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Quality and Safety Assessment of Raw Milk in Lushnja Region

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Abstract

The safety of milk is an important attribute for consumers of milk and dairy products in Albania. Over the past 10 years, farmers and government agencies have made joint efforts not only to increase milk production, but also to improve its hygienic-sanitary quality. In this study, the quality of raw milk produced in 10 farms in the Lushnja area was assessed. Each milk sample (n = 100) was first tested for physicochemical indicators: fat, protein, lactose, density, cryoscopic point and added water. These indicators were evaluated through Lactoscan. The Total Bacteria Count, Coliforms and somatic cell count were also determined. The method used to determine Total Bacterial Count was conducted by the ISO 4833: 2003 method, while for SCC measurement, DeLaval DCC electronic counting was used. Only 37% of all samples resulted in values <100,000 colony forming units (CFU) / ml of total bacteria, a standard bacterial concentration acceptable for raw milk based on Albanian and European law. Similarly, the majority of milk samples (63%)(63/100), showed that they contained> 100 CFU coliforms / ml. In this study, a change in milk composition was found, especially in samples with high SCC. Many of the quality issues, we found were likely related to hygiene and sanitation practices at different points along the entire production chain. Decreasing overall bacterial concentrations could extend shelf life and improve consistency of fermented products. These results will serve as primary data for extension programming aimed at improving milk quality in the region of Lushnja.

Key words: Total Bacteria Count, coliforms, SCC, milk composition.

1. Introduction

Milk is one of the most important foods in the human diet, as it contains a large number of nutritional principles, including proteins, vitamins, fats and mineral salts. To summarize, milk is a rich and slightly costly food. It is the only animal product whose specific function is to serve as a complete food. The nutritional value of milk depends mainly on its protein content, which are generally not lower than those of eggs, meat and fish. Casein and lactalbumin are complete proteins, which contain all the necessary amino acids for the needs of our body.Albania produces an average of 1.1 million tons of milk per year. Referring to INSTAT data in the last 5 years, the highest level of milk production in the country was reached in 2017 at 1 million 156 thousand tons. While in 2018, production fell to the level of 1 million 114 thousand tons of milk. The microbiological quality of milk is a basic requirement for both alimentary and transformation milk. In Europe, the bacterial load of milk is subject to the precise limits of the law on traded milk, in addition to being one of the parameters on which the differentiated payment of milk is based in terms of quality. In Albania and Europe the legal limit for the content of bacteria in milk is ≤ 100,000 UFC / mL [12, 14]. High bacterial contamination constitutes an undesirable factor in the case of milk for consumption. The high number of microorganisms present in milk leads to a reduction in storage time, an increase in the possibility of developing an unpleasant taste and the necessity of using intensive thermal treatments. The bacterial load of milk can also constitute an indirect signal of possible contamination

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with pathogenic microorganisms [2, 1]. Depends mainly on the hygienic conditions during the various processes of the milk production chain, animal health, preparation of the breast in pre-milking, way of milking, way of washing the milking plant, storage conditions up to the moment of delivery[9].

The condition and type of bacterial contamination become parameters of great importance. Even in the process of caseification bacterial contamination can pose a problem both for competitiveness against beneficial microorganisms, as well as for possible and severe alterations of product characteristics resulting from the development of undesirable bacteria or the presence of their enzymes [3]

Coliform testing has been used to indicate hygienic condition of dairy products for nearly a century. Coliforms are common contaminants in fluid milk, cheeses and other dairy products [13,18]. Coliforms not only have the risk of pathogenicity, but also they are responsible for milk post-harvest losses in the low as well as middle economy countries through qualitative loses. Qualitative losses occur due to spoilage especially due to microorganisms. Coliforms decompose nutrients causing milk spoilage. Also, lactose is broken down to lactic acid through fermentation resulting in undesirable flavor in raw milk [17, 8]

To prevent the entry of poor quality milk into the food chain, microbiological monitoring of raw milk, which includes microbial and somatic cell analysis, is essential to ensure the quality of milk and dairy products. Somatic cell count is an important indicator of milk quality and herd management[6].

The probable presence of veterinary drug residues in milk, however, can highly affect the consumer healthn [4,16]. In addition, drug residues can interfere withn the manufacture of fermented products such as yoghurt and cheese [12, 14]. To prevent these problems, the dairy industry is interested in screening incoming milk to ensure that levels of antibiotic residues are not exceeding the safe levels of maximum residue limits (MRLs) set by European Union (EU) [9]. Based on Directive 96/23 EC and Regulation no. 142, dt. 26.03.2008, of the Minister of MAFCP, "Regarding the measures to monitor waste in products of animal origin" continuous monitoring is carried out to determine the beta-lactams residues in milk

2. Material and Methods

2.1. Sample collection

Milk samples (500 ml) were collected in sterile containers on 10 farms in the Lushnja region (n = 100), during 4 seasonal phases in 2018. The samples were transported in refrigeration boxes to the Food Safety Laboratory - Faculty of Veterinary Medicine Tirana for further processing. All samples had a special code and were recorded by date, milking/collection time, farm location, and original source of milk (eg farmer's name). All milk samples underwent a preliminary examination of color, odor and any visible signs of spoilage before laboratory analysis.

2.2 *Sampling method*

The method of sampling ISO 707 IDF 50: 2008 “Sampling methods of milk and its derivatives for chemical, physical, sensory microbiological analysis, was applied for milk sampling.

2.3 *Total Bacteria Count*

Concentrations of total aerobic bacteria were measured followed official method ISO 4833: 2003 "Microbiology of Food and Animal Feeding stuffs - horizontal method for the enumeration of microorganisms, by counting the colonies growing in a solid medium after aerobic incubation at 30^0 C." Milk samples were serially diluted in Buffered Peptone Water (BPW) pH 7,5 and 100 µL of each dilution was transferred to plates containing Plate Count Agar (Oxoid). Samples were then incubated at 37° C and colonies were enumerated after 48-72 hours.

2. 4 Enumeration of Coliform bacteria

Total coliforms were measured by serially diluting milk samples in PBS and transferring 100 µL of each dilution to plates containing violet red bile agar. Samples were then incubated overnight at 37° C and colonies were enumerated the following morning. Colonies with pink centers and surrounding red zones were considered presumptive lactose-fermenting coliforms.

2.5 Somatic Cells Count

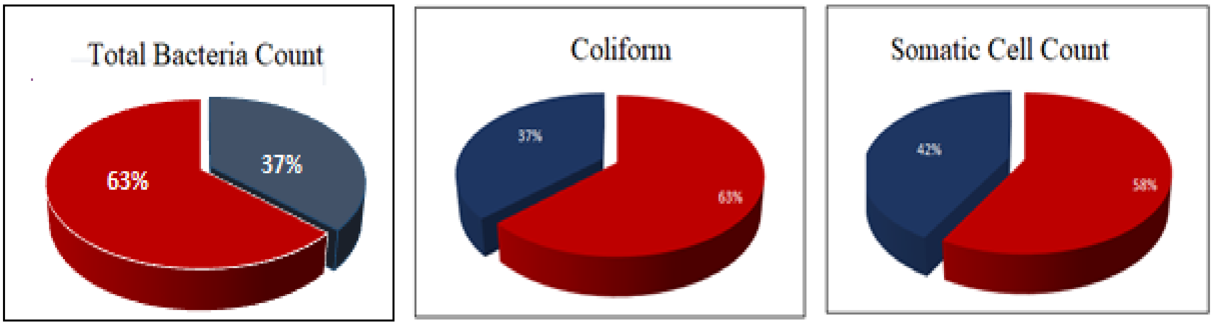
Somatic cell count was determined using the Direct Cell Counter (DeLaval. DeLaval Cell Counter (DeLaval International AB, Tumba, Sweden): is a portable electronic optical device. DCC counts somatic cell nuclei stained with DNA-specific fluorescent probe (Propidium lodide) at just 45 ", Milk collected, and nuclei stained within a cassette containing small amounts of fluorescent staining [6], A small amount of 60 µl of milk sample is required for counting.At a piston, approximately 1 µl of milk is transported to a measuring window.The nuclei are then exposed to an LED light source and their signals fluorescents are recorded and used to determine SCC.After the charged tape is inserted into the instrument, the number of somatic cells is displayed on the instrument screen [6].

2.6 Milk composition

Milk composition was measured by ultrasound with the Lacto scan Ultrasonic Milk Analyzer (Milkotronic, Ltd, Bulgaria) according to the directions of the manufacturer. Briefly, milk samples (~2 ml) were warmed to room temperature before analysis and percentages of fat, protein, lactose, and salts, pH, freezing point, and presence of added water were estimated by ultrasound. In cases, where ultrasonic analysis indicated water irregularities (e.g., high percentages and irregular freezing point), milk density was measured by lactometer (hydrometric analysis). Samples with irregular ultrasounds and specific densities lower than 1.027 were considered to contain water irregularities.

3. Results and Discussion

Only 37% of all samples resulted in values <100,000 colony forming units (CFU) / ml of total bacteria, a standard bacterial concentration acceptable for raw milk based on Albanian and European law. The majority of milk samples (63%)(63/100), showed that they contained >100 CFU coliforms / ml, and 58% of the samples tested showed higher values of ≤ 400,000 cells / ml).



1) 2) 3)

Figure 1. Resuls: 1) Total Bacteria Count; 2) Coliforme; 3) SCC results

Changes in milk composition were also observed in samples with a number higher than 400,000 ml / ml SCC: decrease in lactose % 28/100; 39/100 had changes in fat content (decrease and increase in%); decrease in protein percentage 15/100, decrease in density 42/100, SNF decrease 7/100, and 21/100 freezing point <- 052.

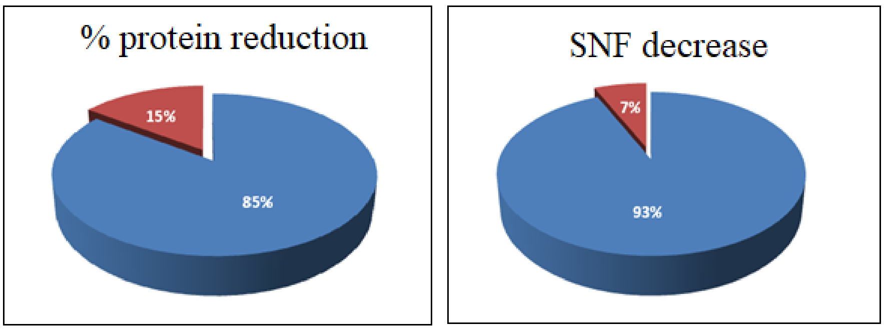
a)  b)

Figure 2. Results: a) of % protein reduction, b) SNF decrease

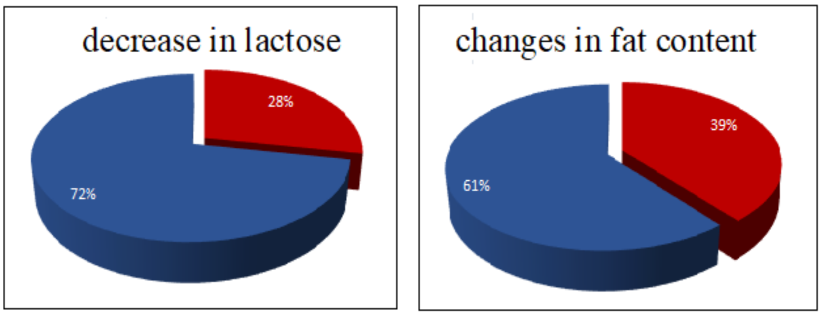


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Figure 3. Results: c) decrease in lactose d) changes in fat content

4. Conclusions

Milk production with high microbial load and high number of somatic cells is associated with lack of care in breeding management, and poor hygiene. This proves a possible presence of environmental pathogens or even the presence of mastitis in animals, which can be problematic for humans. High bacterial load values coincided in most of them with dinner milking samples. This fact is related to the non-compliance with the milk cooling chain immediately after milking, as well as inadequate transport conditions from the farm to the collection centers. According to various studies, it has been proven that the degree of cooling after taking milk is the first step in maintaining low levels of bacterial load. The sooner milk is placed at cooling temperatures, the safer its preservation by preventing the growth of microorganisms. Consequently, the necessity of refrigeration tanks on dairy farms provides conditions for accelerated cooling of milk to 4 ° C.

Developing Programs to reduce the level of subclinical mastitis on dairy farms can have an additional benefit in reducing the risk of antibiotic residues. The obtained results will have an impact on the territory under study regarding the improvement of the quality of milk and dairy products, contributing to the guarantee of food safety of milk in accordance with the requirements provided for the total quality of milk in national legislation and that community.

The food safety of milk and its products can be increased by applying good hygiene standards at the animal level, in farm conditions and milking places, and through the uniform application of milking practices that reduce milk pollution.

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