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Prevention of mastitis and hyperkeratosis in cows

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Abstract

Background and Aim. Mastitis in cows is widespread, causing great economic damage to agriculture. Treatment of the udder before and after milking is an important stage in the process of caring for the skin of the teats, aimed on preventing of infection of the udder and the development of hyperkeratosis, mastitis; to protect the sphincters of the teat after milking, specialized products are used for treatment by dipping the teat into a cup. In addition to antiseptic properties, these products should include caring components; they are necessary to soften and moisturize the skin of the nipple and accelerate the restoration of the epidermis.

Materials and Methods. The study of the preventive effectiveness of LACTIC DIP PRO against mastitis and therapeutic effectiveness of nipple hyperkeratosis was carried out in the Zhigar agricultural production complex of the Gergebil region of Dagestan Republic, on 45 Holstein cows, divided into two groups (experiment - control). For cows of the experimental group (n=30), all teats were treated with LACTIC DIP PRO, by dipping the teats into a glass during 40 days after each milking. Animals of the control (n=15) did not have their teats treated after milking and served as controls. The qualitative composition of milk was studied in the cows of the experimental group on days 15, 30 and 40 of the experiment.

Results. The hygienic product provided protection of the udder teats and mammary glands of the experimental cows from contamination by pathogenic microflora and the preventive effectiveness during the experiment was 100%.

Conclusion. No significant biochemical changes were observed in the milk of cows, therefore, the use of a hygiene product after milking does not impair the quality of milk.

Keywords: cow; hyperkeratosis; hygienic treatment; mastitis; mammary gland; prevention.

Introduction

Dairy farming plays an important role in agriculture, providing people with food. The main problem, facing dairy producers, is mastitis, an inflammatory disease of the udder in cows that can lead to serious consequences, for both animals and milk producers. Currently, this problem occurs in all countries of the world with developed cattle breeding. The extent of disease spread varies from 12 to 60% [1, 2, 3]. The disease is registered during the period of lactation, start-up and dry wood [4, 5].

The course and form of mastitis depend on the degree of virulence of the microflora, the state of the animal's local and general defense systems, the influence of unfavorable factors, the effectiveness and timeliness of treatment and preventive measures.

According to a number of authors, mastitis is mainly isolated from staphylococcus (*Staphylococcus*), streptococcus (*Streptococcus*) and, less commonly, Coliforme microbes [6]. Microorganisms can penetrate in to the mammary gland through the nipple canal, by lymphogenous, or hematogenous routes.

Most often, pathogen penetration occurs through the sphincter of the nipple [7]. After milking, the teat canal remains open during 30 minutes, however, if milking technology is violated, the time to restore of the teat canal may increase.

Inflammation of the mammary gland in highly productive cows is widespread. The greatest economic problem is represented by latent subclinical mastitis, which occurs in 4...5 times more often than clinically expressed ones. In mastitis, there is a decrease of milk production, deterioration of milk quality, impaired of reproductive function, premature culling of animals and treatment costs. In such milk there was a decrease of the content of fat, protein, lactose and an increase of the number of somatic cells [8].

The etiological causes of mastitis include a complex of reasons, including unsatisfactory sanitary and hygienic conditions of detention, violations of the milking routine, untimely identification of sick animals, as well as unbalanced feeding of dairy livestock [9]. Violation of the technology of machine milking can lead to injury to the udder tissue, the manifestation of hyperkeratosis on the nipples, which, in turn, provokes the appearance of mammary gland diseases, in particular, the development of mastitis [10].

Hyperkeratosis is excessive keratinization of the epidermis, expressed in thickening of the skin surrounding the opening of the teat canal in cattle. Changes in the structure of the teat tissue, especially in the area of the sphincter and the teat canal, due to disruption of machine milking, increase the risk of mastitis, since the effectiveness of the barrier function of the teat canal to infections decreases [11, 12]. In places where the epidermis of the nipples grows, conditions are created for the development of pathogenic microorganisms that can penetrate into the udder during and after milking, causing inflammation of the mammary gland.

In the conditions of modern livestock farming, positive dynamics in the fight against latent mastitis is provided by the use of pharmacological drugs for treatment and preventive measures to prevent the development of diseases of the udder and teats in cows during lactation.

Subclinical mastitis often develops into clinically pronounced inflammation of the mammary gland, and often causes atrophy of the affected quarters of the udder. Animals that have suffered from subclinical mastitis lose milk production by average 10-15% [13].

Treating of the udder before and after milking is an important step in the process of teat skin care, aimed on preventing infection of the udder and the development of mastitis [14].

The main goals of treating of teats before milking include caring for the skin of the udder, removing dirt and preventing it from getting into the teat rubber and into the milk line, and reducing of bacterial contamination of milk. To protect the nipple sphincters after milking, specialized means are used to treat the nipple by dipping it into a cup. In addition to antiseptic properties, the composition includes products to soften and moisturize of the skin of the nipples and accelerate the restoration of the epidermis. The protective film, formed after application of the product helps to reduce the time when the nipple is open to the penetration of pathogenic microflora.

A product for treating, the udder after milking based on lactic acid LAKTIK DIP PRO (developed by the VIC group) fits these criteria. The product has a complex composition, including: surfactants, softening, moisturizing and functional additives, allantoin, D-panthenol, which promotes nipple skin regeneration. The product forms a film, protecting the nipple canal from the penetration of microorganisms. LAKTIK DIP PRO has a high-quality color indication that allows you to control the quality of treatment of the udder teats after milking.

The purpose of the work is to study the preventive effectiveness of the hygiene product LAKTIK DIP PRO against mastitis and nipple hyperkeratosis.

Materials and methods

A study of the preventive effectiveness of LAKTIK DIP PRO against mastitis and therapeutic effectiveness in nipple hyperkeratosis was carried out in the Zhigar agricultural complex of the Gergebil region of Dagestan Republic.

For the first series of experiments, 45 heads of Holstein cattle were selected with an average productivity 6 tons per head per year. The animals were divided into two groups (experiment - control).

Cows of the experimental group (n=30) had all teats treated with LACTIC DIP PRO during 40 days after each milking by dipping the teats into a glass for “udder treatment after milking”, filled with at least 3/4 volume of the product. The size of the dipping container should ensure that at least 3/4 of the surface of the nipple skin is treated.

Animals in the control (n=15) did not have their teats treated after milking. Served as control.

The qualitative composition of milk was studied in the cows of the experimental group on days 15, 30 and 40 of the experiment.

In the second series of experiments, 31 heads were selected and divided into two groups (experiment - control). The experimental group included 16 heads with hyperkeratosis, in which, during 40 days after each milking, all teats were treated with LACTIC DIP PRO, by dipping the teats into a glass for “udder treatment after milking”, filled with at least 3/4 volume of the product. The size of the dipping container should ensure that at least 3/4 of the surface of the nipple skin is treated.

Animals of the control group (n=15) did not have their teats treated after milking and served as controls.

Results

Milk is a complete, universal food product; it contains almost all the nutrients necessary for humans and, therefore, is a highly valuable food product. It contains proteins, fats, carbohydrates (milk sugar), mineral salts, vitamins, and in a very easily digestible form, which is why milk is considered indispensable in the diet of adults and especially children.

The widespread spread of mastitis in cows has a serious negative impact on the development of dairy production due to the deterioration of the reproductive capacity of the livestock, a decrease in milk yield, culling of animals, and deterioration in the sanitary and technological qualities of milk.

The structural and mechanical properties of acid and acid-rennet curds also change; they have higher viscosity, lower density and separate whey worse.

Results of studying some physicochemical parameters of milk from experimental cows during 15, 30 and 40 days of the experiment.

A large number of antibacterial drugs used in the treatment of mastitis in cows do not meet modern requirements of veterinary medicine for reasons of insufficient therapeutic effectiveness, milk rejection for long periods, the emergence of resistance in pathogenic microorganisms, and inhibition of natural neurohumoral mechanisms of local and general defense of the body.

Udder treatment before and after milking is an integral part of cattle udder care, and is important for the prevention of mastitis. When choosing products for treating the udder, pay attention to the physical characteristics, of which the most important are:

Film formation – after applying the product, a uniform film should form, covering the sphincter of the udder nipple;

Minimal drip after application;

Retention time on the nipple after application is at least 40 minutes while maintaining the integrity of the film;

Color indication of the treated udder teat, providing the possibility of visual control;

Consumption of product when treating udder teats.

The product for treating of the udder after milking “LAKTIK DIP PRO” has shown high preventive effectiveness against mastitis infection; its use in nipple hyperkeratosis also shows the therapeutic effectiveness. The product has high adhesive film properties, which allows you to protect the open nipple channel during 30 minutes. To assess the economic efficiency, the rate of fall of the product was calculated, which was 2 drops and high preservation of the film on the nipple, which allows reducing the amount of product consumed (Table 1).

Table 1 – Evaluation of the effectiveness of using of the product for treating of the udder after milking LAKTIK DIP PRO

Product viscosity/drop point	2 drops
Adhesive property of the film	High
Duration of fixation of the product on the nipple/minutes	30
Color intensity	Greenish
Drug consumption, ml/head	8,3
Allergic reactions	No
Incidence of mastitis, %	0
Manifestation of hyperkeratosis on the beginning of the experiment, %	16
Manifestation of hyperkeratosis on the end of the experiment, %	4

The data in Table 1 shows that the use of LACTIC DIP PRO in cows does not cause an allergic reaction; in the experimental group (n=30), within 40 days after birth, the incidence of mastitis was prevented on 100%, and the manifestation of hyperkeratosis decreased on 12%.

The results of studying of the physicochemical parameters of milk from in cows of the experimental group during 15, 30 and 40 days are shown in Table 2.

LACTIC DIP PRO has strong regenerative properties of the skin epidermis due to the presence of caring components in its composition, which had a therapeutic effect when used in animals with hyperkeratosis.

Correct and regular processing helps to maintain animal health, maintains of production performance and provides consumers with high-quality and safe dairy products.

Milk is a universal food product, it contains almost all the essential nutrients for humans and, therefore, is a highly valuable food product.

One of the significant issues in the fight against latent (subclinical) mastitis in lactating cows is their early diagnosis, which consists in determining of the sanitary indicators of the resulting milk: somatic cells, titometric and active acidity and bacterial contamination. The admixture of mastitis milk leads to changes in the chemical composition of the collected milk, as a result of which the biochemical and microbiological processes during its processing are disrupted. Such milk does not coagulate well with rennet, is less heat-sensitive, and production-valuable lactic acid bacteria do not develop well in it. The structural and mechanical properties of acid and acid-rennet curds also change; they have higher viscosity, lower density and separate whey worse.

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Results of studying of some physicochemical parameters of milk of experimental cows during 15, 30 and 40 days of the experiment.

As follows from Table 2, when studying milk in experimental cows after 15, 30 and 40 days, the number of somatic cells, pH, titratable acidity and density of milk during the study period corresponded to the physiological norm.

Table 2 – Milk parameters of cows of the experimental group (n=30)

Indicators	Research days		
	15	30	40
	$\bar{x} \pm m_x$	$\bar{x} \pm m_x$	$\bar{x} \pm m_x$
Content of somatic cells, 1sm ³ , no more	347693.17±4621.33***	387349.02±3977.21	372764.07±9752.14

Continuation of table 2

pH	6.64±0.01	6.63±0.01	6.64±0.01
Titrimetric acidity, °T	17.99±0.08	18.01±0.06*	17.94±0.08*
Density, kg/m ³	1028.17±0.03	1028.31±0.08	1028.42±0.11
Note: * – P <0.05, ** – P <0.01, *** – P <0.001			

As follows from Table 2, when examining of milk from experimental cows after 15, 30 and 40 days, all milk parameters studied corresponded to physiological parameters.

Discussion and conclusion

Studies have established that when treating of teats after milking in cows, the preventive effectiveness of the hygiene product LAKTIK DIP PRO was 100%, the therapeutic effectiveness in hyperkeratosis was 75.0%. The quality of milk in experimental cows remained within the physiological norm during the experimental period.

It was determined that the number of somatic cells, pH, acidity and density of milk remained within the physiological norm.

Thus, LACTIC DIP PRO for the prevention of mastitis and treatment of nipple hyperkeratosis is highly effective and can be recommended for wide practical use.

References

- 1 Алиев, А.Ю. Качественная характеристика молока коров после применения гигиенических средств [Текст] / А.Ю. Алиев, С.В. Федотов, Н.С. Белозерцева // Российский журнал «Проблемы ветеринарной санитарии, гигиены и экологии». - 2023. - № 3(47). - С.300-306. DOI: 10.36871/vet.san.hyг.ecol.202303007
- 2 Баймишева, Д.Ш. Факторы, обуславливающие возникновение маститов [Текст] / Д.Ш. Баймишева // Зоотехния. - 2007. - № 8. - С. 22-24.
- 3 Nelson, P.V. How to overcome mastitis [Text] / P.V. Nelson, S.S. Nickerson // Gea farm technologies. - 2010. - P. 6-7.
- 4 Rasmussen, M.D. The impact of automatic milking on udder health [Text] / M.D. Rasmussen, J.Y. Blom, L.A.H Nielsen., P. Justesen // Proceedings of the 2nd International Symposium on Mastitis and Milk Quality. -Vancouver, 2001. - P. 397-400. DOI:10.1016/S0301-6226(01)00275-5
- 5 Алиев, А.Ю. Влияние субклинической формы мастита на качественный состав молока [Текст] / А.Ю. Алиев, С.В. Федотов, Н.С. Белозерцева, И.М. Яхаева // Ветеринария и кормление. - 2021. - № 6. -P. 4-7.
- 6 Udder hygiene Guidebook [Text]: Guide to udder hygiene // GEA farm technologies rus. - 30-31 p.
- 7 Елесин, А.В. Заболевания сосков вымени [Текст] / А.В. Елесин, А. Баркова // Животноводство России. - 2008. - № 8. - P. 47-48.
- 8 Ковальчук, С.Н. Распространение и этиология маститов у коров в ряде регионов Республики Беларусь [Текст] / С. Н. Ковальчук, В. В. Петров, Н. В. Баркалова // Актуальные проблемы интенсивного развития животноводства. - Горки, 2008. - Вып. 11, ч. 2. - С. 255-261.
- 9 Башенко, М. Оценка вымени красно-пестрых первотелок [Текст] / М. Башенко, Л. Хмельницкий // Молочное и мясное скотоводство. - 2004. - № 3. - С.20.
- 10 Шамсиева, Л.В. Физико-химические показатели молока у коров с субклиническим маститом [Текст] / Л.В. Шамсиева // Ученые записки Казанской государственной академии ветеринарной медицины им. Н.Э. Баумана. - 2017. - № 232(4). -С.159-162.
- 11 Шахов, А.Г. Неотложные задачи профилактики мастита у коров [Текст] / А.Г. Шахов, В.Д. Мисайлов, А.Г. Нежданов, В.А. Париков // Ветеринария сельскохозяйственных животных. - 2005. - № 8. - P. 3-7.
- 12 Алиев, А.Ю. Лечебная и профилактическая эффективность препарата Мастифорт БС в сухостойном периоде у коров [Текст] / А.Ю. Алиев, А.С. Айгубова, Б.Б.Булатханов // Прикаспийский вестник ветеринарии. - 2023. - №. 2 (3). - С. 39-42.

13 Mein, G.A., Evaluation of bovine teat condition in commercial dairy herds: non-infectious factors [Text] / G.A. Mein, F. Neijenhuis, W.F. Morgan, D.J. Reinemann, J.E. Hillerton, J.R. Baines, I. Ohnstad, M.D. Rasmussen, L. Timms, J.S. Britt, R. Farnsworth, N. Cook, T. Hemling // Proceedings of the 2nd International Symposium on Mastitis and Milk Quality. - 2001. - P. 347-351.

14 Mein, G.A. Effect of milking on teat-end hyperkeratosis: Mechanical forces applied by the teatcup liner and responses of the teat [Text] / G.A. Mein, D.M.D. Williams, J. Reinemann // Proc. of 42nd Animal Meeting of the National Mastitis Council. - USA, Fort Worth Texas, 2003. - P. 114-123.

References

1 Aliev, A.Yu., Fedotov, S.V., Belozertsova, N.S. (2023). Kachestvennaya karakteristika moloka korov posle primeneniya gigienicheskikh sredstv [Qualitative characteristics of cows' milk after the use of hygiene products]. *Rossijskij zhurnal «Problemy veterinarnoj sanitarii, gigieny i jekologii» [Russian journal "Problems of veterinary sanitation, hygiene and ecology"]*, 3 (47), 300-306. DOI: 10.36871/vet.san.hyg.ecol.202303007

2 Baimisheva, D.Sh. (2007). Faktory, obuslovlivajushhie voznikovenie mastitov [Factors, causing the occurrence of mastitis]. *Zootehnika [Zootechnics]*, 8, 22-24.

3 Nelson, P.V. Nickerson, S. S. (2010). How to overcome mastitis. *Gea farm technologies*. 6-7.

4 Rasmussen, M.D. / The impact of automatic milking on udder health [Text] / M.D. Rasmussen, J.Y. Blom, L.A.H Nielsen., P. Justesen // Proceedings of the 2nd International Symposium on Mastitis and Milk Quality. - Vancouver, 2001. - P. 397-400. DOI:10.1016/S0301-6226(01)00275-5

5 Aliev, A.Yu., Fedotov, S.V. Belozertseva, N.S., Yakhaev, I.M. (2021). Vliyanie subklinicheskoy formy mastita na kachestvennyj sostav moloka [The influence of subclinical form of mastitis on the qualitative composition of milk]. *Veterinarija i kormlenie [Veterinary medicine and feeding]*, 6, 4-7.

6 Udder hygiene. Guide to udder hygiene. *GEA farm technologies*. 30-31.

7 Elesin, A.V. Barkova, A.S. (2008). Zabolevanija soskov wymeni [Diseases of the udder nipples]. *Zhivotnovodstvo Rossii [Animal husbandry of Russia]*, 8, 47-48.

8 Kovalchuk, S.N., Petrov, V.V., Barkalova, N.V. (2008). Rasprostranenie i jetiologija mastitov u korov v rjade regionov Respubliki Belarus' [Distribution and etiology of mastitis in cows in a number of regions of the Republic of Belarus]. *Aktual'nye problemy intensivnogo razvitija zhivotnovodstva [Current problems of intensive development of livestock farming]*, Gorki: BGSHA, 11, 2: 255-261.

9 Baschenko, M., Khmel'nitsky, L. (2004). Ocenka wymeni krasno-pestryh pervotelok [Assessment of the udder of red-and-white first heifers]. *Molochnoe i mjasnoe skotovodstvo [Dairy and beef cattle breeding]*, 3, 20.

10 Shamsieva, L.V. (2017). Fiziko-himicheskie pokazateli moloka u korov s subklinicheskim mastitom [Physico-chemical parameters of milk with subclinical mastitis in cows]. *Uchenye zapiski Kazanskoy gosudarstvennoj akademii veterinarnoj mediciny im. N.Je. Baumana [Scientific notes of the Kazan State Academy of Veterinary Medicine named after. N.E. Bauman]*. 232 (4), 159-162.

11 Shakhov, A.G. Misailov, V.D., Nezhdanov, A.G. Parikov, V.A. (2005). Neotlozhnye zadachi profilaktiki mastita u korov [Urgent tasks of preventing of mastitis in cows]. *Veterinarija sel'skohozjajstvennykh zhivotnykh [Veterinary medicine]*, 8, 3-7.

12 Aliev, A.Yu., Aigubova, S.A., Bulakhanov, B.B. (2023). Lechebnaja i profilakticheskaja jeffektivnost' preparata Mastifort BS v suhostojnom periode u korov [Therapeutic and prophylactic effectiveness of the drug Mastifort dc in the dry period in cows]. *Prikaspijskij vestnik veterinarii [Caspian Veterinary Bulletin]*, 2 (3), 39-42.

13 Mein, G.A., Neijenhuis, F., Morgan, W.F., Reinemann, D.J., Hillerton, J.E., Baines, J.R. Ohnstad, I. Rasmussen, M.D., Timms, L., Britt, J.S., Farnsworth, R., Cook, N., Hemling, T. (2001). Evaluation of bovine teat condition in commercial dairy herds: 1 non-infectious factors. Proceedings of the 2nd International Symposium on Mastitis and Milk Quality. 347-351.

14 Mein, G.A., Williams, D.M.D., Reinemann, J. (2003). Effect of milking on teat-end hyperkeratosis: 1 Mechanical forces applied by the teatcup liner and responses of the teat. Proc. of 42nd Animal Meeting of the National Mastitis Council. USA, Fort Worth Texas, 114-123.