

MILK: OBJECTIONS AND SUPPORT

A CLARIFICATION OF THE EVIDENCE FOR DONORS, IMPLEMENTERS,
AND POLICYMAKERS IN LOW- AND LOWER-MIDDLE INCOME
COUNTRIES



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SUMMARY

Milk is a commonly consumed food in Low- and Lower-Middle Income Countries (LLMICS). It contains many important nutrients and generally appears, together with its derived products, in national dietary guidelines. But objections have been raised to its promotion on several grounds: health, environmental, animal welfare, and affordability. This Discussion Paper reviews commonly presented arguments in favour of and against consumption of dairy, taking into account the specific contexts of LLMICs.

There is considerable evidence on the impact of dairy on health in LLMIC populations. While lactose intolerance is common in many LLMIC populations and dairy protein allergies can be serious, for most people, dairy products are healthy. There is no justification for considering milk a 'breastmilk substitute' beyond the age of 12 months. Using standard measures of emissions intensity, environmental impacts are significant but far less so than for beef production. Animal welfare concerns are different in LLMICs compared to in richer countries, largely due to differences in the intensity of production, but they are still important. Dairy products, like all nutrient-dense foods, are expensive relative to starchy staples.

We recommend that in LLMICs dairy products should be actively promoted within the context of diverse, healthy diets. Appropriate supply-side interventions are needed to minimise animal welfare and environmental concerns and to keep down costs, and consumer education is needed to avoid inappropriate uses, such as feeding to children aged less than 12 months.

KEY MESSAGES

- Milk plays an important part in the production systems and food culture of many Low and Lower-Middle Income countries (LLMICs), but it attracts criticism on grounds that include health, environment, animal welfare, and economics.
- There is ample evidence to draw conclusions around nearly all of these commonly raised issues.
- There are specific features of the contexts of LLMICs that must be taken into account when deciding whether and how to invest in dairy value chains.
- Overall, we feel the arguments against dairy consumption in LLMICs are overstated, and promotion of this food group, within the context of a healthy and diverse diet, is recommended.
- Policymakers and implementers should have a nuanced understanding of the benefits and risks associated with dairy promotion.

BACKGROUND AND OBJECTIVE

Milk is one of the most widely consumed foods in the world, with a total food supply of 656M mt in 2022 (1). It is rich in dietary energy, high-quality protein, essential fatty acids, and multiple minerals and vitamins, and it appears, along with other dairy products, in the dietary guidelines of virtually every country that has them. Yet its benefits are widely contested on all grounds: health, environmental, animal welfare, and affordability. The arguments are so vehement that one could reasonably ask whether it is appropriate for a nutrition organisation to promote this food – which is a debate that we at GAIN have also engaged in.

This Discussion Paper aims to surface some of the main arguments that have raised for and (especially) against the consumption of milk in populations at risk of malnutrition. Key evidence is presented to support and refute these arguments, and conclusions are drawn about the suitability of milk as a key element of a healthy diet in different LLMIC contexts. We focus on LLMICs because many individuals in these countries are deficient in the nutrients that are abundant in milk and because alternatives to milk—such as protein-rich plant-based beverages—are not widely available or affordable.

METHODOLOGY

Artificial Intelligence (Claude 3.7 Sonnet) was used to identify some of the main arguments that have been used to support or oppose the consumption of milk as part of a sustainable and healthy diet. The authors reviewed all output in detail, fact-checked and verified it, and adapted it as needed; they take full responsibility for the accuracy of the resulting content. Relevant evidence was identified using PubMed and Google Scholar. The scope was limited to systematic reviews and to populations living in (LLMICs). The primary focus of the paper is on (cow's) milk as a fresh, long-life or reconstituted liquid, but where appropriate mention is also made of particularities of its derived products (e.g., butter, ghee, cheese, buttermilk, and whey). A special section is dedicated to issues relating to children's consumption of milk and dairy products, as their nutritional needs are different from older individuals in ways that specifically relate to these products.

ARGUMENTS FOR AND AGAINST THE CONSUMPTION OF MILK AND ITS PRODUCTS AS A CORE ELEMENT OF HEALTHY DIETS

HEALTH ARGUMENTS, CHILDREN



'Promotion of consumption of animal milk should be avoided, as it discourages consumption of (human) breastmilk'

The World Health Organization (WHO) and UNICEF recommend that children be exclusively breastfed for the first six months of life and continue to breastfeed for up to two years of age or beyond (2). Recently updated WHO evidence-based guidelines for complementary feeding (3) suggest that 'dairy products, including liquid animal milk, are part of a diverse diet and can contribute to nutritional adequacy' after the period of exclusive breastfeeding. In contrast to earlier versions of this guidance, the recommendations allow for introduction of animal milk as early as six months of age. However, eleven major paediatric associations from around the world have taken issue with this recommendation and suggest that animal milk should only be fed to infants

aged 6-11 months if breast milk and infant formulas are not available (4). All major paediatric authorities do agree that after 12 months of age, full-fat cow's milk can or should be consumed in modest amounts. This is despite some concern that cow's milk is too low in iron, even for children over 12 months of age. On this topic, Griebler and co-authors (5) conducted a systematic review and meta-analysis and showed that children consuming cow's milk were much more likely to develop iron-deficiency anaemia than those consuming 'follow-on' formula (i.e., infant formula designed for babies who starting to transition to a mixed diet with solid foods.) But children in vulnerable communities in LLMICs rarely consume iron-enriched formulas—they are much more likely to consume food from the family meal from the age of 12 months onwards. This suggests an approach that would complement milk consumption with other iron-rich foods rather than actively discouraging the consumption of milk.

Ultimately, national Ministries of Health and professional bodies in LLMICs will need to reach their own conclusions about the appropriate age for introduction of cow's (or other animal) milk. In the interim, **implementing agencies can safely position these products as suitable for consumption from 12 months of age onwards.**



'Milk makes children grow'

De Lamas and co-workers (6) conducted a systematic review of studies where children and adolescents were given diets with controlled (larger) quantities of dairy foods. They found a clear impact on bone mineral content but inconclusive results on linear growth. The studies were not limited to vulnerable populations, and the authors do note that in two studies (in contexts with high levels of malnutrition and mainly vegetarian diets), increased final size was observed. Haile and Headey (7) take a different approach and show that countries that have increased milk consumption over time have achieved large reductions in the prevalence of stunting, even after controlling for important confounding factors. Specifically, a 10% increase in milk supply is associated with a 0.31-point reduction in stunting in their analyses. Herber and co-workers (8) use individual-level data on over half a million children from the Demographic and Health Surveys from multiple countries and over nearly thirty years to examine the associations between anthropometric status and milk consumption. They find that milk consumption is associated with a reduced probability of being underweight of 1.4 percentage points and a reduced probability of stunting of 1.9 percentage points. The exposure measurement is weak in that it assesses concurrent rather than past cumulative intake, which should be more relevant.

Taken together, these findings such that **dairy consumption likely does improve child growth in settings with poor overall dietary quality, but that the effect is not especially large and not always consistently observed.**



'There is a risk of allergic reactions'

Milk allergy is an adverse immune reaction to one or more of the proteins in cow's milk. It normally manifests in infancy or early childhood and often resolves by age ten. Occasionally, it is serious, causing anaphylactic shock. A meta-analysis by Hua Feng and co-workers (9) suggests that the overall global prevalence is 1.1%, which corresponds with other estimates from leading professional bodies.

Food allergies might be dangerous in resource-constrained environments because access to medical assistance could be limited when severe reactions occur. Milder symptoms such as digestive issues will often be noticed by the child's carer, who could simply refrain from giving milk. However, similar concerns apply to other foods commonly used in complementary feeding, such as eggs and peanuts. Since it is not practically possible to remove all potential allergens from complementary foods in LLMICs, **the best options are likely parental education to monitor for signs of allergy** combined with advice to start introduction of cow's milk only from 12 months of age, as noted above.

HEALTH ARGUMENTS, ADULTS



'Many individuals in non-Caucasian populations are lactose intolerant'

Lactose intolerance is extremely common, likely affecting well over half the global population. Developing after the age of six years or so (and later in some populations), it causes symptoms such as abdominal pain, bloating, flatulence, diarrhoea, and nausea.

In populations where nearly all individuals are lactose intolerant, fresh milk is unlikely to be part of the local food culture and no attempts to promote it among adults will succeed. In populations where the situation is less clear cut, those who are lactose intolerant will not want to consume fresh milk. Other dairy products, such as buttermilk, yoghurt, and (especially) hard cheese, contain far less lactose and provide viable alternatives to milk.



'Dairy products are high in saturated fats and therefore a risk factor for cardiovascular disease'

While many dairy products do indeed contain saturated fatty acids (SFAs), the thinking about the health impact of consumption of SFAs has evolved considerably over the last decade. Evidence on their association with cardiovascular disease is summarised by Givens (10), who also provides a summary of dose-response meta-analyses examining the relative risk of cardiometabolic diseases in relation to consumption of dairy foods. The overall conclusion is that **'dairy product consumption has a neutral effect on CVD risk.'**



'Milk sold in LLMICs is generally unsafe'

Grace and co-authors (11) have reviewed the risks of foodborne disease from milk and milk products in developing countries. They find that both biological and chemical hazards are quite commonly found in milk in these settings, with the former entering through the environment, poor handling, or the introduction of an adulterant such as contaminated water and the latter entering through feed or contamination, either accidental or deliberate. They estimate that around 4% of the global foodborne disease burden may come from dairy products.

Other foods in LLMICs also carry a high risk of foodborne disease (96% of the total risk is **not** due to dairy). Rather than eliminate dairy altogether, **consumers in LLMICs, as well as institutional procurement managers and retailers, should always select pasteurised milk (or boil milk at home) and, where possible, source milk from aggregators who conduct quality testing and maintain acceptable levels of hygiene.**

ENVIRONMENTAL ARGUMENTS



'Dairy cattle are a major source of greenhouse gas (GHG) emissions in LLMICs'

As is well known, livestock production is associated with the emission of both methane and nitrous oxide into the atmosphere. All in all, global GHG emissions from milk production, processing, and transportation represent a non-negligible 2.7% of global anthropogenic GHG emissions (12). When expressed per unit of product (mass), dairy production is far less damaging than beef production, for the simple reason that the meat from a beef cow can only be produced once whereas dairy cows continue to produce milk regularly over many years as well as dairy beef at the end of their life. The relationship between the amount of emissions produced and the amount of product produced is referred to as 'emissions intensity'. The emissions intensity of milk production in LLMICs ranges from 2 to 9 kg of CO₂-eq per kg of fat- and protein-corrected milk (FPCM), reflecting the impact of inefficient rearing systems, feed production and manure management (13). In regions like North America and Western Europe, emissions intensity is typically only 1.3-1.5 kg of CO₂-eq per kg of FPCM. The consumption of milk from unimproved production models in LLMICs is thus a valid matter of concern when it comes to GHG emissions and **improving the efficiency of dairy production is an environmental and economic win-win intervention.**



'Dairy cattle compete for use of vast areas of land which could be used for crops, and they contribute to land use change'

In LLMICs, cattle are not generally reared on land which could easily be switched into crop production. In these contexts, cattle are typically reared on rangelands, which are too arid, nutrient-poor, or steeply sloped for crop production, while many smallholder farmers have only one or two cows that are kept very close to the homestead and occupy very little land. Others take advantage of unproductive lands such as roadsides, riverbanks, or other public access areas, while others practice mixed husbandry in which the animals feed on crop residue and provide fertiliser to enhance crop production. A fifth group practice transhumant animal husbandry, passing along traditional migration routes; this group does often get into conflicts with settled farmers over unrestricted foraging.

Commercial, large-scale production of dairy cows is said to account for ~20% of milk consumed in Africa (14). In South Asia, only a minority of milk (perhaps also around one fifth) passes through the organised dairy sector. Cows in commercial dairy farms are more likely to consume fodder consisting of maize, soya, and alfalfa, crops that directly compete with human consumption. Furthermore, the production of soya, which is often produced by large-scale agricultural operations and driven by global demand for animal feed, has destroyed many traditional ecosystems such as rainforest and 'pampa'. Transportation of soya and maize around the world further compounds environmental damage.

The impact of dairy production on land use transformation and the availability of land for arable production depends on the specifics of each local production system. In general, it is expected to be lower in LLMICs than elsewhere.



'Milk is so nutritious that its environmental impact is low when considered per unit of nutrition derived'

Taking a comprehensive view of nutritional value such as that proposed by Beal and Ortenzi (15), milk lies in the middle of the range of different foods available in many countries, halfway between dark green leafy vegetables and organ meat at the maximum and instant noodles at the minimum. Its environmental impact is also moderate (relative to other foods) on a range of standard indicators: GHG emissions, particulate matter pollution, terrestrial acidification, freshwater and marine eutrophication, and land use (16). On one environmental impact measure—water use—it scores favourably compared to other foods. Combining the two dimensions, **the environmental impact of milk *per unit of nutritional value* is comparable to that of most fruits, lower than eggs, and vastly lower than that of ruminant meat.**

All told, there are justifiable concerns about the environmental impact of milk production and processing in LLMICs. Mitigation of the environmental costs of livestock rearing through increased productivity and efficiency in these settings, as described by Herrero and co-workers (17), is a major priority.

ETHICAL ARGUMENTS



'Commodification of animals and their inhumane treatment make consumption of milk unconscionable'

Many of the basic arguments against consumption of animal-source foods—primarily that sentient animals are treated as production units and that they are slaughtered prematurely—apply equally to dairy production in LLMICs. Other common concerns, however, are less salient because of the prevalent farming systems practiced in those contexts; these include concerns about genetic selection prioritising yield over welfare, and excessive use of hormones and antibiotics, among others. Hernández and co-workers (18) have summarised the major welfare aspects for cattle production systems in the tropics. These include poor nutrition; lack of shelter to protect from the weather; parasitic infections and lack of veterinary care, and painful and stressful handling. Addressing most of these animal welfare concerns can also have co-benefits of improved production efficiency, while some may have inevitable trade-offs. **Animal welfare should be routinely assessed and targeted for improvement in all dairy projects.**

ECONOMIC AND COMMERCIAL ARGUMENTS



'Dairy products are too expensive for poor people to afford'

Headey and Alderman (19) have shown that on a ***per calorie*** basis, milk and other dairy products are much more expensive than starchy staples, particularly in lower-income countries. For milk, the price ratios are 4.6 per calorie in lower middle-income countries, and 10.5 in low-income countries.

However, all nutrient-dense foods are more expensive than starchy staples, and value-for-money is better assessed by considering the cost per (integrated unit of) nutritional benefit. Beal (20) looked at the different foods used in complementary feeding in Asia and Africa and find that **dairy is among the most affordable per unit of nutritional value.** For dairy, as for other nutrient-dense foods, investing in modernising and simplifying value chains is an important way of reducing costs.

Economic access is determined by more than just price. Households with their own lactating cows are likely to be able keep aside a small amount of milk for own consumption, at relatively little opportunity cost. For purchasing households, a key consideration will be the option to purchase small serving sizes that match 'cash at hand'.



'Fresh milk is fine, but powdered milk isn't'

Because fresh milk requires cold chain infrastructure and spoils rapidly, powdered milk has become a popular option in many markets. Powdered milk is usually made by spray-drying milk that has previously been concentrated by evaporation. The nutritional quality of dried milk varies in accordance with the type of milk used at source and the process used for drying; poor process control can result in significant reductions in heat-sensitive vitamins and bioactive compounds and can partially denature some of the proteins.

Both fresh and powdered milk can be adulterated. In both cases, constant vigilance is required to prevent unsafe and low-quality products entering the market. The reconstitution of powdered milk creates additional opportunities for contamination and/or over-dilution.

There is no general case for avoiding powdered milk, especially given its advantages in terms of safe storage. Each brand must be evaluated on its own merits.

CONCLUSIONS

Animal milk—not limited to but most commonly from cows—is a nutrient-dense food that is widely available in many regions of the world and is easily processed into a range of derivative products. For many nomadic populations in Africa, it is the single most important item in the diet, and many people in other nations, from East Africa to the Netherlands, also consider it of high cultural value. However, it has also attracted the attention of a particularly vehement set of opponents, who have pointed to potential issues with its health and environmental impacts as well as social and animal welfare concerns.

This paper has examined 12 statements that can be read about milk and finds little reason to re-consider the majority view that dairy products are a suitable component of a healthy diet in low and lower-middle income countries. Milk and other dairy products are suitable for inclusion in complementary feeding from the age of 12 months onwards, alongside other suitable first foods. Although there is not complete consensus about the age group 6-11 months, avoiding promotion to this group of infants should minimise concerns about displacement of breastmilk. After 12 months, it is not appropriate to consider ordinary cow's milk a 'breastmilk substitute' subject to restrictive measures; as such, it is important for regulating authorities to distinguish between ordinary dried milk powder and 'follow-on formulas', which are deliberately designed to approximate human milk.

Milk and other dairy products are also suitable for consumption by adults. Those with lactose intolerance are best advised to prefer dairy products other than fresh milk, such as yogurt and hard cheese; they are most unlikely to wish to consume milk anyway if it causes them issues. Concerns about the saturated fat content of dairy products are not supported by recent evidence, at least if these are consumed as part of a diverse diet.

Milk production and processing have some negative environmental consequences, but the same is true for nearly all food products. Dairy consumption is nowhere near as damaging as the consumption of ruminant meat. Low productivity in dairy production in LLMICs means that more environmental damage is caused per unit of milk consumed than in more productive systems. Increasing productivity would therefore limit the environmental damage, but only if this is done in a sustainable manner. Moving to intensive commercial milk production without adequate sustainability safeguards is likely to increase environmental damage related to land use change, competition for arable land, eutrophication, and GHG emissions from transportation. Animal welfare concerns are different, but likely equally pressing, in the two production systems. Development support in the livestock sector should always promote improvements in animal welfare, though local realities in LLMICs are likely to mean that these improvements will necessarily be incremental over time. For this reason, synergistic interventions (e.g., improved feed and veterinary care) that simultaneously increase production efficiency and improve animal welfare should be prioritised.

Plant-based 'milk-like' products, especially soya 'milk' can also be important sources of major nutrients. They lack some of the beneficial components found in animal milk but also avoid some of the drawbacks, mostly notably those associated with animal welfare. At this point, however, they do not offer a viable alternative for low-income populations in LLMICs; they are simply not available in remote communities, and there is no business model for home production.

Dairy products are expensive... but so are all nutrient-dense foods. Investments in productivity and cold-chain infrastructure would likely bring consumer prices down. In the meantime, despite the cost, modest consumption of dairy products by vulnerable populations is expected to prove a cost-effective investment in better nutritional status.

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The Global Alliance for Improved Nutrition (GAIN) is a Swiss-based foundation launched at the UN in 2002 to tackle the human suffering caused by malnutrition. Working with governments, businesses and civil society, we aim to transform food systems so that they deliver more nutritious food for all people, especially the most vulnerable.

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