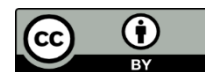


FROM TRADITION TO INNOVATION: GOAT'S MILK IN MODERN DAIRY

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ABSTRACT

Goat's milk has long been used for human consumption and is now recognised as a food with high nutritional and functional properties and a low environmental footprint. It is rich in important nutrients such as protein, calcium, vitamins (especially A and B) and minerals such as phosphorus and potassium and offers a healthy alternative to conventional cow's milk. Goat's milk is known to be easier to digest, making it a favoured choice for people with lactose intolerance or a sensitive digestive system. Compared to cow's milk, it contains higher levels of certain favourable fatty acids, including medium-chain triglycerides, which are associated with various health benefits. Due to its nutritional richness and unique composition, goat's milk is increasingly recognised as a key ingredient in the production of innovative dairy products that meet the changing needs and dietary habits of consumers. In addition, goats are known to efficiently convert their feed into milk and require less land and resources compared to cows. Their adaptability to different climates and terrains makes goat farming a sustainable and environmentally friendly option for milk production. By combining the versatility and nutritional benefits of goat's milk, the dairy industry can appeal to health-conscious consumers looking for new flavours, functional ingredients and high-quality dairy products (artisanal cheese, yoghurt, butter, rich ice cream and other dairy desserts).

Keywords: goats, milk, health benefits, innovative dairy products

INTRODUCTION

Goat's milk is known for its nutritional richness and unique composition and has been consumed for centuries (Kumar et al., 2016; Tarola et al., 2019). Although goats account for only a small proportion of the global milk supply, their impact on human well-being is significant, especially in tropical and developing countries (Nayik et al., 2022). Goat's milk is not only used to feed poor and rural populations, but also as a "super" dairy product with exceptional health, immunological and biological properties (AL Kaisy et al., 2023). The importance of caprine milk for human consumption is gaining acceptance worldwide, as evidenced by the rapidly growing goat milk market in most countries around the world (Hammam et al. 2022). The global demand for caprine milk has increased over the last decade (FAO, 2023), especially during the COVID-19 period when people were more concerned about their well-being and health.

Goat's milk is used for human consumption in many places in Asia, Africa, the Mediterranean countries and the Middle East (Banjare et al., 2017). All these regions have something in common: their economies are

developing rapidly and need to feed a fast-growing population. Goat's milk is usually produced on smaller farms.

The aim of this study is to investigate the nutritional benefits, digestibility and growing global importance of goat milk, especially in developing regions, considering its environmental impact and its role in the future dairy industry.

NUTRITIONAL VALUE AND THERAPEUTIC POTENTIAL OF GOAT'S MILK

Goat's milk is very nutritious because it contains valuable nutrients such as carbohydrates, proteins, fats, micro and macro elements, vitamins and much more (Kondyli et al., 2012). Compared to cow's milk, the fat globules in goat's milk are much smaller and therefore easier to digest (Attaie a Richter, 2000). The beneficial effects of goat's milk have been shown in various health conditions such as anaemia, asthma, intestinal diseases, insomnia and neurotic digestive disorders (Lund a Ahmad, 2021). Goat's milk has more short- and medium-chain fatty acids than cow's milk, which gives it a special ability to provide energy, especially for growing children (Sepe a Argüello, 2019). The protein in goat's milk is more digestible and at the same time less allergenic (Sanz Ceballos et al., 2009; Benjamin-van Aalst et al., 2024). The higher casein content in goat's milk facilitates lactose digestion and reduces the risk of lactose intolerance by accelerating the absorption of sugar through the large intestine. Fresh goat milk and goat milk products (e.g. yogurt and kefir) have various potential health benefits, such as anti-inflammatory effects, prevention of cardiovascular diseases, antidiabetic and antihypertensive, strengthening bones, boosting the immune system and improving metabolism (Paszczyk et al., 2023). Due to their nutritional value and physiologically bioactive components, with probiotic bacterial strains commonly found in these products, goat milk products have gained attention especially in nutritional disorders (Moises et al., 2024).

CONSUMER TRENDS AND MARKET POTENTIAL

The market for goat's milk products has grown strongly in recent years. The growing population is expected to increase the demand for food globally, thereby fuelling the growth of the goat milk products market in the future (Zulkifli et al., 2023). The growth during the forecast period can be attributed to awareness campaigns and marketing, global market expansion, innovations in product development, sustainability and ethical consumption, premium and specialty products (Ribeiro a Ribeiro, 2021).

Goat cheeses and fermented milk beverages are rich sources of fatty acids, protein and minerals, but many consumers do not accept them because of its typical flavour, which comes from the capric, caprylic and caproic acids contained in this milk and dairy products. The negative perception of "goaty flavour" by the public and seasonal milk production are the two major barriers to the commercialisation of goat milk (Zulkifli et al., 2023), but fermentation reduces the "goat flavour" due to yogurt starter cultures (Serdyukova et al., 2021).

Today, goat milk belongs to a new category of functional dairy products in many industrialised countries (Hammam et al., 2022) where dairy goat farming provides smallholder farmers with a sustainable source of

income and wealth in the form of healthy milk products and helps them to lead a more independent lifestyle (Lund a Ahmad, 2021). The fact that the global market for goat milk is estimated at USD 12.45 billion in 2022, with an expected annual growth rate of 4.7% to USD 17.95 billion in 2030 (Research and Markets, 2025), offers interesting opportunities for all players in the food sector.

SUSTAINABILITY AND ENVIRONMENTAL BENEFITS

Goats are able to efficiently convert poor weeds and crop residues into traditional products of high nutritional quality and show great resilience to different climatic and environmental conditions (Nayik et al., 2022). In developing countries, but also in many marginal regions with scarce pasture resources, goat production appears to be a good solution to problems related to food security (FAO, 2018), as it makes an important contribution to the rural economy (Nelson Navamniraj et al., 2023). According to the United Nations, goat milk can be an important tool to achieve the 2030 Agenda for Sustainable Development adopted in 2016 (UN, 2015).

To accelerate the adoption of new strategies and technologies in goat milk production in countries where people are financially constrained, cost-effective measures for goat farming and production need to be considered. From an environmental perspective, dairy goats can be environmentally friendly if managed properly, with increased milk and forage production being the best practical solution to reduce environmental impact (Zucali et al., 2020). With adequate help and support from all stakeholders such as governments, research institutes and international support groups, improved interventions and the introduction of innovative goat milk production have the potential to meaningfully and sustainably increase milk production for food and income generation (Sepe a Argüello, 2019).

GOAT'S MILK AS A BASIS FOR PRODUCT INNOVATION

Goat's milk, known for its nutritional richness and unique composition, is increasingly recognised as an important ingredient in innovative dairy products. It is processed into various dairy products, including fortified and flavoured milk, UHT milk, fermented products (cheese, buttermilk, yogurt), ice cream, frozen yogurt, condensed milk, dried whole milk, sweets and candies (Ribeiro and Ribeiro, 2010) and can also be used as a base for infant formula (Prosser, 2021).

Dairy products made from cow's milk make up the majority of the probiotics market, while there are relatively few studies investigating functional probiotic goat's milk products. However, due to its numerous health benefits, goat milk is considered a potential functional food in an emerging area for the development of goat milk products with prebiotics and probiotics (Lund a Ahmad, 2021). Goat milk fermented with a combination of *Lactobacillus delbrueckii* subsp. *Bulgaricus* and *Streptococcus thermophilus*, making a yoghurt having high folate content and favorable sensory qualities (Kumar, 2016).

Further research could also investigate the potential use of goat milk proteins in the treatment of inflammatory and immune-mediated diseases and as a source of bioactive peptides with potential health benefits (AlKaisy et al., 2023).

CONCLUSIONS

Goat's milk is characterised by its better digestibility, which makes it a preferred option for people with lactose intolerance or a sensitive gastrointestinal system. The composition of goat's milk contains high levels of certain beneficial fatty acids, particularly medium-chain triglycerides (MCTs), which are associated with a number of health benefits. As a result, goat's milk is increasingly recognised as a versatile and valuable ingredient in the production of various dairy products, including artisan cheese, yoghurt, butter and rich ice creams, where its high protein concentration, low lactose content and unique sensory properties are particularly beneficial. Goat's milk also has therapeutic properties for various diseases and digestive disorders. Clinical studies have confirmed the nutritional adequacy and safety of infant formulas made from whole goat's milk proteins and fats. Research into goat's milk as a basis for novel dairy products not only encourages culinary innovation, but also meets the growing consumer demand for nutritious, sustainable and ethically produced foods. In addition, goat's milk has successfully catered to the gastronomic preferences of foodies, an emerging market segment in many industrialised countries. This emphasises the potential of goat's milk to influence the future development of the dairy industry and encourage innovation in the development of dairy products.

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