Evaluation of the Udders Health Status through Somatic Cell Count and the Californian Mastitis Test in Algerian Dairy Farms

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ABSTRACT

Mastitis is the most common infectious disease in dairy cattle farming. It is responsible for the quantitative and qualitative milk deterioration. The objective of this study is to evaluate the mammary health status, based on the individual cell count (ICC) of milk explained by the Californian Mastitis Test (CMT) score. A total of 280 milk samples from the central region of Algeria were examined. The mammary health diagnosis has divided the milk samples in two groups: the first has 55% of samples from the healthy udders. The second group includes 45% of samples from infected udders, about 5% of them with clinical mastitis which showed cell levels>5 million / ml indicating a very alarming epidemiological situation. The results obtained vary from one farm to another and within the same farm, depending on the hygienic practices diversity (P<0.05). The work carried out shows that good farming practices are necessary to maintain the safety of the product.

Key words: Algeria, Californian Mastitis Test, Cell count, Individual milk, Mastitis.

INTRODUCTION

Mastitis is an inflammation of the mammary tissue. The most common source is the penetration of bacteria in a quarter through the teat canal (Rodriguez-Zas et al., 2000; Seegers et al., 2003). Mastitis represents 38% of all morbidity cases and 30% of cows are affected by clinical mastitis once a year, 7% of them are slaughtered and 1% die due to mastitis (Seegers et al., 2003). Sub-clinical mastitis is one of the most common forms of disease in dairy cows (Sağlam et al., 2017). It is responsible for 70% of economic losses related to mastitis (Reksen et al., 2007), because of its deleterious effect on the milk quantity and quality (Petersson-Wolfe et al., 2010; Ruegg, 2011). Bacterial contamination of milk cows affected by mastitis makes it unsuitable for human consumption (Sharma et al., 2011). The evolution of mastitis is usually chronic because of the ability of bacteria to cope with the immune system (Petersson-Wolfe et al., 2010).

In general, lactating animals are predisposed to mastitis (Zachary and Donald Mc Gavin, 2017). Parity and age have been considered as major intrinsic risk factors for mastitis (Jingar et al., 2014; Haftay et al., 2016). On-farm, milking and hygiene are extrinsic risk factors (Haftay et al., 2016; Zachary and Donald Mc Gavin, 2017). During the dry period, about 10 to 17% of new intramammary infections develop and a large proportion of them are related to the presence of microorganisms in the environment (Pantoja et al., 2009).

Although several methods have been developed for the diagnosis of sub-clinical mastitis (Lam et al. 2009), the California Mastitis Test (CMT) is a rapid and reliable test for determining of somatic cell concentration in milk (Anderson et al., 2010; Bastan et al., 2015) and therefore, the identification of unhealthy milk.

The objective of this study is to evaluate the mammary health status of cows, based on the individual cell count (ICC) of milk explained by the Californian Mastitis Test (CMT) score.

MATERIALS AND METHODS

A total of 280 milk samples from 12 farms in the central region of Algeria were examined by the Californian Mastitis Test (CMT), over a period of one year starting from October 2016. For each farm monitored, an individual milk sample of 3 dairy cows was collected monthly at the end of each cow milking. Milk from the four quarters is taken to enable the detection of mastitis through individual cell count (ICC).

California Mastitis Test was performed according to the method described by Bennet (1993). The principle is based on the use of a solution of 4% sodium alkylaryl sulfonate with bromocresol purple at 1/10 000 which acts as a pH indicator. Three milliliters of milk are mixed with the same quantity of CMT reagent (Schalm-Test, Rhône Mérieux). The gentle shake is made. The CMT score ranges from 0 to 4 depending on the gel flakes formation (Farourt et al., 2003). Individual cell count (ICC) is explained according to this score (Table 1).
**Data statistical analysis**

A descriptive statistical analysis is carried out for the evaluation of means, standard deviations, minima and maxima of different parameters studied. Statistical analyzes of the data are performed with the software Statistica 8.0 (2008). The results obtained are the subject of an analysis of variance (ANOVA). The significance level is set at \( P<0.05 \).

**RESULTS AND DISCUSSION**

The mammary health diagnosis has divided the milk samples collected according to the results of the individual cell count in two groups: the first has 55% of the udders considered as healthy, as the cellular level \( < 4 \times 10^4 \) cells/ml of milk (score 1). The second group includes 45% of infected udders, with variable cell levels between score 2 and score 4. Forty of them diagnosed with sub-clinical mastitis. However, about 5% of infected cows with clinical mastitis showed cell levels \( > 5 \) million cells/ml, indicating a very alarming epidemiological situation (Table 2). Note that the test was sometimes repeated for females who responded positively to the CMT tests carried out during the previous controls in order to determine the mastitis evolution in these cows. The average of all the udders cell count in this study is \( 2.1 \times 10^5 \) cells/ml of milk.

By comparison, sub-clinical mastitis was detected in 79% of cows examined in the northeast region of Algeria (Bouaida-Asnoune et al., 2012). While Aggad et al. (2009) reported in western Algeria that mastitis was detected in 47% of individual milks, which is close to the results of our study. Elemo et al. (2017) in Ethiopia found that about 90% of cows were diagnosed with sub-clinical mastitis using CMT.

The results obtained vary from one farm to another depending on the diversity of breeders practices. Statistical analysis revealed a significant difference of individual cell count (ICC) by the farm (\( P<0.05 \)). They also vary within the same farm from one control to another. This may be related to the variability of mastitis risk factors in dairy cows in each farm according to the Table 3 below.

The farm 12 shows the two extremes: the highest rate in heavily infected udders (15.4% of the total examined in this farm) and the least important in sub-clinical mastitis (30.8%) compared to other farms. Unlike farms 3, 5, 9 and 11, where no cow showed signs of clinical mastitis, the unit 10 presents the most alarming rates of doubtful cows (53%) with cell counts ranging from 15.10^5 to 5.10^6 cells/ml of milk. Dellosse et al. (2006) noted that it is the type of mastitis that makes it difficult to control and monitor the animals. This can be explained by the obvious lack of hygienic practices which has aggravated the microbiological status of milk (total lack of washing and disinfection of udders, milk utensils and milking place) (Kaouche and Mati, 2017). Farm 6 seems to be the most affected by mastitis with an estimated rate of over 62% cows divided between sub-clinical mastitis (50%) and clinical mastitis (12.5%).

These results can only partially be explained because many factors influence the number of cells in the blood; even if the main cause of variation is the infectious status of the udder, other factors are not to be discarded such as the age of each cow, lactation number, lactation stage, production level and the season (Serieux, 1995), the beginning of the dry period, the first 50 days of lactation, teat morphology and the nutritional status of the herd (Nakov et al., 2014; Oliveira et al., 2015). An increase in the mammary infection with the cows age with a statistically significant effect was observed by Mir and Sadki (2018). They reported that cows in fifth lactation seem to be more likely to develop mastitis.

In the study conducted by Jingar et al. (2014), it was concluded that buffaloes were more resistance to mastitis as compared to cows. Further, increase in parity number leads to increased incidence of mastitis in both cows and buffaloes.

Enger, (2019) found that certain nutrients provided to the cow to support milk production could instead be used to treat mastitis, given the demand for substrates of activated immune cells. The same author underlines the importance of limiting the incidence and prevalence of mastitis so that this competitive nutrient use would not constitute an obstacle for improving milk production.

However, Patbandha et al. (2016) indicated that milk lactose decreased with increase in severity of infection. Milk

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**Table 1:** Interpretation of Californian Mastitis Test (CMT) (Faroult et al., 2003).

| Score | Gel aspect | Cell concentration | Interpretation |
|-------|------------|--------------------|---------------|
| 0     | No precipitation | 0 - 20.10^4       | No sub-clinical infection |
| 1     | Fine flocc which disappears after shaking | 15.10^4 - 50.10^4 | No sub-clinical infection |
| 2     | Clear flocc without tendency to gelation | 40.10^4 - 15.10^5 | Light sub-clinical infection |
| 3     | Thick flocc with gel formation (white egg consistency) | 8.10^5 - 5.10^6 | Net sub-clinical infection |
| 4     | Thick gel (spit consistency) | > 5.10^6       | Clinical infection |

**Table 2:** Distribution of the cows according to their cell concentrations in relation with CMT score.

| Number of cows | % | Cell concentration/ml of milk | Score | Interpretation |
|----------------|---|-----------------------------|-------|---------------|
| 153            | 54.64 | < 4.10^5                | 1     | No mammary infection |
| 114            | 40, 60 | 4.10^5 to 5.10^6          | 2 to 3 | Sub-clinical mastitis |
| 13             | 4, 74 | > 5 million cells          | 4     | Clinical mastitis |
samples with lactose content below 5.31g% were more likely to come from moderately infected quarters; whereas, below 5.23g% were more likely come from severely infected quarters. A higher incidence of mastitis in forequarters in comparison to hindquarters has been found by Tufani et al. (2012). It could be due to slight larger size of the quarter which readily becomes more prone to external injury, microbial proliferation and resulting in mastitis.

**CONCLUSION**

The results clearly provide information on the health status of the herds examined and show that the presence of cells in the milk at the lower or higher levels can harm its hygienic quality. However, it is necessary to make dairy farmers aware about the mastitis influence on the cow health, milk yield and the quality. Other studies should be considered in order to mainly determine the effect of intrinsic factors such as age, race, lactation stage, lactation number and genetic factors on the variation of the mastitis intensity in the dairy cattle.

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