International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. 13, Issue 6, June 2025

https://ijecm.co.uk/

KNOWLEDGE GAPS IN ON-FARM FOOD SAFETY STANDARDS: EVIDENCE FROM ALBANIAN DAIRY FARMERS

Pranvera Troka
PhD © at Faculty of Economy and Agribusiness, Agricultural University of Tirana, Albania
ptroka@ubt.edu.al

Jonida Avdulaj
Lecturer at Faculty of Economy and Agribusiness, Agricultural University of Tirana, Albania
javdulaj@ubt.edu.al

Ilir Kapaj
Lecturer at Faculty of Economy and Agribusiness, Agricultural University of Tirana, Albania
ikapaj@ubt.edu.al

Abstract

This study examines Albanian dairy farmers' knowledge of food safety standards (FSS) and the main factors influencing their level of knowledge. Data were collected through interviews with 206 farmers in Fier and Lushnje, two of the most important areas for milk production in the country. Through principal component analysis (PCA), three main areas of knowledge are identified: hygiene practices, technical standards and animal health. The results show that farmers have better knowledge in hygiene (mean = 0.72), but lower knowledge in technical standards (mean = 0.31) and animal health (mean = 0.58). Regression analysis shows that education level significantly influences knowledge on hygiene and technical standards, while participation in training has a positive impact on knowledge on animal health. Advisory support from milk processors consistently improves knowledge in all three dimensions. Although farmers show some awareness, informal milk production and limited access to training and institutional support remain major challenges. In conclusion, there is a need for focused support in technical standards and animal health, along with stronger farmer - processor advisory ties, to enhance milk safety and sustainability of the sector.

Keywords: Food safety; Dairy farmers; Knowledge; Albania; Advisory support

INTRODUCTION

Agriculture is one of the main pillars of the Albanian economy, contributing around 18 - 20% of Gross Domestic Product (INSTAT, 2024) and employing over 35% of the country's workforce. Despite this important economic and social role, the agricultural sector in Albania faces numerous structural challenges, including farm fragmentation, informality, lack of investment and limitations in access to technology and information (Gjeci et al., 2016; Imami et al., 2021; Troka et al., 2025). The dairy sector, in particular, is largely composed of small family - run farms, which often fail to meet the necessary food safety standards (FSS) and product quality (Skreli and Imami, 2019).

To improve the quality and safety of dairy products in Albania, attention must start with the first link in the supply chain: the farmers. Farmers often operate from a vulnerable position due to limited technical support, lack of structured information and inadequate infrastructure. Without sufficient knowledge and appropriate conditions for implementing food safety standards, on - farm practices tend to remain weak, directly affecting the quality of the final product. Lack of proper knowledge can lead to unsafe practices, economic losses and obstacles to the development of the sector. Identifying specific areas where Albanian farmers have knowledge gaps is an important step to build targeted interventions that support the improvement of quality and compliance with FSS.

Therefore, *the objectives of this study are:*

- to identify specific areas in which Albanian farmers lack knowledge about on - farm FSS;
- to understand the factors that influence the level of farmers' knowledge.

LITERATURE REVIEW

Studies on farmers' knowledge about FSS are essential, as they help to understand whether farmers are aware of practices that ensure safe and sustainable food production. Deficient knowledge can lead to public health risks, economic losses and the inability to meet the demands of formalized markets. Such studies are conducted in many countries around the world, especially where agriculture plays an important role in the economy and food safety is a critical issue for public health and trade. These studies are common in developing countries where agricultural structures are often family-based and informal (Nyokabi et al., 2021; Korale-Gedara et al., 2022; Lunner-Kolstrup et al., 2016). Also, in developed countries such studies are conducted to ensure that farmers comply with strict food safety regulations and to improve traceability systems (Young et al., 2010). These studies report that dairy farmers often have poor to moderate knowledge of FSS, including limited understanding of milk quality standards, foodborne pathogens and safe handling practices (Zeqiri et al., 2015; Moutos et al., 2022).

Some farmers adopt basic hygiene measures (e.g., hand washing, udder cleaning), however, many do not fully comply with recommended FSS, such as respecting antibiotic withdrawal periods or using proper milking equipment. Farmers often lack awareness of specific foodborne pathogens and the risks associated with improper milk handling (Demirbaş et al, 2016; Nyokabi et al., 2024; Chen et al, 2018).

Higher education levels and participation in training programs are strongly linked to better food safety knowledge and practice (Lindahl et al., 2018; Keba et al., 2024). Larger herd size, more commercialized operations and involvement in formal milk value chains are associated with higher adoption of food safety measure (Korale-Gedara et al., 2022; Nyokabi et al., 2024). In some regions, communal norms and subjective pressures from peers or community members significantly affect the adoption of hygiene practices (Ledo et al., 2021).

It is important to understand the factors that influence farmers' knowledge of food safety. Knowledge is not formed by chance, but it is closely linked to factors such as education level, experience, access to training, information sources and institutional support.

METHODOLOGY

Research Design

This study adopts a descriptive research design, which is appropriate for identifying and summarizing the knowledge levels of dairy farmers regarding food safety standards (FSS). Descriptive designs are widely used in social science research to provide a structured overview of the characteristics of a population or phenomenon (Babbie, 2020). In addition, this study incorporates explanatory elements through linear regression analysis to explore the relationships between knowledge levels and various influencing factors.

Data collection

Primary data were collected directly from a total of 206 dairy farmers. The Fier region (which includes the municipalities of Fier, Lushnja, and Mallakastër) was selected as the study area due to its importance in milk production at the national level. However, data for this study were collected specifically from farmers in the municipalities of Fier and Lushnja.

According to Institute of Statistics (INSTAT), Fier produced 154,894 tons of cow's milk in 2023 out of a total production of 765,347 tons, which accounts for about 20% of the country's production. Due to its geographical position and climatic conditions, Fier is characterized by productive agricultural land which creates favorable conditions for the production of agricultural and livestock products, such as cattle breeding, milk production and various animal feed crops. Interviews were conducted between July 2023 and January 2025. Each interview lasted

approximately 40 minutes and was manually recorded to accurately capture responses. A previous pilot study included 15 farmers. Ethical considerations, including obtaining informed consent and ensuring confidentiality, were a priority throughout the research process. Brief interviews and informal conversations complemented the questionnaires, enabling deeper insights and building personal relationships with participants.

The questionnaire design was based on a literature review, the opinions of experts in the field from the Agricultural University of Tirana and similar studies conducted in other countries.

Inclusion criteria

The list of dairy farmers was provided by the agricultural office in Fier. In selecting the farmers included in this study, the official definition of “milk producer” according to Law no. 9441, dated 11.11.2005, “On the production, collection, processing and marketing of milk and milk-based products” was taken into account. According to this law, a milk producer is considered any individual or group of individuals who own at least three cows or who produces a minimum of 50 liters of milk per day, for the purpose of marketing in collection or processing centers. This criterion was used as the basis for the inclusion of farmers in the study, in order to ensure that all participants represent an active and structured level of cow milk production, which is the focus of this research.

Variable reduction

Principal Component Analysis (PCA) was used to reduce the complexity of the data collected from the questionnaire on dairy farmers’ knowledge related to food safety. The choice of PCA was based on the literature about factor analysis in order to improve interpretability and to reduce internal correlations between variables. This method allows the identification of the main dimensions of knowledge, while preserving as much information as possible from the original variables that are closely related to each other (Jolliffe & Cadima, 2016).

Before performing PCA, the suitability of the dataset was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett’s test of sphericity, both tests suggesting the suitability of this method (Field, 2024).

The number of components was determined based on eigenvalues above 1 (eigenvalue > 1) and an acceptable threshold of cumulative explained variance above 58%. The reliability of each group was assessed through Cronbach's α, with acceptable values (Hair et al., 2016). The questionnaire includes 14 binary questions on knowledge (of which K9, K10, K11 and K14 were excluded from the analysis). All knowledge questions were binary, with responses coded as 1

(Yes) or 0 (No). As a result, three components were constructed which were further used as dependent variables in linear regression model. The components are named as follows: PC1 - Hygiene practices, PC2 - Technical standards and PC3 - Animal health, each representing a different group of knowledge about FSS (Table 1).

Table 1. Grouping of questions using PCA

Knowledge Question	***Hygiene***	***Technical Standards***	***Animal Health***
K1: Milk cooling temperature knowledge	0.78		
K2: Equipment disinfection knowledge	0.75		
K3: Milking unit floor cleanliness knowledge	0.72		
K4: Dairy staff health checks knowledge	0.69		
K5: Dry matter content limits		0.74	
K6: Bacteria count limits		0.76	
K7: Fat content limits		0.79	
K8: Somatic cell count limits		0.77	
K9: Foodborne illnesses		removed	
K10: Germs/microorganisms		removed	
K11: Animal health records			removed
K12: TB/Brucellosis symptoms knowledge			0.81
K13: Knowing to isolate sick animals			0.78
K14: Enforcement institution			removed
Eigenvalue	3.05	2.1	1.1
Proportion Var	30.5	21.2	6.5
Cumulative Var	30.5	51.7	58.2
Cronbach alpha	0.78	0.82	0.65
Mean	**0.72**	**0.31**	**0.58**

The means of the components extracted from the PCA indicate the average level of knowledge of farmers in each area. The results show that farmers have higher knowledge in hygiene aspects (mean 0.72), compared to animal health (0.58) and technical standards (0.31), which resulted lower. This suggests that basic hygiene practices are more well - known, while knowledge on milk quality standards and animal diseases remain areas that require more specialized interventions and training. To continue with the analysis of the data collected from dairy farmers, linear regression model was applied, using each PCA as dependent variable, measured as the sum score of questions in each category (Table 2).

Table 2. Descriptions of variables

Variable Name	*Measurement*	*Description*
Education	Categorical	Farmer's highest education level (1 = Primary, 2 = Secondary, 3 = High School, 4 = Graduate)
Age	Continuous	Farmer's age in years
Gender	Binary	Farmer's gender (1 = Female, 0 = Male)
Cows_nr	Continuous	Number of cows owned by the farmer
Experience	Continuous	Years since the farm was established
Training	Binary	Did the farmer participate in training? (1 = Yes, 0 = No)
Processors_Advisory	Likert Scale	How often does the farmer receive advice from processors? (1 = Never to 5 = Always)
DV: Knowledge_FSS	Continuous	Farmers' knowledge (1 = Yes, 0 = No)

$$Knowledge\_FSS = \beta_0 + \beta_1 \cdot Education + \beta_2 \cdot Age + \beta_3 \cdot Gender + \beta_4 \cdot Cows\_nr + \beta_5 \cdot Experience + \beta_6 \cdot Training + \beta_7 \cdot Processors\_Advisory + \varepsilon$$ **(Model I)**

RESULTS

A short description of the sample profile is presented in Table 3.

Table 3. Summary of the sample profile

Category	*Description*
Location	144 farmers in Fier, 62 in Lushnja
Gender	42% female, 58% male
Age	Average: 51.78 years (range: 24 - 78 years)
Education Level	7% primary, 62% secondary, 23% high school, 8% undergraduate
Farm Age	Average: 18.2 years (most started after early 1990s)
Main Income Source	Farming is the main income source
Farm Activities	Selling milk and raising livestock for meat
Cows per Farm	Average: 5.3 cows
Milk Selling Channel	81% of interviewed farmers sell milk both to processors and locally
Training on FSS	Only 9% attended at least one training program
Main Info Source on FSS	Milk processors (who also collect milk)

Regression analysis shows that education level significantly affects knowledge on hygiene and technical standards, while training is positively related to knowledge on animal health (Table 4). Women farmers and farmers that own more cows have higher knowledge

about animal health. The variable 'Processors Advisory' had a significant and consistent effect across all models. Age and experience were not significant.

Table 4. Results of regression model

Variable	*Hygiene*	*Technical Standards*	*Animal Health*
Const	0.04	-0.05	0.02
Education	0.08 *	0.12 **	0.06
Age	0.002	0.001	0.003
Gender (1 = Female)	0.03	0.02	0.09 *
Cows_nr	0.001	0.002	0.005 *
Experience	0.002	0.001	0.002
Training	0.22	0.13	0.18 *
Processors_Advisory	0.10 *	0.05**	0.08 *

*Asterisks indicate levels of statistical significance - * indicates p < 0.05; ** indicates p < 0.01.*

CONCLUSION AND DISCUSSION

This study shows that, although many dairy farmers in Albania have good knowledge of basic hygiene practices, their knowledge of technical standards of food safety and animal health is limited. These gaps affect not only the quality of milk, but also the ability of farmers to enter formal markets and sustain their activity.

Education and training have a significant impact. Farmers with a higher level of education or who have participated in training showed better knowledge. But what stood out most was the impact of regular advice from milk processors. Farmers who had received advice from processors were more informed in all aspects. This shows that consistent and clear guidance can make a big difference.

Interestingly, age and experience did not have a significant impact on the level of knowledge. This means that years of work in agriculture alone are not enough if access to appropriate information is lacking. On the other hand, women farmers and those with more cows had more knowledge about animal health since they are more involved in the daily care of the livestock.

Although some farmers are aware of food safety practices, most still rely on informal methods, don't analyze milk and don't document production. Training participation was limited across the sample and institutional support is very limited. These are not just individual shortcomings but they reflect structural problems in the sector.

To improve the situation, we need to focus on where there are the most gaps, especially in technical standards and animal health. More training needs to be provided, cooperation between farmers and processors needs to be strengthened and stronger links with formal markets need to be established. Particular attention needs to be paid to smallholder farmers and women, who often have fewer resources but play an important role in milk production.

Ultimately, helping farmers improve their knowledge is not just a matter of food security, it is a way of giving them confidence, support and opportunities to improve their livelihoods and production.

LIMITATIONS OF THE STUDY

This study has a few limitations. First, the data were collected only from one region of Albania, which may limit how well the results apply to the rest of the regions. Second, farmers' knowledge was measured using Yes/No questions, which may not fully reflect how much they understand or apply food safety practices. Third, the sample size may not be large enough to capture all differences between farmers. Future studies should include more regions, a larger sample and a mix of methods to better explore farmers' knowledge and practices.

REFERENCES

Babbie, E. R. (2020). *The practice of social research* (15th ed.). Cengage Au.

Chen, Y., Ji, H., Chen, L., Jiang, R., & Wu, Y. (2018). Food safety knowledge, attitudes and behavior among dairy plant workers in Beijing, Northern China. *International Journal of Environmental Research and Public Health, 15*(1), 63. https://doi.org/10.3390/ijerph15010063

Demirbaş, N., Çukur, F., Yıldız, Ö., & Gölge, E. (2009). Level of knowledge, practices and attitudes of dairy farmers regarding food safety in Turkey. *New Medit, 8*(2), 43–46.

Field, A. (2024). *Discovering statistics using IBM SPSS statistics* (6th ed.). Sage Publications.

Gjeci, G., Bicoku, Y., & Imami, D. (2016). Awareness about food safety and animal health standards – The case of dairy cattle in Albania. *Bulgarian Journal of Agricultural Science, 22*(2), 339–345.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). *Multivariate data analysis* (7th ed.). Prentice Hall.

Imami, D., Valentinov, V., & Skreli, E. (2021). Food safety and value chain coordination in the context of a transition economy. *International Journal of the Commons, 15*(1), 21–34.

Institute of Statistics (INSTAT). (2024). *Statistikat e Blegtorisë*. https://databaza.instat.gov.al:8083/pxweb/sq/DST/START__BL/NewBL0012/

Jolliffe, I. T., & Cadima, J. (2016). Principal component analysis: A review and recent developments. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 374*(2065), 20150202. https://doi.org/10.1098/rsta.2015.0202

Keba, A., Tola, A., Kaylegian, K., Kebede, M., & Zewdu, A. (2025). Impact of hygienic milk production training on knowledge, attitudes and practices of women farmers in the central highlands of Ethiopia. *Frontiers in Sustainable Food Systems, 8*, 1539559. https://doi.org/10.3389/fsufs.2024.1539559

Korale-Gedara, P., Weerahewa, J., & Roy, D. (2022). Food safety in milk: Adoption of food safety practices by small-scale dairy farmers in Sri Lanka and their determinants. *Food Control, 136*, 109274. https://doi.org/10.1016/j.foodcont.2022.109274

Ledo, J., Hettinga, K., Bijman, J., Kussaga, J., & Luning, P. (2021). A tailored food safety and hygiene training approach for dairy farmers in an emerging dairy chain. *Food Control, 124*, 107918. https://doi.org/10.1016/j.foodcont.2021.107918

Lindahl, J., Deka, R., Melin, D., Berg, A., Lundén, H., Lapar, M., Assé, R., & Grace, D. (2018). An inclusive and participatory approach to changing policies and practices for improved milk safety in Assam, northeast India. *Global Food Security, 17*, 9–13. https://doi.org/10.1016/j.gfs.2018.03.002

Lunner-Kolstrup, C., & Ssali, T. (2016). Awareness and need for knowledge of health and safety among dairy farmers interviewed in Uganda. *Frontiers in Public Health, 4*, 137. https://doi.org/10.3389/fpubh.2016.00137

Moutos, A., Doxani, C., Stefanidis, I., Zintzaras, E., & Rachiotis, G. (2022). Knowledge, attitude and practices (KAP) of ruminant livestock farmers related to zoonotic diseases in Elassona Municipality, Greece. *European Journal of Investigation in Health, Psychology and Education, 12*(3), 269–280. https://doi.org/10.3390/ejihpe12030019

Nyokabi, N., Korir, L., Lindahl, J., Phelan, L., Gemechu, G., Berg, S., Mihret, A., Wood, J., & Moore, H. (2024). Exploring the adoption of food safety measures in smallholder dairy systems in Ethiopia: Implications for food safety and public health. *Food Security, 16*, Article 14. https://doi.org/10.1007/s12571-024-01439-y

Nyokabi, S., Luning, P., Boer, I., Korir, L., Muunda, E., Bebe, B., Lindahl, J., Bett, B., & Oosting, S. (2021). Milk quality and hygiene: Knowledge, attitudes and practices of smallholder dairy farmers in central Kenya. *Food Control, 130*, 108303. https://doi.org/10.1016/j.foodcont.2021.108303

Skreli, E., & Imami, D. (2019). *Milk sector study* [Technical report]. EBRD AASF Project.

Troka, P., Luarasi, M., & Kapaj, I. (2025). Food safety practices in artisanal and semi-automated dairy processors: Evidence from Fier, Albania. *Agriculture, 15*(7), 762. https://doi.org/10.3390/agriculture15070762

Young, I., Hendrick, S., Parker, S., Rajić, A., McClure, J., Sanchez, J., & McEwen, S. (2010). Knowledge and attitudes towards food safety among Canadian dairy producers. *Preventive Veterinary Medicine, 94*(1–2), 65–76. https://doi.org/10.1016/j.prevetmed.2009.11.010

Zeqiri, M., Bytyqi, H., Imami, D., & Biçoku, Y. (2015). Dairy farmers' awareness about food standards – The case of Kosovo. *Albanian Journal of Agricultural Sciences, 14*(2), 93–100