



Cows' mastitis and its therapeutics: A survey study

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Abstract. Mastitis represents a complex disease of the mammary gland which cause significant losses by decreasing the quantity and quality of the obtained milk, and by mortalities among affected animals. In addition, the costs of sick animals treating must be considered. Mastitis treatment is complex and often involves the use of medicines containing antibiotics. Besides purchasing these drugs, an important problem is represented by their residues finding in the milked milk from the treated animals. This period of milk contamination varies with the used antibiotic. The aim of this paper is to present the importance of mastitis in lactating cows and the need of its prevention. The presented results highlighted the mastitis resistance to treatments, and the veterinarian efforts to find the proper treatments.

Key Words: mastitis, antibiotic residues, milk.

Introduction. Milk is an important food in terms of its composition, providing the necessary elements for the survival of the newborn. Humans are regular consumers of other species milk, such as cow, buffalo, goat or sheep. The consumption of camel, reindeer and mare milk is limited to certain regions with a tradition in this respect, such as the desert of Africa, Lapland and Central Asia, respectively (Huppertz et al 2006).

From 1961 to 2007, the milk consumption in developing countries almost doubled, the global milk production being mostly covered by cows' milk (83%). A contribution to the global milk production also had buffalos (13%), goats (2.4%), sheep (1.4%) and camels (0.3%). The situation is different for the countries of South Asia, where the cows' milk accounts for 42% of production, and sub-Saharan Africa, where its share is 75% of production (Gerosa & Skoet 2013).

Given the increased demand for cow's milk and the potential of this species to meet it, the breeding of these animals experienced a significant progress in the last decades in terms of their selection based on genetic markers and expressed phenotype, as well as in technologically terms, in order to ensure adequate support under the ratio of space, hygiene and nutrition used. Unfortunately, significant milk production is usually associated with increased incidence of mastitis in those females. Consequently, mastitis treatment often requires the use of antibiotics, generating concern about the purchase costs of these drugs (Feștilă et al 2010) and the possibility of their retention in the milk obtained from the treated animals (Grădinaru et al 2011).

Material and Method. This paper is a screening study on the clinical mastitis incidence in a herd of Holstein Friesian cows in their first two lactations, and the therapeutics used to treat this condition. The epidemiological survey was conducted over a period of 12 months and aimed to answer the following questions:

1. Which was the incidence of clinical mastitis from all treated cases?
2. Which was the average number of affected mammary quarters?
3. Which was the pathway chosen for mastitis treatment?
4. What kind of products was used to treat mastitis?
5. How long the mastitis treatment was applied?

6. How many days after stopping the treatment the milk was considered safe for human consumption or processing with regard to the antibiotic residues? (According to the data provided in the drug prospectus).

All investigated data were expressed using basic statistical indicators, such as minimum, maximum, ordinary or weighted arithmetic mean, standard deviation (σ), and the coefficient of variation (CV%).

Results and Discussion. Mastitis is an important disease of the bovine mammary gland, with clinical or subclinical evolution, and with repercussions on the quality and quantity of milk. Clinical forms are readily detectable by local changes, such as modifications in the appearance of milked milk (serous, haemorrhagic, or purulent secretion), increased volume of the affected quarter(s) or of the entire mammary gland, pain at palpation, local temperature increasing. The general condition of suffering females is often affected, with fever and loss of appetite. On the other hand, the subclinical mastitis is not characterized by obvious symptoms at the level of mammary gland, but by changes in milk quality: increased chlorine / lactose index by decreasing the lactose content and increasing the chlorine amount, decreasing the casein content, increasing the number of somatic cells, increasing of pH and of the microorganisms number. Subclinical mastitis is particularly important due to the possibility of passing into clinical forms and due to the depreciation of obtained milk from affected animals. In practice, rapid tests based on changes in electrical resistance of milk (due to the modification of salt levels), or tests that take into account the increased number of somatic cells in milk are used for their diagnosis.

In the investigated population, clinical mastitis accounted for 35.61% of all cases that required administration of drugs. Of these, 31.07% were new cases of clinical mastitis and 68.93% were cases of relapsed and re-treated mastitis. From all relapsed cases, 57.14% required one re-treatment, 19.05% required two re-treatments, 11.9% required three re-treatments, and 11.91% required up to six re-treatments (Figure 1).

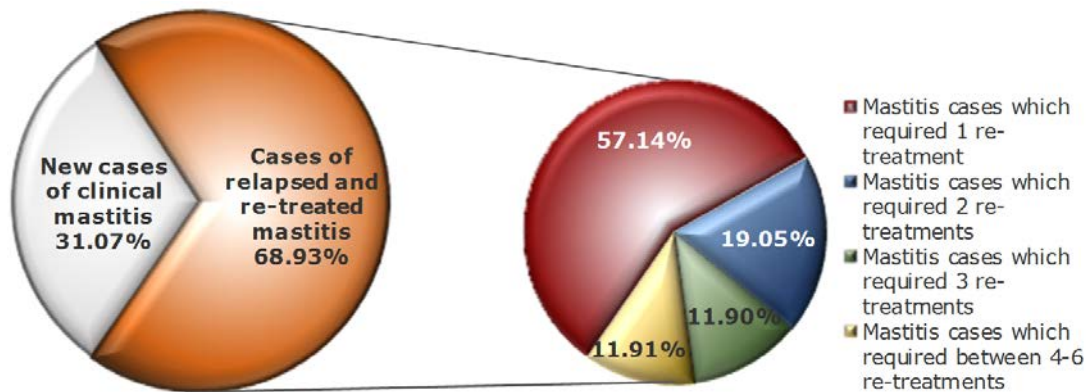


Figure 1. The share of new, and relapsed and re-treatment cases of mastitis.

The average period among the initial treatment and the first re-treatment was 16.4 days ($\sigma = 20.88$; CV% = 127.33), with a minimum of two days and a maximum of 101 days. The average period among the first and the second re-treatment was 16.67 days ($\sigma = 19.77$; CV% = 118.6, with a minimum of two days and a maximum of 91 days), among the second and the third re-treatment was 11.36 days ($\sigma = 8.98$; CV% = 79.03, with a minimum of four days and a maximum of 33 days), among the third and the fourth re-treatment was 8.6 days ($\sigma = 6.5$; CV% = 72.63, with a minimum of four days and a maximum of 20 days), among the fourth and the fifth re-treatment was 10.5 days (5 and 16 days) and among the fifth and the sixth re-treatments was 15.5 days (3 and 28 days) (Figure 2).

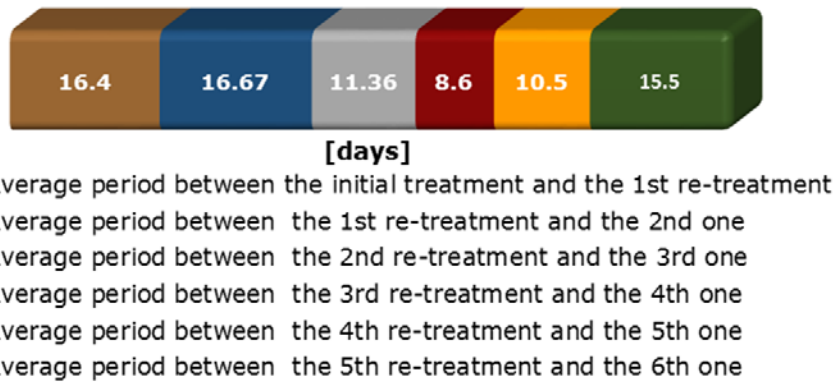


Figure 2. The average period among the performed treatments.

From the total treatments performed for mastitis cases, 61.63% were for one mammary quarter, 22.01% for two mammary quarters, 2.51% for three mammary quarters, and 13.85% for all four mammary quarters (Figure 3).

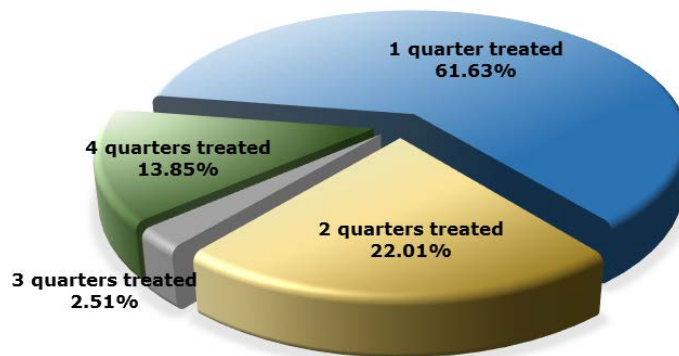


Figure 3. The share of treatments per mammary quarters.

In 62.5% of cases, the applied therapy was only local, in 17.86% of cases the local therapy was associated with the parenteral therapy, and in 19.64% of the cases, the applied therapy was only parenteral (Figure 4).

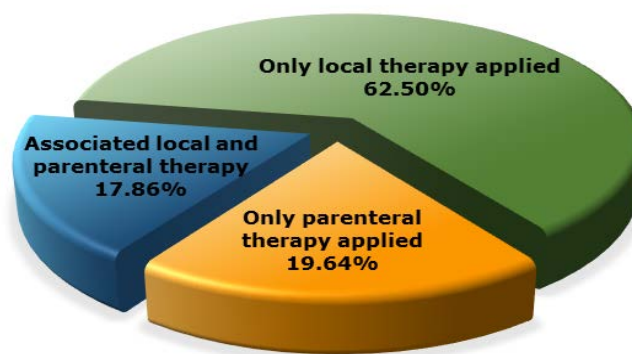


Figure 4. The share of various types of applied therapies.

The local therapy was applied in 66.67% of newly diagnosed cases of mastitis and 33.33% of re-treatment cases, the local therapy associated with the parenteral one was applied in equal manner to both new and re-treatment cases, and the only parenteral therapy was applied in 51.51% of new treatment cases and 48.48% of re-treatment

cases. From the total cases which were only local treated, 76.36% were with one affected quarter, 18.18% with two affected quarters, 1.82% with three affected quarters, and 3.64% with all quarters affected. From the total cases treated both locally and parenterally, 45.16% were with one affected quarter, 41.93% with two affected quarters, and each 6.45% with three and four affected quarters. From the total cases treated only parenteral, 11.12% were with two affected quarters and 88.88% with four affected quarters. From the total cases that affected only one quarter, in 85.71% of the cases was applied only the local treatment, whereas in 14.29% of the cases was applied the associated treatment, local and parenteral. From the total cases that affected two quarters, in 57.14% of the cases was applied only the local treatment, in 37.14% of the cases, the associated treatment, local and parenteral, and in 5.72% of the cases, only the parenteral treatment. From the total cases that affected three quarters, in half of them was applied only the local treatment, the other half being considered for the associated treatment, local and parenteral. From the total cases that affected 4 quarters, in 18.18% of the cases the applied treatment was only local, in 9.09% of the cases the applied treatment was associated, local and parenteral, and in 72.73% of the cases, the applied treatment was only parenteral.

Considering the usage of antibiotics in the therapeutics of mastitis cases, in 68.18% of the situations, the locally used medicines contained a single antibiotic, and in 31.82% of the situations, the locally used medicines contained an association of antibiotics. Considering the same criterion, in 73.08% of the situations, the locally and parenterally used medicines contained each one a single antibiotic, in 11.54% of the situations, the locally and parenterally used medicines contained a single antibiotic (for the local therapy) and an association of antibiotics (for the parenteral therapy), and in 15.38% of situations, both locally and parenterally medicines with associations of antibiotics were used. In all cases treated only parenteral, medicines containing one antibiotic were used.

When only the local therapy was applied to mastitis cases, it lasted one day in 20.37% of cases, two days in 28.70% of cases, three days in 15.74% of cases, four days in 11.11% of cases, five days in 23.15% of cases, and seven days in 0.93% of cases. When local and parenteral associated therapy was applied, it lasted one day and ten days, respectively, in each 2.78% of cases, three days in 19.44% of cases, four days in 41.67% of cases, five days in 19.44% of cases, and 14 days in 13.89% of cases. When only parenteral therapy was applied, it lasted three days in 33.33% of cases, four days in 8.33% of cases, and five days in 58.34% of cases.

The average period since the antibiotic administration was stopped and until the milk could be considered safe for consumption or processing with respect to this residue was 3.64 days (according to the data provided by the manufacturer on the product label). In 57.80% of cases, the milk was safe for consumption or processing at 3.5 days after stopping the antibiotic treatment, in 24.85% of cases milk was safe at three days after stopping the antibiotic treatment, in 6.94% of cases at seven days after stopping the antibiotic treatment, in 4.62 % of cases at two days, and in each 1.73% of cases, at five and twelve days, respectively, after stopping the treatment with antibiotics. In 2.31% of cases, only parenterally medicine was used for which the manufacturer guaranteed the lack of antibiotic residues in milk if its recommendations for administration are respected.

The performed research and the experience in mastitis justify the following recommendations. The early diagnosis of any form of mastitis is important in order to achieve a prompt healing of affected females and to limit the spread of pathogenic germs in the livestock. An important aspect is the clinical examination of lactating females by the veterinarian of the farm, performing both a general and local examination, and of mammary gland secretion.

The association between bacteria belonging to the same genus or different genres is common in the etiology of mastitis. Most commonly, pathogenic germs ascend into mammary gland through the streak canal, especially when its sphincter is lightly opened as a result of milking, nipple catheterization or too much milk in the gland cistern. An

important role is played by the hygiene of the shelter and of the mammary gland in order to limit the survival and multiplication of various pathogens. A shelter free of microorganisms is a utopia, but their number can be reduced by ensuring elementary hygiene measures such as to clean up the dirty bedding, to isolate the diseased animals that can contaminate by their secretions and excretions, to disinfect the mammary gland before milking and to wipe it with a clean towel, to sanitize the milking machines and the hands of milker. Dirty animals can be washed with warm water from a reliable source.

Once penetrated into the mammary gland, microbes multiply and diffuse rapidly into its structures, generating inflammation. When the female health condition is only locally affected, at a small number of quarters, the therapy will assume the drugs infusion at this level followed by the mammary gland massage to provide a better diffusibility in affected tissues. If the general condition of the female is affected, it is recommended to associate the local therapy with the parenteral one. In some cases, especially when all mammary quarters are affected, only a parenteral therapy is chosen.

Nowadays, there is a variety of local-acting medicines with one antibiotic included or associations between different antibiotics. Some of them also include an anti-inflammatory drug. The parenteral therapy of mastitis is usually done with single antibiotic medicines; the anti-inflammatory therapy can also be performed parenterally. However, choosing a medicine based on antibiotics requires caution. A therapy without enough medical knowledge can cause many adverse effects, such as antibiotic resistance, toxicity or imbalance in the intestinal ecosystem. In addition, the milk obtained from antibiotic-treated females, either locally (even at the level of one quarter) or parenterally, will be separately milked due to antibiotic residues contained. These residues have a negative impact both directly on the consumer health, and indirectly through the degradation of the bacterial populations used in the dairy industry. Le Breton et al 2007 draw attention to hypersensitivity and allergic reactions to antibiotic residues in some people, while Fonseca et al (2009) reports hearing problems as toxic effect to human beings due to streptomycin, and allergy problems and anaphylactic shock caused by penicillin. Even at levels below 1 ppm (micrograms per gram), antibiotic residues seem to have an effect on the human gut flora (Corpet 1987). Antibiotic residues cause the slowness of lactic acid development during cheese and yogurt manufacture (Cogan 1972). Erdogan et al (2001) showed that in the context of penicillin dose increasing in milk used for yogurt obtaining, the pH and syneresis also increased. In the same study was demonstrated that more than 0.0045 IU/ml penicillin in milk failed desired curd formation.

In conclusion, mastitis is an important cause of economic loss in the farms, by affecting the health of lactating females and the need to use costly treatments mainly based on antibiotics; the obtained milk from treated females must be retained on-farm and cannot be capitalized to the processing units. On the other hand, processing units are required to test milk at its reception for the presence of antibiotic residues in order to avoid financial losses related to the inefficiency of started cultures used and by obtaining improper fermented products which cannot be capitalized.

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