

Research Article

Assessment of Milk Quality and Safety Practices in Commercial Dairy Farms: Findings from West Arsi and Sidama Regions, Ethiopia

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Abstract

Milk quality and safety are fundamental for a sustainable and resilient dairy sector, as they directly affect public health, human nutrition and economic development. In Ethiopia, dairy production plays a crucial role in supporting household incomes, generating employment, and contributing to national food security, particularly among small- and medium-scale producers who supply urban and peri-urban markets. The sector has experienced steady growth in recent years due to increasing consumer demand for milk and dairy products, yet significant challenges persist that limit its full potential. Many commercial and semi-commercial dairy farms operate without standardized quality assurance systems, reliable cold-chain infrastructure or consistent hygiene monitoring practices. These limitations create vulnerabilities across the production and supply chain, increasing the likelihood of microbial contamination, milk spoilage and the transmission of zoonotic pathogens and antimicrobial-resistant bacteria. Such risks not only endanger consumer health but can also undermine confidence in local dairy products and constrain access to higher-value markets. Improving milk quality and safety requires a multi-faceted approach, including the adoption of Good Dairy Practices, effective farm-level hygiene management, regular quality testing and strengthened regulatory enforcement. Enhancing cold-chain logistics, farm management practices, and staff training is equally critical to minimizing contamination risks. Addressing these gaps is essential not only for protecting public health but also for increasing the competitiveness of the Ethiopian dairy value chain and ensuring alignment with international quality and biosafety standards. Ultimately, prioritizing milk quality and safety will support the long-term sustainability, resilience, and growth of Ethiopia's dairy sector, benefiting producers, consumers and the broader economy.

Keywords

Milk Quality, Milk Safety, Dairy Farm Management, Hygiene Practices, Biosecurity

1. Introduction

Milk quality and safety are fundamental to the sustainable development of Ethiopia's dairy sector, which remains a crucial contributor to livelihoods, nutrition, and employment throughout the country [5]. In rural Ethiopia, livestock

production (including dairy) has been shown to support agricultural livelihoods and provide cash income for small-holder households [7].

Moreover, production of milk and dairy products is

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closely linked to food and nutrition security: one review of raw milk and dairy product safety in Ethiopia points out that poor quality and safety of milk reduces its potential nutritional benefits [2].

In urban areas, rapidly growing populations have increased the demand for fresh milk and dairy products, creating economic opportunities for producers but also placing greater pressure on supply chains to ensure safety and quality [15]. A systematic review of milk production, consumption and safety in Ethiopia notes that urbanisation and rising consumer income are expected to raise dairy demand, while major safety and quality challenges such as microbial contamination and informal marketing remain [11].

Given this dynamic, ensuring good milk quality and safety is not just a hygiene issue it is central to enabling the dairy sector to deliver its full economic, nutritional, and employment potential [8].

Despite its economic and nutritional importance, the Ethiopian dairy sector faces several structural and operational challenges. Many commercial farms still operate without standardized quality assurance systems, limiting their ability to consistently produce milk that meets national and international safety standards [13]. In addition, gaps in cold-chain infrastructure, inadequate hygiene practices during milking and transportation, and insufficient regulatory oversight compromise milk quality, increase post-harvest losses, and pose public health risks. These deficiencies also limit the sector's potential to participate in higher-value domestic and export markets, where strict safety and quality standards are required [10].

Recognizing these challenges, SNV Ethiopia (Netherlands Development Organisation) in collaboration with the Ethiopian Agricultural Authority (EAA) conducted a comprehensive assessment of milk production and safety practices across selected commercial dairy farms. The assessment aimed to systematically evaluate on-farm practices, identify critical gaps in quality control, trace deficiencies in regulatory compliance, and generate evidence-based recommendations to improve milk safety, enhance quality standards, and strengthen the

competitiveness of Ethiopia's dairy sector. By addressing these gaps, the assessment supports efforts to protect public health, reduce market inefficiencies, and promote sustainable growth within the dairy industry.

Objective of assessment:

- 1). Evaluate milk production, handling, and transportation practices among commercial farms.
- 2). Identify hygiene and biosecurity gaps affecting milk safety and compliance with national standards.
- 3). Promote awareness of certification and regulatory requirements among producers.

2. Methodology

Eighteen commercial dairy farms were randomly assessed across the West Arsi and Sidama Regions of Ethiopia to evaluate milk quality, hygiene, and management. Data were collected through on-site inspections, structured interviews with farm managers and evaluation using SNV-EAA dairy farm assessment checklists [12].

Study area

The assessment focused on selected commercial dairy farms in the West Arsi and Sidama regions of Ethiopia, both of which play a vital role in the country's dairy production and contribute significantly to the national milk supply. West Arsi is known for its mixed crop-livestock farming systems, favorable climate, and proximity to key urban markets such as Shashamane and Asella. In contrast, Sidama hosts a mix of small- and medium-scale dairy farms spread across peri-urban and rural areas, supplying milk to towns including Hawassa and its surroundings.

These regions were deliberately selected because of their high dairy farm density, diversity in management practices, and importance to urban and peri-urban milk supply chains. By including farms of different sizes, infrastructure levels, hygiene standards, and herd management practices, the study aimed to capture a full picture of the challenges and opportunities facing Ethiopia's commercial dairy sector.

3. Result

Table 1. Summary of Farm Management, Milk Hygiene, Feeding and Animal Health Practices.

No. of Farm	Management and Infrastructure	Milk Hygiene and Handling	Feeding and Watering	Animal Health Management
1	Modern, large-scale; automated milking, ration software, biogas system, and full records.	High hygiene; stainless containers; regular cleaning and teat dipping; adequate cooling.	Balanced ration using formulated feed and forages (desho, Rhodes). Reliable water.	Regular vaccination and veterinary service; minimal disease cases.
1	Medium-large; organized structure, trained staff; affected	Good hygiene; occasional storage constraints.	Forage-based with brewery by-products; adequate water.	Routine health checks; some gaps in

No. of Farm	Management and Infrastructure	Milk Hygiene and Handling	Feeding and Watering	Animal Health Management
	by power interruptions.			recordkeeping.
1	Well-managed; uses sexed semen, forage-based feeding, and disease control.	Exemplary hygiene; effective mastitis prevention.	Balanced ration and adequate water supply.	Active disease prevention and regular vaccination.
13	Small-scale; limited space, poor ventilation, traditional milking, weak recordkeeping.	Use of non-food-grade containers; no cold storage; manual milking; minimal hygiene control.	Feeding based on availability; forage and by-products; irregular water supply.	Infrequent vaccination; mastitis and FMD common; scarce drugs.
2	Large forage base; weak waste management and biosecurity.	Inconsistent hygiene; lacks disinfection systems.	Forage-based, limited concentrate supplementation; water interruptions.	FMD common; incomplete treatment records.

4. Discussion

The evaluation of eighteen commercial dairy farms in the West Arsi and Sidama regions of Ethiopia revealed marked disparities in management systems, infrastructure and herd health practices. These variations illustrate the uneven development of the country's dairy sector, where a few technologically advanced farms coexist alongside a majority of smallholder or semi-commercial enterprises that rely on traditional production systems.

4.1. Management and Infrastructure

Only a limited number of farms demonstrated advanced management structures and modern infrastructure. Two dairy farms have Large-scale operations Farm exemplified efficient, well-organized systems, characterized by automated milking, use of ration formulation software, biogas generation and comprehensive recordkeeping. These farms also benefited from trained personnel and consistent managerial oversight, which collectively enhanced productivity and operational sustainability. In contrast, the majority of farms (13 out of 18) operated under resource-constrained conditions, with limited space, poor ventilation and weak recordkeeping. The absence of essential biosecurity measures such as vehicle disinfection points, footbaths, and proper waste management further increased disease transmission risks and compromised milk safety.

4.2. Milk Hygiene and Handling

Considerable variability was observed in milk hygiene and handling practices. Well-equipped farms maintained high hygiene standards, including the use of stainless-steel containers, regular cleaning and sanitization of equipment, and consistent teat-dipping procedures [3]. These practices contributed to superior milk quality and reduced microbial

contamination. In contrast, smaller and less organized farms often used aluminium or plastic containers and cloth sieves, which are difficult to clean effectively and easily harbour pathogens [4]. The lack of cold storage, coupled with delayed milk transportation, further increased the risk of bacterial growth [6]. Power interruptions and the absence of backup systems were additional constraints affecting milk preservation, particularly among medium-scale producers.

4.3. Feeding and Watering Practices

Feeding strategies exhibited a clear divide between advanced and traditional farms. The better-managed farms employed balanced rations formulated using software, combining improved forages such as *Desho* (*Pennisetum pedicellatum*) and *Rhodes* (*Chloris gayana*) grasses with concentrate supplements. This approach enhanced milk yield and animal condition. Conversely, most smallholder farms relied on seasonal forage availability and agro-industrial by-products, often without appropriate nutritional balancing. Such practices contributed to inconsistent milk production and suboptimal animal performance. Moreover, frequent municipal water interruptions disrupted animal watering and sanitation routines, negatively affecting productivity and hygiene across most small-scale farms [1].

4.4. Animal Health Management

Animal health management varied considerably across the farms. Modern operations maintained preventive health programs, including regular vaccinations, periodic veterinary visits and systematic recordkeeping. As a result, these farms reported minimal disease occurrences. However, the majority of smallholder farms practiced reactive treatment approaches, with limited access to veterinary drugs and infrequent disease monitoring. Foot and Mouth Disease (FMD) and mastitis were among the most common health problems, largely attributed to poor hygiene, weak biosecurity

measures and inadequate disease surveillance systems [9]. The lack of reliable health and treatment records further constrained the ability to track disease trends or evaluate intervention outcomes [14].

4.5. Overall Implications

The findings underscore the need for targeted interventions to address gaps in infrastructure, management, and health services within Ethiopia's commercial dairy sector. Strengthening farm-level biosecurity, ensuring reliable access to clean water and electricity and promoting the adoption of modern feeding and recordkeeping systems are essential steps toward improved productivity and milk safety. Furthermore, capacity building through continuous training, coupled with effective regulatory enforcement on milk hygiene and animal health, will play a critical role in advancing sustainable and high-quality dairy production across the region.

5. SWOT Analysis of the Dairy Sector

Strengths

- 1). Expansion of on-farm forage and silage production.
- 2). Increasing adoption of hygienic milking and handling practices.
- 3). Emerging use of digital management tools (e.g., Rumen App, SNV templates).
- 4). Growing awareness of animal welfare and herd health monitoring.

Weaknesses

- 1). Weak biosecurity protocols (only 2 of 18 farms had footbaths).
- 2). Frequent FMD outbreaks despite vaccination.
- 3). Poor infrastructure and limited veterinary access.
- 4). Inadequate clean water supply and recordkeeping.

Opportunities

- 1). Institutional support from SNV, Wondogenet Agricultural Research Centre, and Hawassa University.
- 2). Expanding markets through processors sourcing directly from farms.
- 3). Potential to establish model farms as regional training and demonstration centers.

Challenges

- 1). Recurring FMD epidemics and ineffective vaccines.
- 2). Rising feed costs and supply shortages.
- 3). Market distortion due to sale of adulterated milk.
- 4). Outdated barn designs compromising hygiene and animal comfort.

6. Conclusion and Recommendation

6.1. Conclusion

Despite disease outbreaks and infrastructural gaps, many commercial dairy farms in West Arsi and Sidama show strong potential for transformation. Management discipline, rather than farm size, was identified as the key determinant of success. Farms applying structured hygiene, data-driven feeding, and regular veterinary follow-up consistently achieved higher milk yields, better animal welfare, and improved consumer trust. Scaling best practices requires policy support, financial incentives, and improved access to veterinary services and quality inputs.

6.2. Recommendations

Biosecurity and Hygiene

- 1). Install footbaths and vehicle disinfectants at farm entry points.
- 2). Provide PPE (boots, aprons, gloves) for all staff and visitors.
- 3). Segregate animals by health and productivity.
- 4). Regularly sanitize milking areas and use food-grade containers.

Animal Health

- 1). Strengthen FMD vaccination programs and post-vaccine monitoring.
- 2). Improve access to quality veterinary drugs and trained professionals.
- 3). Maintain comprehensive health and production records.

Infrastructure and Training

- 1). Expand access to clean water and reliable electricity.
- 2). Provide training and certification programs for farm personnel.
- 3). Encourage investment in modern barns, feed storage, and biogas systems.

Policy and Market

- 1). Establish a national milk certification and traceability system under EAA supervision.
- 2). Enforce quality-based pricing to reward compliant farms.
- 3). Promote leading farms as regional learning hubs.

Abbreviations

SNV	Netherlands Development Organisation
EAA	Ethiopian Agricultural Authority
FAO	Food and Agriculture Organization (of the United Nations)
FMD	Foot and Mouth Disease
PPE	Personal Protective Equipment

Author Contributions

Tegegn Teshome: Conceptualization, Methodology, Formal Analysis, Writing – original draft

Seble Haile Maraim: Data curation, Project administration, Visualization, Investigation

Mesfin Sewelam: Validation, Funding acquisition

Kassaye Erkihun: Supervision, Writing – review & editing

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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