	262	213	270	254	375	266	1646
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
SFA g	1.9	1.28	2.35	1.16	0.94	0.09	18.43
Cholesterol mg	10.0	7.0	11.0	8.0	7.0	1.0	115
CHO g	4.8	4.9	4.5	6.5	15.0	4.9	1.8
Iron mg	0.1	0.1	0.1	0.1	0.1	0.6	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	2.0	390
Thiamin 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 B12 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

SFA: Saturated fatty acids; CHO: Total carbohydrates, including added sugar

Conjugated linoleic acids (CLAs)

Milk fat is a complex natural fat, its triacylglycerols being synthesised from some 400 different fatty acids.[21] In addition to the monounsaturated fatty acids (about 25% of the total) and the saturated fatty acids (SFA) (about 60% of the total), milk fat contains several other fatty acids with possible beneficial effects on risk for NCDs. These include the short-chain fatty acid, butyric acid, sphingolipids and CLAs, rumenic and vaccenic acids. These CLAs exhibit remarkable biological properties.[22] They are thought to be anti-carcinogenic, anti-atherosclerotic and may play a role in prevention of obesity. Milk is the richest dietary source of CLAs but typical intakes may be too low for these beneficial effects. Lock and Bauman[23] pointed out that the CLA content of milk can be increased by specific feeding regimes in cows. At present supplements of CLAs are not recommended, because of potential adverse effects[24]. More research is needed before the beneficial effects of milk consumption can be attributed to the CLAs in milk.

Fermented milks: maas

Milk products soured in calabashes, clay pots, milk-sacks, stone jars or baskets are part of the traditional South African cuisine. Maas (amasi) is the common word 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 *Lactococcus lactis 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] Incorporation of probiotics in fermented milks have beneficial health effects such as improving lipid profiles.[27] Haug and co-workers[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 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, leading to a low sodium to potassium ratio, is an important attribute in the light of emerging evidence that this ratio may be important for the prevention of hypertension and cardiovascular disease (CVD).[30-33] The WHO recommends an increase in potassium intake from food and a lower sodium intake to reduce blood pressure, CVD, stroke and CHD and improve bone density.[34]

Milk, dairy products and calcium in non-communicable diseases (NCDs)

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

Cardiovascular disease (CVD) and cancer

Alvarez-Leon *et al*[35] critically reviewed the epidemiological evidence that dairy consumption is associated with 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 CVD and two on bone health. These authors concluded that there is an inverse association between dairy intake and colorectal cancer, hypertension and stroke. They found no evidence that dairy intake is related to breast cancer but found some evidence that high intakes of dairy is associated with an incremental risk of prostate cancer.

Bone health

The same review[35] also reported that evidence for a protective relationship between dairy and bone health is weak at this stage and recommended that more prospective studies should be done to examine this relationship. Nevertheless, the Institute of Medicine[36] in the latest revision of Dietary Reference Intakes concludes that available scientific evidence supports a key role 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 dietary intake of calcium, dairy associated nutrients and dairy products on bone mineral content in children, revealed that increased intake of these nutrients/products, with and without vitamin D, significantly increases total body and lumbar spine bone mineral content. In all likelihood calcium/dairy intake has a much more profound impact on bone accretion in children than presently appreciated, particularly among those with dietary intakes below currently recommended levels.[37] A review of numerous intervention and observational studies in many countries showed that for stunted children of developing societies milk intake reduced morbidity, whereas in well-nourished children its long-term consequences are less clear.[38] The relationship between dairy intake and bone health clearly 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, their cognitive performance and level of physical activity, whilst simultaneously reducing micronutrient deficiencies. This results in lower morbidity and mortality.[40]

Hypertension

About 50% of the reduction in blood pressure associated with the DASH diet has been attributed to dairy. Conversely, low consumption of milk in the NHANES I study was associated with high incidence of hypertension[41]. The calcium in dairy offers several potential mechanisms 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 proteins and other bioactive components of dairy could be inducing 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 on the risk of having metabolic syndrome may be linked to dairy specifically, though methodological and other challenges hinder final conclusions.[48]

The metabolic syndrome

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

The intricate relationship between dairy products and the metabolic syndrome is illustrated in Figure 1. It shows that many

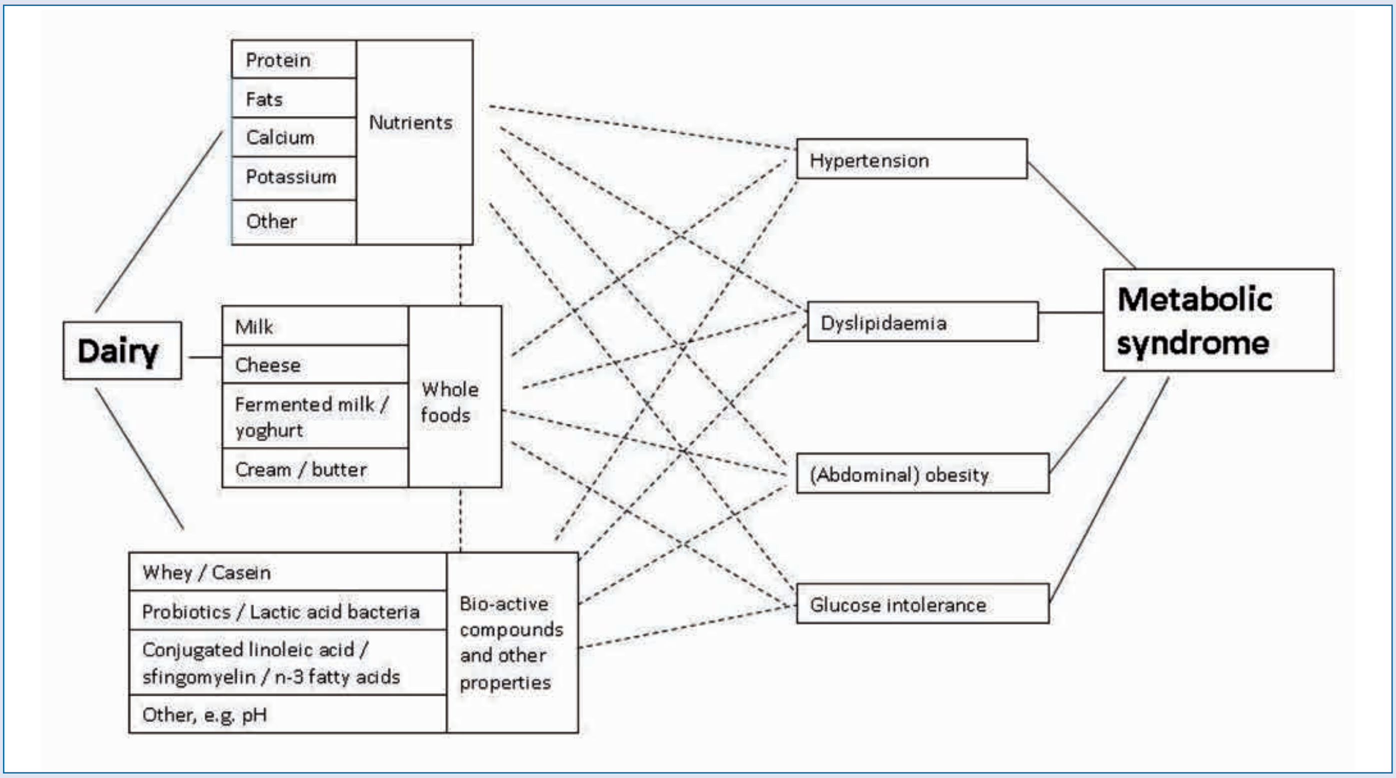

Fig 1. Dairy products and the metabolic syndrome

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 hand, metabolic syndrome as an outcome, is a disorder characterised by complex interactions between many risk factors.

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 lactase-phlorizin 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 result in fermentation of lactose by bacteria in the large gut. This is associated with symptoms such as flatulence, diarrhea, abdominal bloating and pain.

Lactase persistence is common among people of European ancestry probably because of a genetic mutation that maintains functionality of lactase production into adulthood. Itan and coworkers[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 during the last 5 000 to 10 000 years.

Because lactose intolerance is often given as a reason for non-compliance to recommended intakes of milk and dairy, making it very difficult to meet calcium needs, 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) is not a major cause of symptoms in lactose maldigesters. Keith *et al*[52] determined self-reported lactose intolerance and its influence on dairy consumption among African-American adults and found that it is less than commonly reported. Beyers and Savaiano[53] reiterated that lactose intolerant individuals can consume at least one cup (250 ml or 8 oz) of dairy without experiencing symptoms, and that tolerance can be improved by consuming milk with a meal, by choosing yoghurt (or other fermented milks) or hard cheeses in which lactose have 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 it is taken with food at separate meal times. She also mentions that tolerance improves with regular milk consumption.

Saturated fatty acids (SFAs) in dairy

It is accepted that dietary SFAs with a chain length of 12-16°C increase serum LDL-cholesterol and thus the risk of CHD. However, Griffin18 pointed out that "there has always been a lack of evidence to link dairy foods with CVD, and that there is rather evidence of a protective effect of dairy" as discussed above. The protective effects of dairy on LDL- and HDL-cholesterol as well as blood pressure are now thought to be related to the calcium and biopeptides in milk.

Lorenzen and Astrup[54] showed in a clinical trial an attenuation of the effect of SFAs on serum lipids by milk, 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 fibres. Givens[55] emphasised that simply reducing milk and dairy intake to limit SFA intake is unlikely to have effects on serum lipids and NCD risk.

It has been established that the fatty acid profiles of milk can be changed by feeding cows[56] and sheep[57] modified diets, creating the possibilities that lower SFA milk can be produced if required or demanded.

Trans fatty acids (TFAs) in milk

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

The World Health Organization Scientific Update on TFAs[60] specifies that "there is convincing evidence that TFAs from commercial partially hydrogenated vegetable oils increase CHD risk factors and CHD events", but for ruminant TFAs more research is needed.

Milk allergies

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

Dental caries

In a recent review, Aimutus64 mentioned that lactose cariogenicity has been debated for many years, "but that the buffering capacity and potential bioactive components present in foods containing lactose offer tooth enamel protection from cariogenicity. In breast-fed infants maternal factors contribute more to dental caries than breast milk per se and improved parental personal and oral hygiene could mitigate potential problems. Regularly putting children to bed with a bottle of milk is, however, discouraged.[65]

Consumption of milk and dairy products in South Africa

In the motivation of milk consumption as part of the animal food guideline, the 2001 Technical Support paper66 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 to 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 PURE (Prospective Urban and Rural Epidemiological) study are shown in Table II (personal communication, Wentzel-Viljoen). These values confirm the previously reported low intakes, 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 and in largest quantities. In the THUSA-study[67] mean intakes in this population 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 (cheese, yoghurt, custard, milk drinks and ice cream), but consumption of these in rural areas was low, probably related to availability and affordability.

Barriers towards increased consumption of milk, maas and other dairy products

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

Jarvis and Miller68 found that low intake of milk and dairy in African-Americans was related to perceived lactose intolerance, but that culturally determined food preferences and dietary practices learned early in life actually played a bigger role. Zablah and coworkers[69] interviewed 90 African-American women in a grocery store, and found that a perceived negative taste, perceived association with digestive problems and the perception that they already have adequate calcium intakes, were the main reasons for low milk intakes. Substituting soft drinks for milk has been mentioned as a barrier to adequate calcium intake.[70]

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

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

In developing countries, the price of milk and dairy may be a barrier to consumption. In the 2001 Technical paper that supported the South African FBDG message on animal foods[66] the reasons why milk and dairy products are relatively expensive in South Africa were discussed. These reasons 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, when compared to other

Table II: Average intakes in g/day of milk and other dairy products of urban and rural subjects participating in the 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, milk beverages)	Ice cream all types
Urban men: n	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: n	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: n	170	1	0	3	155	0	1	0
Average	106.9	4	-	2.33	6.4	-	3.6	-
SD	131.7	-	-	0.9	4.5	-	-	-
Rural women: n	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	-

** Reported intakes from a validated quantitative food frequency questionnaire during baseline in 2005 (unpublished, data provided by PURE-research team); SD: standard deviation; n: number of consumers (total 1397 subjects, n= 524 men; n= 873 women) commodities, should actually be calculated based on its nutrient content. For example, when the price of 100 mg calcium from different sources is calculated (prices in June 2011, obtained from a "middle-priced" supermarket) it is found that this amount of calcium when provided by whole fresh milk is R0.62, compared to R1.273 when provided by canned pilchards in brine and R5.74 when provided by frozen broccoli.

Another barrier to consumption may be related to culture and/or religious taboos and practices, also discussed in the previous Technical Support paper[66]. For example, consumption will be affected by fasting practices of different religions. Although milk and especially fermented milk have always been favourite foods 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 has been accepted by her husband's family. "Impure" women (during menstruation or after a miscarriage) had to avoid all milk and milk products.

Overcoming the barriers: promotion of milk, maas and yoghurt consumption

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 the other health attributes of milk, it is necessary to promote an increased consumption of milk and maas in South Africa.

For South Africans to realise that "milk matters", the above-mentioned barriers to consumption must be overcome. This could start with explaining the core nutrient contribution of dairy[52], but should also address salient misconceptions and perceptions[75,76] and recent research findings. In Table III practical considerations for dairy promotion are summarised. We distinguish between a supply and a demand aspect in dairy promotion. Supply focuses on production, processing and marketing so as to increase availability, accessibility, affordability and safety, a so-called "push approach". Increased demand for dairy would be the outcome of an empowered consumer, in other words the consumer wants dairy – a "pull-approach". In general, the promotion should be "generic" as opposed to brand specific, to ensure public health and not commercial interest is in the foreground. The table shows that the promotion of dairy intake has to come from many angles, employ multiple techniques, and involve all stakeholders: from producers, industry and government to health professionals, care givers and consumers.

Table III: Dairy promotion in action: Thinking out of the box

		Application in dairy promotion
SUPPLY ("Pushing dairy")	Accessibility	Take into account the individual end user in his/her specific environment as this affects availability, acceptability and affordability of dairy – i.e. apply an ecological approach Examples: Make dairy products available where the masses shop, focusing not only on the major stores, but also on small retail outlets, convenience stores, rural independents, spaza shops, street vendors Consider context-appropriate distribution, e.g. three-wheeler cycles (Egyptian experience), or tap into existing distribution networks Consider convenient and safe packaging, e.g. liquid dairy treated with ultra-high temperature (UHT) and packaged in single-serving "Tetra Paks" or equivalent containers Include dairy in ration scales, food baskets, school and other feeding programmes, tuck shops Take market research into consideration, e.g. flavoured milk or other dairy snacks may be the drivers for milk consumption among children, or young adults who want the best for their offspring see dairy as a good source of nutrients (information from Indonesia), yet adhere to responsible standards for marketing foods and beverages (especially to children)
	Affordability	Lower unit costs to "crack the price point challenge" (e.g. smaller portion sizes, such as tetra packs of 180 or 220mL) Subsidization
DEMAND ("Pulling dairy")	General considerations	Interventions (nutrition promotion and education / health communication campaigns) should • be theory-based, e.g. social (cognitive) marketing, health-belief model, Stages of Change (trans-theoretical model), Theory of Planned Behaviour etc • go beyond creating awareness to include change in knowledge, preferences, attitude and behaviour (practices) e.g. purchasing and consumption • be target group-specific (see below) • be multi-faceted (combined media / communication channels) • be ongoing (behaviour does not change over-night) • consider coverage • be locally relevant.
	Target groups ("Who should be empowered?")	Opinion leaders (health, education and agriculture professionals) Consumers: The life course model suggests "critical periods" for focusing on calcium and dairy, e.g. adolescence for achieving peak bone mass, also pregnancy, infancy and early childhood, school-age children, young adults, elderly [77](Bronner *et al*, 2006) Policy makers, including health, education and agriculture (e.g. school nutrition programme, including the curriculum)

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		Caregivers / parents (In the case of children it has been shown that availability at home, knowledge of calcium and osteoporosis, parental role models and attractive presentation (flavouring, packaging etc) of dairy products in schools and elsewhere leads to increased adoption[78,76](Sharma *et al*, 2010; Reicks *et al*, 2011)) Industry, including producers and marketers (nutrient profiling as possible point of entry)
	Content ("What should be taught?")	Type and amount of dairy for optimal nutrition and health must be included: • "What is included in this food group?" (distinguishing better and less appropriate dairy foods) • "What is a serving?"(using meaningful visual representations) Health and nutrition links of dairy Beyond the nutrient level to the food-based and whole diet approach Cost considerations (Nutrition best buys) "Label literacy"
	Delivery (How should we teach?)	From mass media campaigns, to groups in community-, school- or worksite-based interventions, up to individual nutrition education / counseling Active and practical involvement of target group Match to learning preferences of target group. Examples include • web-pages (and micro-sites) plus other electronic media • interactive exhibits and posters • tasting, recipes, cooking classes and demonstrations • (interactive) booklets & brochures • printed advertorials in newspapers, magazines, scientific journals • continuing professional development activities • television, billboards, radio, cartoon strips and videos ("Wellness TV" shown, for example, in waiting rooms) that use real scenarios to which the target audience can relate, provide short segments, present simple, single and achievable messages with close benefits, convey a skill in action, and support the target audience (e.g. children) to grasp (conceptualise) the information • games and activities like "dairy hangman", bingo, quiz, competitions, "make your own smoothie" • point of purchase promotion, joint ventures with retailers • school milk days, themed national nutrition week • dairy foods education in the school curriculum • endorsement (credible company, vertical endorsement e.g. collaborative campaigns with professional organizations, government departments; celebrities).

Sources: 79-86 and personal communication with Consumer Education Progamme of Milk SA (August 2012)

Conclusion

It is concluded that the inclusion of milk in the diet is essential to meet nutrient needs, especially calcium and potassium, of most South Africans. In addition, milk, maas and yoghurt have many other attributes which recent studies indicate may be protective against some NCDs, including overweight and obesity. As stated in the introductory paper of this series of technical Support Papers to the South African FBDGs,[87] the nutrition-related NCDs are already responsible for unacceptable high rates of morbidity and mortality in South Africa, motivating efforts to improve dietary intakes of the population, Milk, maas and yoghurt can play an important role towards this objective. The literature also shows that the concerns about milk and dairy consumption by some individuals can be addressed, and that it is possible to overcome the barriers that prevent increased consumption.

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