Oct 28th, 8:00 AM - Oct 29th, 6:00 PM

The effects of hygiene and good manufacturing practices on the quality of fresh milk in some farms in the Gjilan region

Medin Zeqiri
University for Business and Technology, medin.zeqiri@ubt-uni.net

Xhavit Bytyçi
University for Business and Technology, xhavit.bytyci@ubt-uni.net

Mergim Daci Mestani
University for Business and Technology - UBT, mergim.mestani@ubt-uni.net

Valon Durguti
University for Business and Technology, valon.durguti@ubt-uni.net

Fidan Feka
University for Business and Technology - UBT, fidan.feka@ubt-uni.net

See next page for additional authors

Presenter Information
Medin Zeqiri, Xhavit Bytyçi, Mergim Daci Mestani, Valon Durguti, Fidan Feka, Vezir Januzi, and Ylli Biçoku

The effects of hygiene and good manufacturing practices on the quality of fresh milk in some farms in the Gjilan region

Medin Zeqiri[1], Xhavit Bytyçi[1*], Mërgim Mestani[1], Valon Derguti[1], Fidan Feka[1], Vezir Januzi[1], Ylli Biçoku[2]

[1]UBT Higher Education Institution, Prishtina, Kosova
[2] Agricultural University of Tirana

[*]e-mail: xhavibytyçi@ubt-uni.net

Abstract. The research is important because it highlights the deficiencies that milk producers have in implementing proper hygiene practices in dairy cow stalls, which have an impact on milk quality. The study was conducted in three Municipalities of the Gjilan region (Vitia, Kamenica and Gjilani), Kosovo. Data were collected during April-May 2021 for the years 2019 and 2020. A structured questionnaire was used to collect all information related to milk quality. The questionnaire was designed to capture information related to general farm characteristics, number of dairy cows, use of mastitis tests, presence of lactofreezes for milk, pre-milking udder hygiene practices, udder disinfection and use of cleaning wipes etc. Out of 71 farms surveyed, 47 of them or 66.2% reported that they did not have lactofreezes for milk cooling, while only 24 farms or 33.8% had lactofreezes for milk cooling. Farms with lactofreeze, on average, have more experience (18.87 years), while those without lactofreeze have less experience (14.7 years). The surveyed farms, based on milk quality, were: 16.9% or 12 farms of extra class, 29.6% or 21 farms in the first class and 4.2% or 3 farms in the 2nd class, while 35 farms were below the quality standards. 84.5% or 60 farms clean the cow's udder with warm water, while 15.5% or 11 farms with cold water. 48 farms use the same wiping cloth for two or more cows. 32.4% or 23 farms were controlling mastitis. To assess the effects of udder disinfection in relation to milk quality, half of the farms fall below the national minimum standard. We recommend the relevant institutions, local and central, to encourage farms to improve quality by offering them technical and financial support through associations, advisory services and other interested parties.

Keywords: hygiene, good production practices, milk quality, farm.

1. Introduction

According to (MBPZHR, 2022) [1], the number of farms with 5 or more dairy cows at the state level is 9163, while in the researched municipalities of Gjilan, Kamenica, and Viti, there are 845 potential farms [2]. (AZHB, 2022) [2] 1374 farms at the state level have benefited from milk quality based on approved criteria in the 2006, extra class, classes 1 and 2. However, of the 845 potential farms only 95 farms or 11.24% met the quality standards according to the administrative directive and received state incentives for milk quality improvement. In the study by (Pavičić et al., 2008) [3], the impact of udder hygiene on the quality of raw milk from cows is discussed. Improved udder hygiene, including pre and post-milking udder disinfection, significantly reduced the average number of somatic cells and microorganisms in raw milk, thus enhancing milk hygiene and quality for a specific time period. In another study by (De Silva et al., 2015) [4], the microbiological quality of raw milk and its improvement through best management practices in Sri Lanka is explored. After implementing good management practices, the standard plate counts of cooling centers improved, indicating lower microbial counts in the milk The Kosovo Dairy Producers Association [5] provides a manual for improving milk quality and good practices before milking. The main aim is to reduce bacterial counts on the udder before attaching the milking machine. Teats must be cleaned and dry, and the milking machine should not be placed on a wet or inadequately cleaned udder to prevent bacterial growth and mastitis. (Mergim Mestani and Almir Abdurramani, 2016) [6] emphasize hygienic conditions in animal husbandry. Proper hand and equipment washing, as well as udder hygiene practices, directly influence the microbial load in the milk. The udder should undergo special cleaning and disinfection before each milking. Disinfection is crucial, especially when performed after washing. Common disinfectants include iodophors and hypochlorites. (Merkez and Ahmed, Bagcilar) [7] discuss the system of good production practices in Istanbul, Turkey. This system ensures that products adhere to standards throughout all production processes, including input material handling, production, packaging, storage, and distribution, with a focus on product quality. In modern times, the fields in which the system of best practices for PMP (Proper Milk Production) is applied have significantly expanded. For

instance, ISO 9001 Quality Management System, 14001 Environmental Management System ISO, HACCP (Hazard Analysis Critical Control Point) System, 22000 Food Management System ISO, OHSAS 18001, etc. (G.M. Jones, 2006) [8]. All equipment, lines, and surfaces of milk vessels that come into contact with milk, from impurities to organic residues, must be thoroughly cleaned and disinfected before the next milking. The purpose of cleaning is to remove milk deposits, solid organic and mineral substances that form on the equipment surfaces after milk removal. The purpose of disinfection is to eliminate any remaining microorganisms present on these surfaces immediately before milking. (Gelane Kumssa, 2018) [9]. The effect of the milk processing procedure and treatment on its quality at the Haramaya University Dairy Farm in Addis Ababa, Ethiopia, observed that the percentage of producers who used separate towels for each cow was only 3.8%. The average overall bacterial count of raw milk produced on the farm was 6.65 log cfu/ml. This value was higher than the acceptable value of 1 x 105 bacteria per ml of raw milk. The high level of milk contamination was due to interior contamination, water quality, cleaning, and milking utensils. Mastitis is, along with fertility disorders and lameness (Mitev et al., 2011; Varlyakov et al., 2012),([10 and 11] the most common diseases of dairy production and a significant source of economic losses. Mastitis leads to increased somatic cell counts in milk, which affects its quality. High somatic cell counts can result in decreased milk production, altered composition (such as reduced protein and lactose content), and compromised shelf life which affects the decrease in profitability. (Hogeveen et al, 2011). [12]. Subclinical mastitis increases the susceptibility of cows to clinical mastitis, which is characterized by visible signs of inflammation and illness. Persistent subclinical infections can progress to clinical mastitis episodes, further impacting cow health and milk production. (Schukken et al,2011).[13] This means that the decrease in milk quality affects the decrease in profitability because the production of milk is reduced kg per cow per lactation (Kvapilik et al, 2014). [14]. Economic losses per case of clinical mastitis can be direct costs which include diagnostics, therapeutics, non-saleable milk, veterinary service, labor and death loss and indirect costs which included future milk production loss, premature culling and replacement loss and future reproductive loss. (E. Rollin et al, 2015).[15]. (Zeqiri M. et al., 2015), In studies Dairy Farmers Awareness about Food Safety Standards - the case of Kosovo Answer to the question: “Do you have cooling tank?” In the 150 case farms researched in the region of Gjilan and Ferizaj, only 20 farms or 13.3% had lactofreezes, while 130 farms or 86.7% of them did not have lactofreezes at all, all of these farms were directed to the market of the milk. [16].

2. Materials and methods

The study was conducted in the three municipalities of the Gjilan region (Viti, Kamenica, and Gjilan) in Kosovo. The data was collected during the months of April-May 2021 for the years 2019 and 2020. A structured questionnaire was used to gather all information related to milk quality. To avoid confusing questions and ensure clarity, the questionnaire was pre-tested with 5 farmers. A total of 71 face-to-face interviews were conducted, and the farms were randomly selected from the respective municipalities' lists of farmers. 5-78 dairy cows are cultivated on each of the visited and interviewed farms. Interviewers did not encounter any significant problems regarding participation willingness, as they were informed about the purpose of the interview and survey. The questionnaire was created to capture information regarding the general characteristics of the farm, the number of dairy cows, the use of mastitis testing, the possession of milking machines, udder pre-milking cleaning, udder disinfection, the use of tea cups for cleaning, etc.

3. Results and Discussions

Hygiene and good production practices have a big role in the quality of fresh milk, which also depends on the quality of the first product, whether as milk for consumption or for its products in the food industry. To see some of the good practices and milk hygiene, the following tables are also presented for: the number of cows in the researched farms, milk freezers, milk classes in which the farms are located, experience, cleaning of milk equipment and machines, cleaning of the cow's udder, disinfection and tests for mastitis.

Table 1. Descriptive statistics for farms

	N	Minimum	Maximum	Mean	Std. Deviation
Milk cows 2019	71	5.0	70.0	13.761	10.9329
Milk Cows 2020	71	4.0	78.0	12.887	10.6698
Valid N (listwise)	71				

In 2019, a farmer had an average of nearly 14 cows, while in 2020 about 13 cows. The minimum value of the number of cows on the farm for 2019 was 5 heads, while for 2020 the minimum value for the head of cows on the farm was 4 heads.

The maximum number of cows per head for 2019 was 70, while for 2020 it was 78 heads. The standard deviation is 10.93 for the 2019 cow, while for 2020 it was 10.66.

Table: 2. Do you have a milk cooler?

	Frequency	Percent	Valid Percent	Cumulative Percent
Vlid	24	33.3	33.8	33.8
1.0	47	65.3	66.2	100.0
2.0	71	98.6	100.0	
Total				

* (1.0) farms that have a cooling tank for milk
* (2.0) farms that do not have cooling tank for milk
* (71) Number of farms in the research

Column (2.0), 66.2% or 47 farms did not have cooling tank for milk, while 33.8% or 24 farms had cooling tank for milk (1.0) columns.

Table: 3. In which class of milk are you according to quality (classification of milk according to national guidelines)

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	21	29.2	29.6
	2.0	3	4.2	4.2
	3.0	1	1.4	1.4
	4.0	12	16.7	16.9
	5.0	34	47.2	47.9
	Total	71	98.6	100.0

* (1.0) first class
* (2.0) second class
* (3.0) third grade
* (4.0) extra classes
* (5.0) They don't know the class of milk

Regarding the milk class, 47.9% (34 farmers) declared that they do not know what class they are in, 16.9% or 12 farms are in the extra class, 29.6% or 21 farms in the first class, 4.2% or 3 farms in class 2 and 1.4% or 1 farmer in class 3.

Table: 4. Group Stats experience on farms vs owning a cool tank

	Lactofreeze	N	Mean	Std. Deviation	Std. Error Mean

Cow Experience	1.0	23	18.87	12.843	2.678
Cow Experience	2.0	47	14.72	11.300	1.648
Missing	System	1	1.4		
Total	72	100.0			

* valid 70 farms
* (1.0) experience in farms for more than 15 years
* (2.0) farm experience of less than 15 years

Farmers who have cooling tank, on average, have more experience (18.87 years), while those who do not have a tank (14.7 years). For the "farm experience" factor, there are two categories: 1.0 (indicating experience more than 15 years) and 2.0 (indicating experience less than or equal to 15 years). In the category of experience in farms greater than 15 years (1.0), there are 23 observations (N). The average (mean) farm experience for this group is 18.87 years, with a standard deviation of 12.843 years and a mean standard error of 2.678 years. In the category of farm experience less than or equal to 15 years (2.0), there are 47 observations (N). The average farm experience for this group is 14.72 years, with a standard deviation of 11,300 years and a mean standard error of 1,648 years.

Table: 5. Do you clean the milking machines and at what intervals?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.0	27	37.5	38.0	38.0
2.0	39	54.2	54.9	93
3.0	4	5.6	5.6	98.6
4.0	1	1.4	1.4	100.0
Total	71	98.6	100.0	
Missing System	1	1.4		
Total	72	100.0		

*valid 71 farms

Table: 6. Do you clean the cow's udder before milking and what water do you use?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.0	60	83.3	84.5	84.5
2.0	11	15.3	15.5	100.0
Total	71	98.6	100.0	
Missing System	1	1.4		
Total	72	100.0		

*valid 71 farms
* (1.0) hot water
* (2.0) cold water

From the table we see that 84.5% or 60 farms clean the cow's udder with warm water, while the rest 15.5% or 11 farms clean the udder with cold water.

Table :7 Do you use cleaning cloths to wipe the cow's udders?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.0	4	5.6	5.6	5.6
2.0	22	30.6	31.0	36.6
3.0	17	23.6	23.9	60.6
4.0	23	31.9	32.4	93.0
5.0	5	6.9	7.0	
	71	98.6		
Total			100.0	100.0

* (1.0) cloth for 2 or more cows
* (2.0) did not use cloth at all
* (3.0) cloth for one or two cows
* (4.0) separate cloth for each cow
* (5.0) cloth for the whole farm

5.6% or 4 farms used one cloth for two or more option cows (1.0), 31% or 22 farms did not use (2.0), 23.9% or 17 farms used it for every two option cows (3.0), 32.4% or 23 farms used a separate cloth for each cow (4.0) and 7% or 5 farms used the only cloth for the whole farm.

Table :8 Do you test for mastitis on your farm?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.0	9	12.7	12.7	12.7
2.0	62	87.3	87.3	87.3
Total	71	100.0	100.0	100.0

* (1.0) farms that test for mastitis
* (2.0) farms that do not test for mastitis

From the above table we can see that 87.3% of farmers have declared that they do not control mastitis or in total 62 farms out of a total of 71 researched option (2.0) and 12.7% or 9 farms had done mastitis control in their option farms (1.0).

Table :9 Do you disinfect the cow's udder before and after milking

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1.0	16	22.5	22.5	22.5
2.0	10	14.1	14.1	36.6
3.0	25	35.1	35.1	71.8
4.0	20	28.2	28.2	100.0

Total	71	100.0	100.0	

* (1.0) disinfection before milking
* (2.0) disinfection before and after milking
* (3.0) disinfection after milking
* (4.0) disinfection is not done at all

From the above table we see that 22.5% or 16 farms disinfect udders before milking, 14.1% or 10 farms disinfect the udder before and after milking, 35.2% or 25 farms declare that they disinfect the udder only after milking, while 28.2% or 20 farms do not perform disinfection at all.

4. Conclusion

It is research that aims to highlight some of the best practices in milk production following the milk hygiene protocol in some randomly selected farms in the Gjilan region. Descriptive statistics for the number of dairy cows on farms (Table 1) show that in 2019, a farmer had an average of about 14 cows, while in 2020, about 13 cows, indicating a decrease in the number of cows in 2020. two variables had 71 observations with minimum values of the number of cows on farms for 2019, 5 cows per farm, and for 2020, the minimum value of cows per farm was 4, heads.

The maximum number of cows per farm for 2019 was 70, while for 2020 it was 78 cows. The standard deviation was 10.93 for cows in 2019 and for 2020 it was 10.66.

The question of whether you have a cooling tank (Table 2), to better understand how many of the farms surveyed perform milk cooling according to standards and best practices, out of 71 farms surveyed, 47 of them or 66.2% reported that they do not this.

while only 24 farms or 33.8% have milk coolers and do milk cooling. This shows that more than half of the farms (Table 3) are not yet equipped with milk coolers and do not perform milk cooling according to production standards, reflecting a relatively high number of farms that do not know what class of milk they are, or 37 farms or 47.9% of the 71 farms under study. In 2015, out of 150 farms surveyed, 86.7% or only 20 farms had lactofreeze, which shows a very small increase for 2019 and 2020. [16].

Comparing the impact of experience (Table 4) in relation to milk coolers (Table 2), we note that farmers who have milk coolers, on average, have more experience (18.87 years) with a standard deviation of 12.84, while non-coolies have a mean of 14.7 years of experience, with a standard deviation of 12.84 years and a standard error of 2.67 years.

To observe the ranking of dairy farms based on quality (Table: 3) and in which class of milk quality compared to the question of whether you clean milk machines (table 5), we have: 16.9% or 12 farms of the class above good or extra, 29.6% or 21 farms in the first class and 4.2% or 3 farms in the 2nd class, while 35 farms fall below the quality standards, which shows that the hygienic process of cleaning the milk machine has affected almost 50% of farms to meet milk production standards according to quality.

To observe the effect of udder cleaning (table 6) on milk quality before and after milking in relation to the ranked milk quality classes (table 3), out of 71 farms, 84.5% or 60 farms clean the udder with warm water , while 15.5% or 11 farms use cold water for cleaning the bay. This resulted in 35 farms, or half of those in the study, falling below the quality standard, suggesting that udder drying may not have been done properly in the process.

To observe the effect of using towels for wiping or drying the cow's udder (Table: 7) in relation to the ranked milk quality classes (Table 3), it turns out that half of the surveyed producers, or 35 farms, are under the standard. This is due to the fact that only 32.4% or 23 farms out of 71 surveyed use separate towels for each cow, while other farms lack this hygienic measure. This may be one of the reasons why half of the farms do not meet the standards for the quality of milk production.

To observe the effects of mastitis control and tests (Table 8), tests are carried out in relation to milk quality classes (Table 3), revealing that half of the investigated producers, or 35 farms, do not meet the quality standards.

When we evaluate the impacts of udder disinfection on cows (Table 9) in relation to milk quality (Table 3), we find once again that about half of the farms are below the minimum national standard in relation to milk quality, which amounts to 50 %, or 35 farms under study. This may be due to the fact that udder disinfection before and after milking is implemented by only 14.1% or 10 farms out of all surveyed farms, while the remaining 61 farms implement it partially or not at all (Table 9).

We recommend dairy producers follow a hygienic protocol including cleaning the cow's udder, drying it, disinfecting the udder, testing for mastitis, cleaning and disinfecting milking machines and equipment in contact with the milk, and cooling the milk. The goal is to ensure the production of high quality milk.

We advise milk producers to be equipped with cooling tanks for optimal storage and quality maintenance of raw milk. We suggest that milk producers apply hygiene and best production practices.

We recommend that milk producers attend trainings related to hygienic measures and the protocol of good manufacturing practices.

We recommend the relevant institutions, such as the local and central ones, to promote the farms more in quality by supporting them even more in the technical and financial aspects through associations, advisory services and other actors.

Acknowlwdgment

The authors thankfully acknowledge farmers with cooperation.

5. References

1. MBPZHR (2022): Lista e fermerëve përfitues për Pagesa Direkte - Blegtori 2022.Agjensia për zhvillimin e bujqesise,https://azhb-rks.net/repository/docs/2023_05_11_041958_Lista__e_fermereve_perfitues_per_Pagesa_Direkte_-_Blegtori_2022.pdf
2. AZHB(2022):Lista e fermerëve përfitues për Pagesa Direkte - Qumështi sipas cilësisë, therrjet e raportuara, akuakultur dhe viçat për majmëri 2022, https://azhb-rks.net/repository/docs/2023_05_11_041930_Lista_e_fermereve_perfitues_per_Pagesa_Direkte_-_Qumeshti_sipas_cilesise_therrjet_e_raportuara_akuakultur_dhe_vicat_per_majmeri_2022.pdf
3. Pavičić, Ž., M. Cergolj, T. Balenović, A. Ekert-Kabalin, H. Valpotić: Influence of udder sanitation on hygienic quality of cow milk. Vet. arhiv 78, 105-112, 2008. Influence of udder sanitation on hygienic quality of cow milk, file:///C:/Users/OEM/Desktop/Referenca%203.%20Influence_of_udder_sanitation_on_hygienic_quality_.pdf.
4. S.A.S.D De Silvaa , K.A.N.P Kanugalab , N.S Weerakkodya (2015) , Microbiological quality of raw milk and effect on quality by implementing good management practices, International Conference of Sabaragamuwa University of Sri Lanka 2015 (ICSUSL 2015). Procedia Food Science 6 (2016) 92 – 96. https://www.sciencedirect.com/science/article/pii/S2211601X16000201
5. Shoqata e prodhuesve te qumeshtit te Kosoves,https://shpqk.org/broshura/P%C3%ABrmir%C3%ABsimi_i_kualitetit_t%C3%AB_qum%C3%ABshtit-2.pdf.
6. Mergim Mestani and Almir Abdurramani, (2016), BAZAT E TEKNOLOGJISË USHQIMORE 2 Book · January 2016. file:///C:/Users/OEM/Downloads/BAZATETEKNOLOGJISEUSHQIMORE2MM-AA.pdf
7. Science, Merkez Mh,Dr Sadik Ahmed Cd,Bagcilar Stamboll Turqi, Certifikimi i praktikave të mira të prodhimit GMP,https://www.belgelendirme.com/sq/belgelendirme/urun-belgelendirme/gmp-iyi-uretim-uygulamalari-belgelendirmesi

8. .G.M. Jones (2006), Extension Dairy Scientist, Milk Quality & Milking Management, Virginia Tech. 22 September 2006,Cleaning and Sanitizing Milking Equipment.

9. Gelane Kumssa 2018. Effect of Milking Procedure and Handling on its Quality.Jornal of Dairy $ veterinary science 2018. file:///C:/Users/OEM/Downloads/Effect_of_Milking_Procedure_and_Handling_on_its_Qu.pdf.

10. Mitev, J., Z. Gergovska, T. Miteva and T. Penev, 2011. Influence of lameness on daily yield, lactation curve and body condition score during lactation in black-and White cows. Bulg. J. Agric. Sci., 17 (5): 704-711.

11. Varlyakov, I., T. Penev, J. Mitev, T. Miteva, K. Uzunova and Z. Gergovska, 2012. effect of lameness on the behavior of dairy cows under intensive production systems. Bulg. J. Agric. Sci., 18 (1): 125-132 Varlyakov, I., T. Penev, J. Mitev, T. Miteva, K. Uzunova and Z. Gergovska, 2012. effect of lameness on the behavior of dairy cows under intensive production systems. Bulg. J. Agric. Sci., 18 (1): 125-132.

12. Hogeveen, H., Huijps, K., & Lam, T.J.G.M. (2011). Economic aspects of mastitis: New developments. New Zealand Veterinary Journal, 59(1), 16-23.

13. Schukken, Y.H., Günther, J., Fitzpatrick, J., Fontaine, M.C., Goetze, L., Holst, O., Leigh, J., Petzl, W., Schuberth, H.J., Sipka, A. and Smith, D.G. (2011). Host-response patterns of intramammary infections in dairy cows. Veterinary immunology and immunopathology, 144(3-4), 270-289.

14. Kvapilik, O. Hanus, J. Syrucek, M. Vyletelova-Klimesova and P. Roubal, 2014. The economic importance of the losses of cow milk due to mastitis: a meta-analysis. Bulg. J. Agric. Sci., 20: 1483-1497.

15. E. Rollin 1, K C Dhuyvetter 2, M W Overton 3, 2015. The cost of clinical mastitis in the first 30 days of lactation: An economic modeling tool. Prev Vet Med 2015 Dec 1;122(3):257-64. doi: 10.1016/j.prevetmed.2015.11.006. Epub 2015 Nov 7.

16. Zeqiri, M., Bytyqi, H., Imami, D., Biçoku, Y (2015): Dairy Farmers Awareness about Food Standards - the Case of Kosovo. Albanian j. agric. sci. 2015;14 (2):93-101.