

Quality of milk and dairy products under traditional smallholder system in Northern Ethiopia

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Introduction

In Ethiopian lowlands, goats represent an important component of the farming systems. In Abergelle, goats make the highest contribution to farmers' livelihoods. Processing of traditional dairy products is an important activity of women contributing to the nutrition and livelihood of the family.

The main fermented milk products that are widely consumed in Abergelle area are *Ergo* (local fermented milk), *Ayib* (acidic cheese), *Kibe* (local butter) and *Arera* (buttermilk). Moreover, *Ergo* is considered a special food which plays an important role in the diet of low income and the majority of people in the rural areas of Ethiopia. It also serves as a basis for further processing. These traditional dairy products are produced by spontaneous fermentation. However, hygienic conditions are often poor and milking practices are conducive to contamination with foodborne pathogens. Improving goat milk processing in Ethiopia requires situation-specific technical interventions. This should be based on better understanding of constraints and opportunities. However to date, little has been done to characterize current practices and identify opportunities for improving traditional milk processing technologies.

Methods

Farmers' local knowledge on traditional processing methods was assessed through a survey conducted in 375 households in eight villages in Amhara and Tigray Abergelle regions using a structured questionnaire. Data on milk production, processing and hygienic practices were collected mainly from women respondents to develop safer, low-cost processing technologies. In addition milk and available dairy products were sampled for determining major components and for microbial examination.

The main milk components (fat, protein, and solids-not-fat) were determined using an ultra-sound spectroscopy device (Lactoscan SA, Milcotronic, Bulgaria). The pH value and electric conductivity (EC) of milk was measured using a portable field device (Eutech Instruments, USA). Standard plate count was performed to assess overall microbial quality of milk. Furthermore, the presence of two major food-borne pathogens (*E. coli* O157 and *Staphylococcus aureus*) were determined in raw milk and processed products using standard microbial methodology.



Milk composition

Analysis of milk components showed a big variation in composition. Fat content which is important for butter production was 31% higher in goat milk collected in Amhara region than in samples from Tigray region ($P < 0.01$), with a large variation of up to 52% among villages ($P < 0.05$) reflecting difference in herd management, feeding and breeding. Almost 60% of the milk samples had already become acidic when tested due to a high microbial load. In addition, alkaline milk was observed in some farms (12.5%) indicating mastitis, which is confirmed by elevated values of electric conductivity of up to 7.3 mS/cm (Table 1). With the exception of fat content, the variations observed in measured parameters did not significantly differ among villages ($P > 0.05$) and regions ($P > 0.05$).

Table 1. Physico-chemical characteristics of goat milk collected in Abergelle

	Fat %	SNF %	Protein %	Lactose %	Density	pH	EC mS/cm
Average	5.88	9.51	3.49	5.24	1.033	6.13	5.85
Min	2.76	7.06	2.59	3.89	1.023	4.46	3.97
Max	9.94	14.48	5.31	7.97	1.050	8.28	7.26
SD	1.85	1.12	0.41	0.62	0.004	0.97	0.90
n	41	41	41	41	41	25	41

Microbial Quality

The standard plate count (SPC) revealed a high level of bacterial contamination. Of the 19 raw milk samples tested, 68.4% had a count greater than 100,000 CFU/ml indicating serious deficiencies in processing hygiene.

Furthermore, *Escherichia coli* O157 was isolated from 7 milk samples and one buttermilk sample (8.8% of all samples) indicating poor hygienic conditions. *Staphylococcus aureus* was isolated from 5 milk samples (5.5% of all samples) indicating mastitis in the herd; however, it was not isolated from any processed product (Figure 1).

There were no significant differences in the prevalence estimates for both pathogens between the two regions ($P > 0.05$).

Results

Fresh milk is not commonly used. It is mainly processed into local products. It was found that *Ergo* is mainly consumed by the family. *Kibe* is the main product sold at local markets and 44% of the households regularly sell *Kibe*. Processing *Kibe* was described as labor intensive by 12%. The women are facing problems related to product quality, for example product spoilage due to hygiene conditions was reported by 28% of the respondents and 6% experienced a problem of crumbling due to elevated acidity of *Ergo*. 43% of households attribute good product taste to proper cleaning and fumigation of the milk containers with *Ekema* wood.

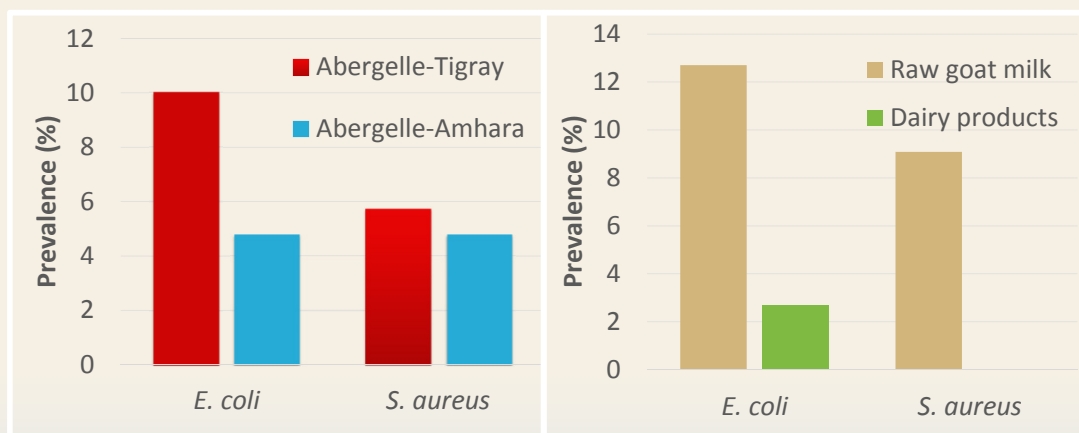
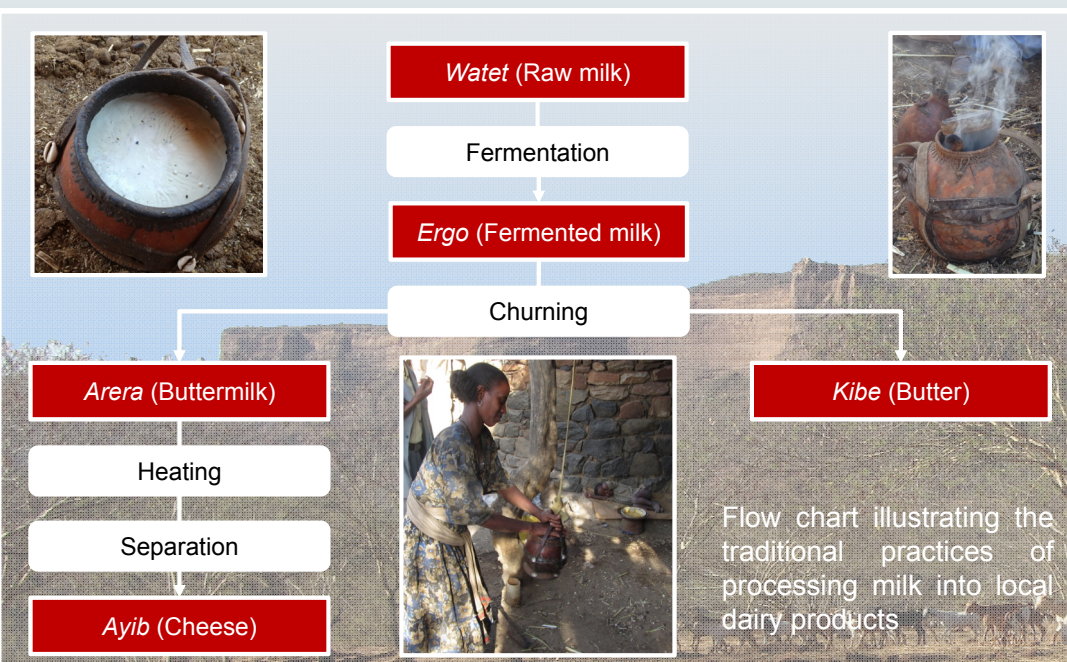


Figure 1. Assessment of health risks in raw goat milk and dairy products samples from Abergelle District

Local practices in dairy processing



Conclusion

The quality of raw milk is a challenge for milk processing. The high EC values and SPC along with the presence of pathogens in milk indicate poor hygienic practices, which negatively affect milk safety and quality.

Improving processing and hygiene practices like filtering the milk after milking and introducing milk pasteurization before processing is crucial to produce healthier products. To introduce such practices is essential to overcome faced constraints and enhance the quality of goat milk and dairy products for family consumption and sales.