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Food Safety Practices in Dairy Farms in Albania

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Abstract: *The aim of this study is to investigate the level of food safety compliance of dairy farmers, as well as to identify factors that hinder farmers to comply with food safety standards (FSS). This study is focused on the region of Fier, interviewing 76 dairy farmers in selected villages. The results show that 32%, 29% and 39% of farmers are respectively low, medium and high adapters of FSS. Challenges in FSS compliance include lack of farmer awareness, supply chain issues, weak law enforcement, low government support, and poor infrastructure. To improve milk quality at the farm level, farmers require better education through training programs, resolution of supply chain problems, strengthened laws, and improved infrastructure. By addressing these issues, Albania can boost its dairy sector, leading to a more sustainable sector for the future.*

1. INTRODUCTION

As it grows rapidly, the food industry is facing increasing challenges related to the quality and safety of its products. Food products, especially agricultural products, are very perishable due to their biological characteristics. Therefore, their quality can change very quickly. In addition to that, foods are prone to adulteration and fraudulent activities, mostly because of financial gain motives, jeopardizing consumer health.

Soon and Wahab (2022) have identified milk as one of the most fraudulent food products, along with beverages and meat, and the adulteration of these products primarily occurred during the manufacturing process. Milk is very important for a healthy diet, providing essential nutrients for people of all ages. As milk production rises to meet growing demands, ensuring the safety of this product becomes paramount. Milk fraud is a common problem in developing countries, with water being the most common adulterant used, decreasing the nutritional value and posing serious health risks for consumers (Handford et al., 2016).

In Albania, dairy farming is a vital source of income, particularly in rural areas, as most of families living there rely on agriculture. Dairy products are the main products of the Albanian household consumer basket. Albania is the eighth largest milk consumer in the world, with a consumption of 305.94 kg/capita (World Population Review, 2024). The dairy sector is considered a priority sector by the government of Albania due to its importance for employment in rural areas, and its contribution to the agricultural sector and GDP. Despite recent growth, the sector still faces various challenges, including compliance with quality and safety standards (Imami et al., 2021). It is for

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this reason that Albania is not yet able to export dairy products to EU markets. Subsequently, most of the milk is destined to fulfill the increasing domestic demand and only a small part is exported, mostly to Kosovo* (AASF, 2019). Food quality and safety challenges in the milk sector are related to limited farmer awareness about animal diseases and food safety standards, gaps in the supply chain, weak law enforcement, inadequate infrastructure and a legislative framework that is not in compliance with EU standards (Gjeci et al., 2016). Milk adulteration can happen at any point along the value chain. Compromising the safety and quality of the milk at the farm level can be a result of unintentional or intentional actions of dairy farmers. For that reason, it is important to first understand the importance of following good agricultural practices (GAP) at the onset of the supply chain. GAP can significantly minimize the environmental, social, and economic impacts associated with milk production and consumption, making the sector more sustainable.

There are approximately 83 000 active registered farmers and half of them are engaged in livestock and dairy production (General Directorate of Taxes, 2022). The latest report from Institute of National Statistics (INSTAT) shows that total milk production during the year 2022 is 824.942 tones, and cow's milk dominates by milk production by 85% (INSTAT, 2024). The number of cattle and small ruminants has been decreasing during this period, as shown in Table 1, while the yield has been improving due to better farming management, feeding practices, animal disease control, government support, etc. However, the milk production yield is far below EU levels. The average milk yield per cow in the EU reached 7,653 kg in 2022 (EUROSTAT, 2024), meanwhile in Albania the milk yield was only 2.76 kg in 2023 (INSTAT, 2024). The regions with the highest level of production of cow milk are Fieri, Tirana and Korça, characterized by relatively larger farm sizes, contributing to 42% of total production followed by Elbasani and Tirana region (INSTAT, 2024).

Table 1. Livestock number and milk production during 2000-2022

Category	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022
(000 heads)											
Cattle	728	655	493	504	492	475	467	416	363	337	298
Sheep & goat	3,045	2,701	2,581	2,850	2,911	2,859	2,781	2,621	2,332	2,256	2093
(000 tons milk)											
Cattle	807	930	930	964	975	983	974	947	897	859	824
Sheep & goat	141	146	140	167	170	174	171	166	155	153	145
Yield											
kg/cattle	1.11	1.42	1.89	1.91	1.98	2.07	2.09	2.28	2.47	2.55	2.76

Source: INSTAT (2024); Own processing

The available previous studies that are conducted in order to assess the level of practices with regard to food safety standards in dairy farms predominantly focus on low and middle-income countries, mostly of which indicate a low level (Kumar et al., 2017; Chengat Prakashbabu et al., 2020; Nyokabi et al., 2021; Patel & Sabapara, 2023). There are only a few studies conducted in Albania (Gjeci et al., 2016; Bicoku et al., 2018) or similar countries such as Kosovo* (Zeqiri et al., 2015) and Greece (Moutos et al., 2022). The existing studies conducted in Albania have primarily explored farmers' and consumers' awareness of food safety standards. There is a lack of studies about the level of practices, as well as the factors that determine compliance with FSS within Albanian dairy farms. The research questions of the study are the following:

- What are the levels of practices of dairy farmers with regard to food safety standards?
- What are the challenges and problems of dairy farmers in complying with food safety standards?

* Under the UN Resolution 1244.

Through a detailed analysis, this study not only contributes to filling a crucial gap in the literature, but also offers valuable recommendations on how dairy farms can improve their food safety standards, thereby strengthening food safety culture within the sector.

2. METHODOLOGY

2.1. Study Area

Albania is divided into 12 administrative regions, 31 districts and 61 municipalities. Fier region includes the districts of Fier, Lushnja and Divjaka, and is one of the biggest milk producers in Albania in terms of the number of dairy farms and milk processing plants. It produced 160,778 ton of milk in 2022, which accounts 19.4% of the total milk production in the country (INSTAT, 2024).

Fier district was chosen as the study area, as it comprises half of the total dairy farms within the region. There are 545 dairy farmers meeting the inclusion criteria of owning at least 5 cows. There are located 14 milk processing plants, out of 37 across the region. Frakull, Levan, Libofshë, Mbrostar and Dermenas are the villages included in the study (Figure 1).

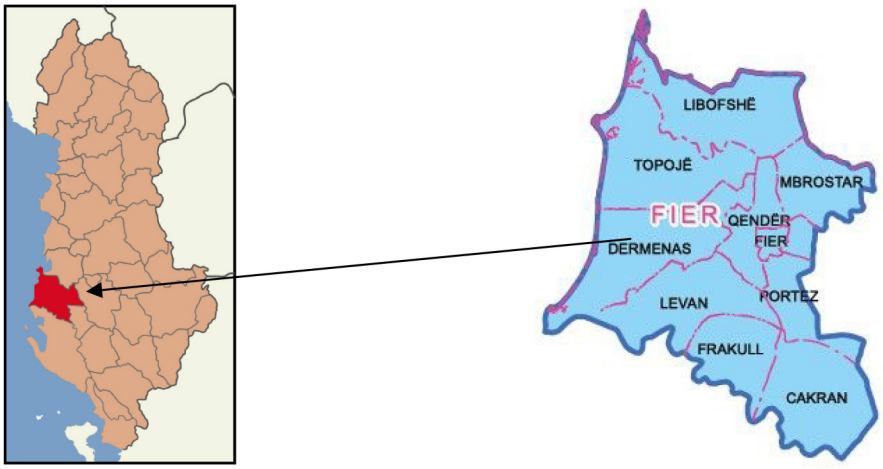

Figure 1. Fier municipality and its administrative units

Source: Wikipedia (n.d.)

2.2. Sampling Procedure

Villages were randomly selected, and the selection of farmers who were willing to collaborate in each village was also randomized to ensure representativeness. The inclusion criterion was dairy farms with at least 5 cows, which are typically considered to be at a commercial scale rather than small-scale or hobbyist operations, and are significant contributors to the dairy industry. These farms are more likely to keep detailed records and have more standardized practices, making data collection and analysis more feasible.

2.3. Data Collection

In order to meet the objectives of the study, face-to-face questionaries were conducted with 76 dairy farmers in several administrative units in Fier municipality during July-August 2023. A prior pilot study included 15 farmers. Each interview lasted approximately 40 minutes and was recorded manually for accurate capture of responses. Short interviews, informal conversations and on-site

observation complemented the questionnaires, allowing for deeper insights and rapport-building with participants. Secondary data from Institute of Statistics (INSTAT) and the Ministry of Agriculture and Rural Development (MARD) provided additional context and validation. Excel and R-Studio were used to manage and process the data.

2.4. Questionnaire Design

The design of the questionnaire was based on a literature review (Armagan et al., 2009; Young et al., 2010; Kumar et al., 2017), opinions of experts in the field from the Agricultural University of Tirana and similar studies conducted in other countries as well. The questionnaire was built in the QuestionPro program. Divided into four sections, it began by introducing participants to the concept of FS and gathered general data about their farm activities. This section explored their familiarity with food safety concepts and importance, farm products and operational scale. Following this, socio-demographic questions provided insights into the profile of respondents, including age, gender, education level, and farm experience. The core of the questionnaire focused on FS knowledge with a series of fourteen yes/no questions probing participants' awareness of hazards and regulations. Last section included nineteen Likert five-point scale questions (ranging from never to always) that measured the frequency of various FS practices implemented by farmers, covering aspects such as sanitation, hygiene, and farm management. Ethical considerations, including obtaining informed consent and ensuring confidentiality, were prioritized throughout the research process.

3. RESULTS

Initial data analyses start with descriptive statistics about farmer's socio-demographics, farm activity and knowledge about food safety standards (FSS). The number of farmers included in this study is 76 from a total of 545 dairy farmers in Fier. As previously mentioned, the inclusion criteria were that farms have at least 5 cows. Among the surveyed farmers, the average age is 51 years old, with a gender distribution of 30% females and 70% males. Regarding the level of education, 7% of farmers have completed only primary education, while 69% secondary education, 21% high school and 3% have graduated from university. The average number of cows per farm is 7. The average of other livestock kept in the farms, such as small ruminants, is 4 animals.

The farm activity began immediately after the fall of communism, specifically in the early '90s, for 62% of the farmers and it continues to be the main or sole source of income for all of farmers' family. In addition to selling milk, they also raise livestock for meat. A trend was observed towards selling milk directly to processors compared to other channels. In fact, milk collectors (known as middle man) are almost non-existent now because processors offer better contract terms. Meanwhile, there is hesitation to sell milk locally (e.g., to neighbours or local markets) because it is more convenient to deal with processors only, in terms of consistent demand, prices stability, quality standards support and contractual agreements. Therefore, 72% of farmers sell the milk to processors or collectors.

The majority of the farmers were not very familiar with the concepts of food safety, and only 8% of them had participated in at least one training session about FSS at the farm level. These trainings were primarily organized by the U.S. Agency for International Development (USAID) and took place several years ago. In recent years, none of the interviewed farmers had participated in such training. The main information source about FSS was the milk processor, which also collects milk directly from the farmers. According to reports, 81% of the farmers indicated that they were often or always advised by the processor.

3.1. Food Safety Practices

The microbial quality and safety of milk and milk products in the 21st century is influenced by environmental factors, production, and storage parameters, with emerging and re-emerging pathogens posing major food safety challenges (Fusco et al., 2020). Using a similar approach to Kumar et al. (2017) the questions about food safety practices at the farm level were categorized in four categories, respectively: milking hygiene practices (Table 3), animal health management practices (Table 4), animal care and environment practices (Table 5) and record-keeping and management practices (Table 6). A five-point Likert scale was used to measure the level of farmers' practices and the mean for each question is calculated.

Strict hygiene practices such as cleaning udders before milking, using disinfected milking and transportation equipment and maintaining a clean milking environment significantly reduce the risk of bacteria entering the milk. Regular hand washing by milkers before and after milking is another important step in preventing the transmission of bacteria. In addition, wearing appropriate protective clothing forms a barrier that prevents hair, dust and other contaminants from entering the milk from the milker.

Table 2. Milking hygiene practices

	Never (1)	Sometimes (2)	Half of the time (3)	Often (4)	Always (5)	Total	Mean
Is the barn clean?	0%	0%	0%	89%	11%	100%	4.1
Is the milking area clean?	0%	0%	0%	93%	7%	100%	4.1
Do you check and clean the udders of the animals before milking?	0%	0%	4%	11%	86%	100%	4.8
Do you check the cleanliness of the milking and transportation equipment?	0%	0%	0%	11%	89%	100%	4.9
Do you wash your hands before and after milking?	0%	0%	0%	39%	61%	100%	4.6
Do you use appropriate caps, masks, and clothing during milking?	0%	0%	7%	61%	32%	100%	4.3
Do you use a cooling tank?	0%	29%	4%	14%	54%	100%	3.9

Source: Own research

Herds should be free of diseases such as tuberculosis and brucellosis because they carry a significant risk of bacterial contamination and can be transmitted to humans (Khurana et al., 2021). Regular testing for diseases allows for early detection and treatment and prevents these bacteria from contaminating the milk. Vaccination and responsible use of antibiotics, under veterinary supervision only, protects cows from various diseases. It is important to avoid selling the milk from sick animals, milk which contains antibiotics or sediment because it is not accepted by the dairy industry (Achaw & Danso-Boateng, 2021).

Table 3. Animal health management practices

	Never (1)	Sometimes (2)	Half of the time (3)	Often (4)	Always (5)	Total	Mean
Do you check your animals for tuberculosis/brucellosis?	0%	0%	0%	36%	64%	100%	4.6
Do you vaccinate your animals?	0%	0%	0%	7%	93%	100%	4.6
Do you administer antibiotics without consulting a veterinarian?	93%	4%	0%	0%	4%	100%	1.2
Do you sell the milk when animals are sick?	100%	0%	0%	0%	0%	100%	1.0

Source: Own research

Factors affecting milk quality include temperature, relative humidity, air quality, livestock housing, hygienic practices, stocking density, and materials used in livestock houses (Granados et al., 2018). Ensuring the health of dairy cows is the first step toward producing safe milk. Healthy cows that feel well are crucial for good milk quality. Checking animal feed for safety ensures that cows do not ingest molds or insects that could transmit toxins or bacteria. Comfortable flooring and appropriate barn materials minimize stress for the cows and reduce the risk of injuries. The quality of milk is significantly impacted by the presence of water, which is a common adulterant. Therefore, providing comfortable housing and good overall care can contribute to improved milk quality.

Table 4. Animal care and environmental practices

	Never (1)	Sometimes (2)	Half of the time (3)	Often (4)	Always (5)	Total	Mean
Do you check if the foods you buy for the animals are safe (e.g., do not contain mold, insects, etc.)?	0%	0%	4%	71%	25%	100%	4.2
Is the ventilation system suitable for the animals?	0%	0%	4%	93%	4%	100%	4.0
Are the flooring and materials of the barn suitable for the animals?	0%	0%	4%	93%	4%	100%	4.0
Do you check the quality of the water source you use for your animals?	4%	18%	21%	43%	14%	100%	3.5
Do you practice open grazing for your animals?	93%	0%	0%	7%	0%	100%	1.2

Source: Own research

Effective record-keeping practices are essential for maintaining a high standard of milk quality. Recording books enable documentation of animal health, vaccinations and milking practices. These detailed records facilitate traceability and the identification of potential problems that could affect milk quality. Through the use of ear tags or other methods of animal identification, individual animals and their health status can be tracked so that targeted action can be taken if necessary. Registration certificates ensure that animal health is monitored and meets legal standards, which in turn contributes to the overall safety and quality of the milk produced.

Table 5. Record-keeping and management practices

	Never (1)	Sometimes (2)	Half of the time (3)	Often (4)	Always (5)	Total	Mean
Do you have a farm registry book to keep track of your farm activities?	100%	0%	0%	0%	0%	100%	1.0
Do you use ear tags for identifying your animals?	0%	0%	0%	0%	100%	100%	5.0
Do you have registration certificates for your animals?	4%	0%	0%	0%	96%	100%	4.9

Source: Own research

A composite Food Safety Index, based on Kumar et al., (2017) and Gedara et al. (2023) methodology, was calculated for each farmer. Each question was evaluated on a scale of 1 to 5 points, ranging from 'Never' to 'Always,' except for the questions regarding the 'use of antibiotics without consulting a veterinarian' and 'selling milk from sick cows'. In these cases, 'never' would indicate a good practice, therefore the assigned point would be five, and not one. Weights are assigned to each category (Milking hygiene practices; Animal health management practices; Animal care and environment practices; and Record keeping and management practices) concerning their relative importance to quality and safety production of milk, respectively, 0.35; 0.25; 0.25 and 0.15.

$$FSI_i = \sum_{j=1}^{4} W_j S_{ij}$$

- W_j represents the weight of category *j*.
- S_{ij} represents the sum of points of farmer *i* for category *j*.

After calculating the FSI for each farmer, they were divided in three categories: low adapter, medium adapter and high adapter of FSS. Using the percentiles of 30 and 60 as cut-off points, we found that the level of practices is low for 32%, medium for 29% and high for 39% of the farmers.

4. CONCLUSION

This study aimed to investigate the level of compliance with food safety practices among dairy farmers in Albania. The results show that 32% of the farmers are low adapters of FSS, 29% are medium adapters and only 39% are high adapters. Through questionaries and interviews, different factors were identified, within or beyond the control of farmers, which hinder their efforts to comply with FSS on the farm. The lack of financial support, such as input subsidies or cash payments, is one of the main factors. Only 40% of them have received at least one subsidy from the government for their activity. The change in legislation to financially support farms that have no less than ten cows (from five cows that was before) has excluded a considerable number of farms from the support scheme, as the average number of cows per farm is only seven. Albania still continues to have problems with fragmentation and land ownership, causing plots to be far from each other and increasing operational costs. A significant number of farmers are also renting land to produce the feed. The costs are even higher after the war in Ukraine and the inflation of recent years, therefore increasing the prices for animal feed. An obvious tendency to reduce the number of animals is observed, as a result of the increase in the age of farmers and the decrease in the interest of young people to participate in agriculture, among other factors. Meanwhile, the development and implementation of good agricultural practices are accompanied by additional costs for farmers, which limits the farmers to improve the safety and quality of the milk they produce. The low yield of production, the high prices of the farm activity, and low gate price of milk demoralize the growth and development of dairy farms, jeopardising the future and sustainability of the sector.

Several practical interventions can be suggested to policymakers and agricultural authorities in order to further improve food safety in dairy farms, such as educational training that focus on hygiene, sanitation, and proper handling of dairy products; increased financial support and subsidies for equipment upgrades and infrastructure improvements; promoting good agricultural practices through regular audits, certification programs, and technical support to ensure compliance; supporting youth engagement for more innovative and sustainable practices; and establish networks that provide ongoing support and knowledge exchange among farmers, such are cooperatives. These measures and incentives are necessary to increase the importance of food safety practices, to enhance the reputation of the sector and achieve the export of dairy products and by-products to the European market and beyond. This way, the productivity and sustainability of the sector can increase, benefiting not only farmers, but also consumers and the country's economy in general.

5. FUTURE RESEARCH DIRECTIONS

This is a preliminary study; therefore, to conduct more advanced and detailed statistical analyses a bigger sample is required. This way, we can identify the main determinants and mediating factors, and their importance regarding farmers' compliance with FSS.

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