Original scientific paper
Оригиналан научни рад
UDC 636.2:637.1]:618.19-002
DOI 10.7251/AGREN2202087Š

University of Banjaluka, Faculty of Agriculture
Agro-knowledge Journal

Influence of mastitis on reproductive parameters in holstein-freisian cows

Milenko Šarić[1], Zora Čolović-Šarić[2], Dragana Rujević[3], Mišo Vejin[1]

[1]Veterinary and livestock center a.d. Banja Luka, BiH
[2]University of Banja Luka, Faculty of Agriculture, Republika Srpska, BiH
[3]JU Veterinary Institute "Dr Vaso Butozan" Banja Luka, Republika Srpska, BiH

Abstract

As mastitis is one of the most significant causes of health problems in dairy cows and, besides economic, also has other negative effects, the aim of this paper is to study the influence of mastitis on reproductive parameters in cows that have an evident and clinically obvious mastitis. In this study we observed the duration of the "service period" and the number of inseminations (frequency of abortions) as reproductive parameters, up to the time of the next conception of lactating cows. Our research was carried out on a farm with Holstein-Friesian cows in duration of 15 months with breaks. First, 30 heads of cattle of various age were selected, the number of their lactations from 3 to 6. We took samples from the whole amount of milk twice a month in order to find out the number of somatic cells on the farm. The California Mastitis Test was carried out in all selected cattle. From all of the quarters of selected cows which showed a positive reaction with CMT, we took samples of udder (milk) secretion and sent them to the laboratory in the "Dr. Vaso Butozan" Veterinary Institute to estimate the number of somatic cells. Highly sophisticated equipment Fossomatic FC was used to identify the found microflora for these purposes. In all of the 30 cows a secretion disorder was found in one quarter: in 3 cows – in the front left quarter; in 5 cows - in the front right one; in 12 cows - in the back left one and in 10 cows - in the back right udder quarter. After the appropriate therapy was administered, we took the samples of udder secretion again in order to estimate the number of somatic cells. By this study it was estimated that the calving to conception interval in cows with clinical mastitis was ±76 days and the insemination index 2.6.

The calving to conception interval referring to the farm in whole was ±53.2 days and the insemination index 1.96. Clinical mastitis followed by the increase in the number of SC prolongs the calving to conception interval to the significant extent, i.e., increases the insemination index.

Key words: mastitis, calving to conception interval, somatic cells

Introduction

Main losses on lactating cow farms are caused by complex disorders that directly or indirectly lead to the culling of breeding females. More than a half of culling is connected with breeding females with health problems. Primary causes of culling are reproductive disorders, mastitis, laminitis, and low productivity.

All of the health problems in lactating cows are, in general, followed by certain reproductive disorders. In big animal agglomerations, there is mostly a prolonged period between two calvings, i.e., the time of "service period", conception in animals is low and they abort more often. These facts have their influence on the animal exploitation period and on production efficacy.

In the last several decades chronic contagious diseases, such as tuberculosis or brucellosis, have not been playing an important role, while mastitis, especially its latent and chronic forms, have become a specific health problem in highly productive dairy cows. Therefore, a significant attention is paid to secretion disorders in dairy cows udder (Šarić, 1999).

Mastitis and reproductive capability ratio in lactating cows have not been studied to a great extent. Mastitis is the most expensive disease in dairy industry (Harmon, 1994). Although preventive and therapeutical measures were caried out, in most countries with developed cattle farming there were 20-30% cows with an infected udder (Bratlie, 1972).

In France, Beaudeau et al. (2000) systematized eight (8) groups of primary causes of dairy cows: a mammary gland (12.4%), infertility (28.4%), laminitis (2.7%), low productivity (16.7%), urgent reasons (3.9%), interest selling (5.9%), planned reasons (25.4%), and other health reasons (4.6%).

Health condition of a mammary gland is one of the most significant factors of total hygienic quality of milk. Therefore, it is understandable that a modern dairy industry attempts to continue the trend of decreasing cow mastitis. In many countries programs of mammary gland disease control led to a significant decrease in the number of cows with mastitis (Radostits et al., 1994).

However, there are still many problems. So, Ribeiro et al., 2003; Silva et al., 2004; Bell et al., 2010., inform that in the GB, the USA and Brazil 90% of culling refers to infertility, mastitis, laminitis, and low production.

Evaluations show that annual losses caused by mastitis in the USA are between 82 and 200 $ per cow (Jasper et al., 1979). The biggest part of losses (70%) referred to low milk production, production of low-quality milk, buying of new cattle, and expenses for medicines (Harmon, 1994). Losses per cow, caused by mastitis, in Switzerland were 120 CHF (Schallibaum, 1995). Total amount of milk in cows with mastitis decreases and by quarter is 15-40%. It depends on ethiology, infection type and its duration, and on the extent of mastitis. Decreased milk production in the infected quarter by 30% is partly compensated by increasing secretion of healthy quarters, so that the total losses are 20% (Jones et al.,1994).

The biggest problem for the hygienic quality of milk is subclinical mastitis, which, in absence of regular control, remains uncovered (Rujević, 2013).

One of the most important criteria for the evaluation of udder health condition, quality of milk and its suitability for processing is the number of somatic cells. Expressions such as cell number, leukocyte number, total cell number, body cells, etc. are replaced by the term "somatic cells" in 1968 (Schalm et al., 1971).

A significant attention is paid to the number of somatic cells as to a test for the estimation of disordered secretion in the mammary gland caused by mastitis or other reasons, and as to a test for milk quality standardization as well. Differential cell counting has a significant value in differentiation of normal milk from the milk with disordered secretion of the mammary gland. In general, it is accepted that the presence of neutrophiles above certain percentage represents abnormality, while the increase in the number of somatic cells limited on epithelial cells may be physiological (Randolph & Conner, 1966).

Chemical composition of milk changes when the somatic cells reach 250,000/1ml. Activity of many enzymes in mastitical milk is increased. These primarily refer plasmin, acid and alkaline phosphatase, catalase, lipase, xantyn-oxydase, oesterase, and lactat-dehydrogenase (Kitchen, 1981; Harmon, 1994).

Period of milk coagulation is prolonged by 25-50% when milk contains >500,000/1 ml of somatic cells (Rogers & Mitchell, 1994).

Milk containing a relatively low number of somatic cells of 200,000 ml is not suitable for yoghurt production. During our survey of two months we observed that the number of somatic cells in milk in cows with healthy and good shaped udder and in different lactations was <150,000/1 ml. This is a clear evidence that the number of somatic cells does not depend on the age of cattle, i.e., on the number of lactations, but exclusively on the udder health condition. A large number of somatic cells in milk in cows with more lactations is not a physiological phenomenon, but a result of infections which cows are exposed to during many lactations (Šarić, 1999).

Cows with clinical mastitis, ketosis, and rennet dislocation show low milk production and have a dramatic influence on fertility (Esslemont, 2003).

In domestic literature there are not many data about the influence of mastitis on reproductive parameters in lactating cows.

Matarugić et al. (1997; 2002) examined the causes of low fertility in first-time calving cattle imported from abroad. Cows were twice gynecologically examined after calving, within 10-15 and 21-30 days. Reproductive disorders were found in cows, such as endometritis, degeneration, and hypofunction of ovaria. Using an appropriate therapy, in 83.3% of cases endometritis was cured and in 81.8% of cases degeneration and hypofunction were cured. After oestrus induction and synchronization, oestrus appeared in 75% of the treated cattle. A service period lasted approximately 105 days.

Caraviello et al. (2006) confirm that in the GB in the 1950s and 1960s, infertility was a reason for culling in 5% cases and at this moment even in 20%, as well as that the exploitation period of lactating cows was 3.03 years. In the first three lactations 52% of the cattle was culled. Mastitis was more often a reason for culling when lactating cows were older. As mastitis is one of the most significant causes of health problems in dairy cows and, besides economic, also has other negative effects, the aim of this paper was to study the influence of mastitis on reproductive parameters in cows that have evident and clinically obvious mastitis.

In this study we observed the duration of "service period" and the number of inseminations (frequency of abortions) as reproductive parameters, up to the time of the next conception of lactating cows.

Material and methods

We carried out our research on a farm with black spotted cows. This breed is characteristic by a big agglomeration of cattle at the same place and this breed is faced with a series of zoohygienic and epizootiological problems connected with the environmental microbiose.

Due to the technical and financial problems, our research lasted about 15 months with breaks. In that period we selected 30 heads of cattle that, according to the data on the farm, had healthy problems with udder. The cows were of various age and with the number of lactations between 3 and 6.

As the number of somatic cells in milk is a reliable indicator of mammary gland health condition, we took samples from the whole amount of milk twice a month in order to find out the number of somatic cells on the farm. The samples were immediately treated with azodiol, a preservative which can hold intact somatic cells.

After the selection we applied the California Mastitis Test in order to observe the situation with milk secretion in all of the selected cattle.

From all of the quarters of selected cows which showed a positive reaction with the CMT, we took samples of udder (milk) secretion and sent them to the laboratory in the "Dr. Vaso Butozan" Veterinary Institute to estimate the number of somatic cells. Highly sophisticated equipment BactoScan FC, MilkoScan FT 6000, and Fossomatic FC was used to identify the found microflora for these purposes.

In all of the 30 cows a secretion disorder in one quarter was found: in 3 cows – in the front left quarter; in 5 cows - in the front right one; in 12 cows - in the back left one and in 10 cows - in the back right udder quarter.

All cows were treated according to the antibiogram results. After the appropriate therapy was administered, we took the samples of udder secretion again in order to estimate the number of somatic cells.

As oestrus in cows appears in principle every 21 day, we monitored if oestrus appeared in the selected cows as a control group after partus and also in the 30 other cows that did not show health problems. It is usual that the first oestrus after partus is omitted, which was the case on this farm.

We monitored the number of inseminations and registered them in the "book of inseminations".

Results and discussion

It was noted that the annual average number of somatic cells was 51,000/ml on this farm. The lowest number was in January – 17,000/ml and the highest one in September – 81,000/ml.

Tab. 2. Results of analyses of the somatic cells number on the farm

Month	MM %	proteins %	lactose %	NSC %	Num. SC/ml
January	4.43	3.87	4.64	9.47	17,000
	4.17	3.65	4.66	9.21	
February	3.67	3.55	4.60	9.08	40,000
	3.46	3.62	4.62	9.11	
March	4.31	3.69	4.69	9.22	33,000
	4.32	3.88	4.67	9.44	
April	4.57	3.87	4.64	9.51	62,000
	4.44	3.76	4.66	9.38	
May	4.28	3.92	4.71	9.51	51,000
	3.96	3.89	4.65	9.44	
June	3.94	3.45	4.74	9.43	63,000
	3.54	3.65	4.86	9.33	
July	3.32	3.49	4.82	9.22	55,000
	3.85	3.94	4.85	9.53	
August	5.01	3.63	4.49	9.28	71,000
	4.37	3.74	4.51	9.86	
September	4.33	3.80	4.49	9.16	87,000
	4.58	4.14	4.41	9.18	
October	4.52	3.99	4.57	9.30	66,000
	4.74	3.94	4.52	9.48	
November	4.63	3.68	4.67	9.53	33,000
	4.78	3.76	4.65	9.40	
December	4.37	3.46	4.74	9.29	35,000
	4.05	3.63	4.73	9.35	

According to our expectations, the number of somatic cells increased during the summer due to high environmental temperatures. The influence of endogenic and exogenic factors on milk quality was reduced to the minimum. Therefore, the results showed the quality milk in „extra class“ during the whole year.

Tab. 3. Number of somatic cells in udder secretions from the quarters with positive CMT reaction

Number of sample	Num. SC		Num. inseminations	Service period/ days*
	I control	After therapy		
1.	663,000	62,000	4	105
2.	86,000	17,000	2	63
3.	240,000	40,000	2	64
4.	251,000	33,000	2	65
5.	194,000	51,000	3	85
6.	211,000	63,000	2	64
7.	197,000	55,000	3	86
8.	166,000	71,000	2	64
9.	97,000	35,000	2	63
10.	112,000	87,000	2	64
11.	143,000	66,000	3	87
12.	172,000	17,000	3	85
13.	312,000	66,000	3	85
14.	186,000	40,000	2	65
15.	130,000	45,000	2	63
16.	141,000	42,000	2	63
17.	180,000	40,000	3	85
18.	145,000	25,000	3	86
19.	130,000	33,000	2	63
20.	160,000	63,000	1	43
21.	1,641,000	530,000	5	128
22.	900,000	162,000	5	130
23.	368,000	51,000	2	65
24.	274,000	28,000	5	129
25.	208,000	63,000	2	64
26.	180,000	32,000	2	64
27.	154,000	55,000	1	43
28.	79,000	20,000	2	66
29.	591,000	71,000	3	87
30.	91,000	17,000	2	65
Approximately	280,000	66,000	77/2,566	2.282/76

*= the first oestrus omission included (21 days)

During this research, in 30 cows with udder secretion disorder the average number of somatic cells of 280,000/ml was estimated. The highest number of SC/ml was $1,6x10^6$ and the highest number of inseminations was 5.

It is also noted the average number of inseminations – 2.6 and the duration of the service period – 76 days.

According to the data obtained from the veterinary service on the farm, the average number of inseminations on this farm was 1.96 per female breeding,

which leads us to the conclusion that the service period was approximately 53.2 days for all the farm.

Conclusion

Clinical mastitis followed by the increase in the number of SC prolong the service period to significant extent, i.e., the number of inseminations.

The service period in cows with clinical mastitis was 76 days.

The average number of inseminations of cows with clinical mastitis was 1.96.

References

Beaudeau, F., Seegers, H., Ducroco, V., Fourichon, C., & Bareille, N. (2000). Effect of health disorders on culling in dairy cow: a review and critical discussion. *Ann. Zootech.*, *49*(4), 93-311. doi: 10.1051/animres:2000102

Bell, M.J., Wall, E., Russel, G., Roberts, D.J., & Simm, G. (2010). Risk factors for culling in Holstein-Friesian dairy cows. *Veterinary Record, 167*(7), 238-240. doi:10.1136/vr.c4267.

Bratlie, O. (1972). Dry cow therapy. *Nord. Vet. Med.*, *24*(9), 433-439

Caraviello, D.Z., Weigel, K.A., Fricke, P.M., Wiltbank, M.C., Florent, M.J., Cook, N.B., Nordlund, K.V., Zwald, N.R., & Rawson, C.L. (2006). Survey of Management Practices on Reproductive Performance of Dairy Cattle on Large US Commercial Farms. *Journal of Dairy Science*, *89*(12), 4723-4735. doi:10.3168/jds.s0022-0302(06)72522-x.

Esslemont, R.J. (2003). The costs of poor fertility and what to do about reducing them. *Cattle Practice*, *11*, 237-250.

Harmon, R.J. (1994). Physiology of Mastitis and Factors Affecting Somatic Cell Counts. *Journal of Dairy Science*, *77*(7), 2103-2112. doi: 10.3168/jds.s0022-0302(94)77153-8

Jasper, D.E., Dellinger, J.D., Rollins, H.M., & Hakanson, D.H. (1979). Prevalence of mycoplasmal bovine mastitis in California. *Amer. J. vet. Res.*, *40*(7), 1043-1047.

Jones, L.R., Rogers, G.W., & Wiliams, E.I. (1994). Management strategies culling. In Williams, E.I. (Ed.), *Proceeding of the twenty-seventy annual convention of the American Association of Bovine Practitioners, September, 22-25, 1994, Pittsburg, Pensylvania* (pp. 93-96). Pittsburg (USA): Frontier Printers, Inc.

Kitchen, B.J. (1981). Review of the progress of Dairy Science. *Journal of Dairy Research, 48,* 167-188.

Matarugić, D., Šarić, M., & Kovačević, Z. (1997). Uzroci izlučivanja mlečnih krava iz stada u našim poljoprivrednim dobrima. In *IV Savjetovanje veterinara RS, Teslić 1997, Zbornik radova* (pp. 220-223).

Matarugić, D., Šarić, M., & Čolović, Z. (2002). Uzroci smanjene plodnosti u prvotelki uvezenih iz inostranstva i način njenog suzbijanja. *Agroznanje, 4*(1), 53-61.

Radostits, O.M., Leslie, K.E., & Fetrow, J. (1994). *Herd Health: Food Animal Production Medicine, 2nd Edition* (pp. 183-214). Philadelphia (USA): W.B. Saunders Company.

Randolph, H.E., & Conner, D.J. (1966). Survey of abnormal milk programs administered by state regulatory agencies. *Journal of Milk and Food Technology, 29*(6), 188–190. doi: 10.4315/0022-2747-29.6.188

Ribeiro, A.C., Mcallister, A.J., & Queiroz, S.A. (2003). Efieto das texas de descarte sorbe medidas economicas de vacas leiteiras em Kentucky. *Rev. Bars. Zootec. 32*(6), 1737-1746. doi: 10.1590/s1516-35982003000700025

Rogers, S.A., & Mitchell, G.E. (1994). The relationship between somatic cell count, composition and manufacturing properties of bulk milk. *Australian Journal of Dairy Technology*, *49*, 70-74.

Rujević, D. (2013). *Uticaj somatskih ćelija i ukupnog broja bakterija na kvalitet sirovog mlijeka (Diplomski rad).* Univerzitet u Banjoj Luci, Poljoprivredni fakultet.

Schallibaum, M. (1995). Milk quality and mastitis control in Switzerland. *Dairy Science Abstracts*, *57*(1), 482.

Schalm, O.W., Carroll E.J., & Jain N.C. (1971). *Bovine mastitis*. Philadelphia (USA): Lea & Febiger.

Silva, L.A.F., Solva, E.B., Silva, L.M., Zrindade, B.R., Solva, O.C., Romani, A.F., Fioravanti, M.C.S., Souza, J.N., Franco, L.G., & Garcia, A.M. (2004). Causas de descarte de femeas bovinas leiteiras adultas. *Revista Brasileira de Saúde e Produção Animal, Salvador*, *5*(1), 9-17.

Šarić, M. (1999). *Kontrola mastitisa i higijenske ispravnosti mlijeka na bazi broja i porijekla somatskih ćelija (Doktorska disertacija)*. Univerzitet u Banjoj Luci, Tehnološki fakultet.

Утицај маститиса на репродуктивне параметре код крава холштајн-фризијске расе

Миленко Шарић[1], Зора Чоловић-Шарић[2], Драгана Рујевић[3], Мишо Вејин[1]

[1]*Ветеринарско-сточарски центар а.д. Бања Лука, БиХ*
[2]*Универзитет у Бањој Луци, Пољопривредни факултет, Република Српска, БиХ*
[3]*ЈУ Ветреинарски институт "Др Васо Бутозан"Бања Лука, Република Српска, БиХ*

Сажетак

С обзиром да маститиси представљу један од најзначајнијих здравствених проблема мљекарског говедарства и да поред економских имају и друге негативне утицаје, као циљ рада смо дефинисали утицај маститиса на репродуктивне параметре у крава које имају евидентан и клинички манифестан маститис.

Као репродуктивне параметре пратили смо дужину „сервис периода" и "индекс осјемењавања" (број осјемењавања до поновне концепције музних грла). Испитивања су проведена на фарми црношарих крава у трајању, са прекидима око 15 мјесеци. Одабрано је 30 грла различите старосне доби и бројем лактација 3 до 6. Два пута мјесечно анализирали смо узорке из цјелокупног млијека фарме, како би смо стекли утисак о кретању броја SĆ на цијелој фарми. Код свих одабраних грла извршили смо „Калифорнија маститис тест" (CMT). Из свих четврти одабраних грла, које су показале позитивну реакцију са CMT узели смо узорке секрета вимена (млијека) и доставили у лабораторију Ветеринарског института „Др Васо Бутозан" на утврђивање броја SC, који за ове потребе користи високософстицираном апарат *Fossomatic FC* и идентификацију нађене микрофлоре. Код свих од 30 грла утврђен је поремећај секреције у једној четврти и то код 3 у предњој лијевој, код 5 у предњој десној, 12 у задњој лијевој и 10 у задњој десној четврти вимена. Након проведене адекватне терапије поново смо узели узорке секрета вимена ради утврђивања броја SĆ.

Истраживањем је утврђено да је сервис период у крава са клиничким маститисом износио 76 дана, а индекс осјемењавања 2,6, док је за цијелу фарму сервис период износио 53,2 дана а индекс осјемењавања 1,96.

Клинички маститиси праћени повећањем броја SĆ значајно продужавају вријеме сервис периода и индекс осјемењавања.

Кључне ријечи: маститис, сервис период, соматске ћелије

Corresponding author: Milenko Šarić
E–mail: milenkosaric@yahoo.com

Received: May 11, 2022
Accepted: June 02, 2022