

## Distribution, etiology and prevention of subclinical mastitis in cows

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### Abstract

According to the results of the diagnostic stage of obstetric examination in 2016–2018, the etiology and pathogenesis of mastitis in 90 cows of FG "Mriia" of Rivne region were analyzed. During the research, 83.3 % of the cows were diagnosed with breast inflammation. Subclinical form of udder inflammation was found in 51.1 %, clinical in 32.2 %, and at the same time hidden and clinical, in the same proportion – in 12.2 % of animals. In the farm, the cause of mastitis, were violations of sanitary and hygienic conditions of keeping cows and systematic technological underdevelopment of specialists in zootechnical and veterinary services. Frequent postpartum pathologies, including postpartum paresis and ketosis, contributed to the development of the disease. The experimental data for the study of the prophylactic and therapeutic effect of "Forticept" udder hygiene products on the condition of the breast, milk quality and cow productivity are presented. The "Forticept Udder Wash" antiseptic is used to prepare the udder for milking, and the "Forticept Udder Forte" film-forming agent is used to preserve udder nipples after milking is completed. It is established that the treatment, before and after milking, of the udder of cows by means of the "Forticept" complex, after 15 days allows to reduce significantly (by 55 %) the number of animals with subclinical mastitis (SFM). Within 30 days of "Forticept Udder Wash" and "Forticept Udder Forte", the incidence of SFM in the cows of the experimental group decreased from the starting 41.7 % to 19.0–23.0 %. Hygienic treatment of the cows udder with the drugs "Kenopur" and "Kenocidin" did not give the desired effect of reducing the manifestations of SFM: on the 30th day of the experiment, the number of positive milk samples in the control group increased by 4.0 % (up to 54 %). On the thirty-day "Forticept" series, only one new case of subclinical mastitis was diagnosed in the experimental group. The preventive effect of "Forticept Udder Wash" and "Forticept Udder Forte" on SFM is 96.0 %, in the preparations "Kenopur" and "Kenocidin" – 70.0 %. Reducing the incidence rate naturally contributed to the increase in daily milk yields, the improvement of milk quality indicators for fats, protein, casein and a decrease in the content of SC, KMAFanM1 and microorganisms. In the animals of the experimental group, the level of somatic cells was  $339.14 \pm 21.22$  thousand/ml by the end of the observation period and was 26.7 % lower than the control group. At that, the number of quarters of the breast with somatic cell content more than 400 thousand/ml of milk decreased in both groups, namely: in the experimental group – by 19.0 %, in the control group – by 15.1 %.

**Key words:** Forticept Udder Forte, cows, subclinical mastitis.

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### 1. Introduction

The pathogenesis of mastitis is dominated by bacteria that, under favorable conditions, have penetrated into the breast. Naturally occurring mechanisms have a number of mechanisms for preventing bacterial infiltration, in particular such obstacles are the keratin plug in the actual duct, the annular sphincter at the apex, which closes the duct after milking and the epidermis of the skin, performing a barrier

function (Semacan et al., 2012; Kushnir & Murska, 2017; Zhuk et al., 2017; Shevchenko et al., 2019). Reduced immunity, trauma, poor diet and animal hygiene are prerequisites for mastitis, the effective treatment of which depends on the correct and timely diagnosis, detection and elimination of associated threats. In the context of prevention of breast diseases, conditions and hygiene of milking require constant attention, new approaches, more detailed study and maximum coverage of advanced knowledge and achieve-

ments of innovative technologies (Kolos, 2012; Yurchenko & Bihun, 2012; Horiuk, 2018).

The key to preventing bacterial infiltration into the mammary gland is effective post-milking udder treatment. Nowadays, the most common methods of using hygiene products are dipping – dipping after milking the rods in a special glass with disinfectant solution and pre-packing if breast treatment is performed before milking (Kasianchuk et al., 2013).

In the veterinary market of Ukraine there is a considerable assortment of breast hygiene products, but their composition does not differ in the variety of active substances. The basis is preferably hydrogen peroxide, iodine, chlorhexidine and lactic acid. Particularly important in terms of composition and mechanism of action are the latest agents based on Quaternary ammonium compounds: “Forticept Udder Wash” with benzalkonium chloride and cosmetic skin care components (chamomile and yarrow extracts) and “Forticept Udder Forte”, which includes active components of artificial (benzethonium chloride) and natural origin (thyme oil, lanolin, chamomile extracts and yarrow).

The aim of the research was to study the etiology and pathogenesis of subclinical mastitis and to determine the effectiveness of “Forticept Udder Wash” pre-dumping and “Forticept Udder Forte” dumping in the prevention of subclinical mastitis and their effect on milk quality.

## 2. Materials and methods

The experiments were conducted in FG “Mriia” which is situated in village. Big Omelyan of Rivne district of Rivne region on cows of black-rippled breed, which are kept by stall-pasture system.

Two groups of cows of 7 heads each were selected for testing. The selection criteria was the number of somatic cells in milk of each quarter of the mammary gland, which were calculated using a portable optical somatic cell counter. A California test was used to determine the affected breast quarter. The amount of mesophilic aerobic and optional anaerobic microorganisms (KMAFanM) in milk was determined according to DSTU ISO 4833: 2006 (ISO 4833: 2003, IDT); DSTU (State Standard of Ukraine) IDF 100B: 2003 (IDF 100B: 1991, IDT); DSTU (State Standard of Ukraine) 7357: 2013.

Animals with clinically expressed mastitis were not included in the experiment.

The breast of the experimental group of cows was treated with udder hygiene series “Forticept” (Lidan Inc., USA). “Forticept Udder Wash” was diluted 1: 4 with water before use. The first was used in the form of foam obtained by foaming glasses, by fully immersing the nipples with an exposure of 30 s. After that, the milking of the first teats of milk was performed with a massage of the nipples, wiped dry and connected to the milking machine.

After milking, the nipples of the udder of the cows of the experimental group were immersed for 1–3 seconds in a dipping glass with a solution of the drug “Forticept Udder Forte”. As a result, a protective film was formed on the nipples, which prevented the pathogenic microflora from entering the milk duct of the udder before the next milking.

For cows of the experimental group for predipping were used classic for the farm preparations, namely a solution based on lactic acid. The pre-milking treatment of the udder of the cows was carried out with disposable wipes, which

were moistened with 0.5 % solution of “Kenopur” by the company “Sid Lines”. After milking, the nipples were immersed in a dipping glass with a “Kenocidin” composite solution based on chlorhexidine, mint, allantoin, lanolin, glycerol and sorbitol.

Statistical processing of the results was performed by variational statistics methods using Statistica 6.0 (StatSoft Inc., USA). Nonparametric research methods were used (Wilcoxon, Mann – Whitney criteria). The arithmetic mean ( $\bar{x}$ ), standard error of the mean (SE) was determined.

## 3. Results and discussion

According to the results of the diagnostic stage of obstetric examination during 2016–2018, 75 cases of mastitis were established in 90 cows of FG “Mriia” of Rivne region, during the dry and postpartum period. The results on the prevalence of various forms of mastitis in cows are given in Table. 1.

**Table 1**  
Prevalence of mastitis in cows

Indicator	Number of animals	
	n	%
Total cows	90	100
with mastitis:	75	83.3
including:		
- subclinical	46	51.1
- clinical	29	32.2
- subclinical and clinical	11	12.2

Totally, 83.3 % of cows were diagnosed with breast inflammation. Of the mastitis patients, subclinical progression of udder inflammation was found in 51.1 %, clinical in 32.2 %, and at the same time, hidden and clinical, in the same proportion in 12.2 % of animals. The largest number of cases ( $n = 36$ ) of subclinical mastitis occurred in the postpartum period.

Retrospective monitoring of obstetric pathologies and analysis of the farm of udder of cows of farm, revealed a number of organizational omissions, including: lack of accounting for cows suffering from mastitis during lactation, lack of diagnosis of subclinical mastitis, untimely isolation of sick cows from the general group. The disadvantages of the technological nature were the following: the animals lie on the floor in the manure alleys, enter the puddle on the playgrounds (with heat stress), used sawdust for litter (especially coniferous trees, which contributes to the contamination of *Klebsiella* sp.).

Other violations include non-compliance with the order of milking cows: mastitis patients were milked at the same time as healthy animals. The animals were treated without bacterial identification and their sensitivity to antibacterial agents. Often the course of treatment was too short – 2–3 days. It has been established that in the last two years, cows with mastitis have been treated with antibiotics of the cephalosporin series – “Tseftiodev” and “Tseftiokur”. Because the drugs do not have a withdrawal period cows were not isolated from the total herd. In addition, due to the lack of a veterinarian, the treatment was assigned to a milking machine operator, which did not contribute to controlling the disease. There have been no cases where the management of the farm has decided to cull cows that are constantly suffering

from mastitis and are a source of infection. Frequent post-ophthalmic pathologies have also contributed to the development of mastitis, among which were obstetrics, postpartum paresis and ketosis.

It is worth noting defects in the operation of milking equipment, which led to the violation of the technology of milking, namely excessive vacuum, overexertion (“dry milking”), the wrong ratio of milking and rest periods (not regulated pulsator), mismatch of the actual rubber. As a result, breast cancer diseases have become hyperkeratosis - excessive thickening of the tip of the cervix, which is gener-

ally known to increase by 2–3.5 times the risk of bacteria getting into the actual canal (Danylov & Vorobev, 2004).

Analysis of the results of clinical trials of 30-day administration of Forticept complex drugs to the cows of the experimental group showed that antiseptic hygienic means for udder “Forticept Udder Wash” and “Forticept Udder Forte” have a curative effect (Fig. 1). In half of the cases, the complete disappearance of the signs of subclinical mastitis (SFM) was observed. In addition, 15 % of sick cows initially affected by SFM had a 30-day remission during the experiment.

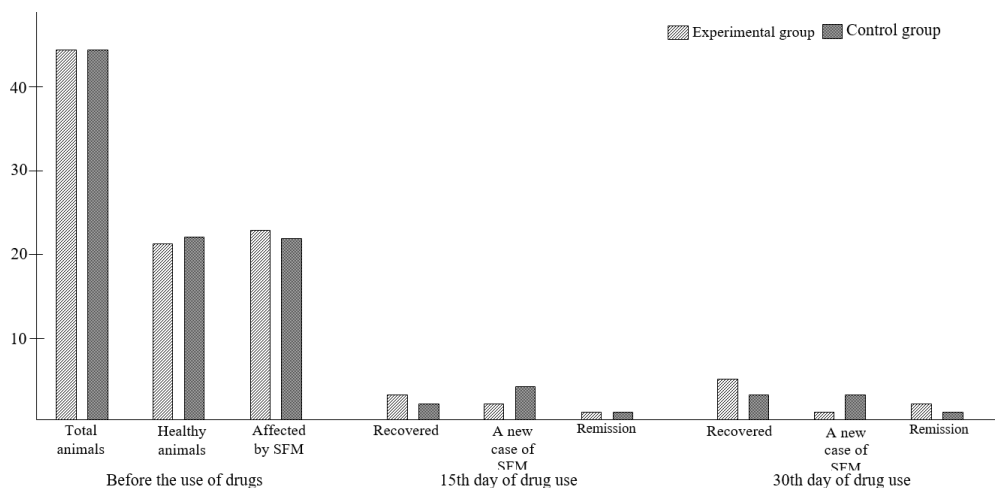


Fig. 1. Dynamics of cases of subclinical mastitis in cows,  $M \pm m$ ,  $n = 45$

It is established that the treatment of cow udders by means of “Forticept” complex before and after milking, after 15 days allows to reduce significantly (by 55 %) the number of animals with subclinical mastitis (SFM). For 30 days of application of “Forticept Udder Wash” and “Forticept Udder Forte” the dynamics of SFM, in cows of the experimental group decreased from the starting 41.7 % to 19.0–23.0 %. The use of the drugs “Kenopur” and “Kenocidin” did not reduce the incidence of manifestation of SPS. On the contrary, on the 30th day of the experiment, the number of positive milk samples in the control group increased by 4.0 % (to 54 %). During the month of “Forticept” series use, only one new case of an animal with subclinical mastitis was recorded in the study group. Thus, the prophylactic effect of “Forticept Udder Wash” and “Forticept Udder Forte” on SFM is

96.0 %. For the drugs “Kenopur” and “Kenocidin”, this effect was 70.0 %.

Reducing the level of lesions of the mammary glands naturally contributed to the increase in daily milk yields, quality indicators – fats, protein and casein, as well as a decrease in the content of SC, KMAFanM1 and the number of microorganisms in the milk of cows. In the animals of the experimental group by the end of the observation period, the level of somatic cells was  $339.14 \pm 21.22$  thousand/ml and was lower than the control group by 26.7 %. At that, the number of quarters of the breast with somatic cell content exceeding 400 thousand/ml of milk decreased in both groups, namely: in the experimental group – by 19.0%, in the control group – by 15.1 % (Table 2).

Table 2

Milk quality indicators,  $M \pm m$ ,  $n = 7$

Indicator	Study Group		Control Group	
	Impressions	On the 30th day	Impressions	On the 30th day
Daily hope, kg	$20.8 \pm 0.29$	$23.0 \pm 0.21^{***}$	$20.9 \pm 0.19$	$21.2 \pm 0.16$
Fat, %	$2.9 \pm 0.03$	$3.0 \pm 0.04^*$	$2.9 \pm 0.02$	$2.9 \pm 0.02$
Protein, %	$2.8 \pm 0.04$	$2.9 \pm 0.02^{***}$	$2.8 \pm 0.04$	$2.7 \pm 0.04^{***}$
Casein, %	$2.7 \pm 0.03$	$2.8 \pm 0.04$	$2.7 \pm 0.03$	$2.8 \pm 0.03$
The amount of SC, thousand/ml	$462.86 \pm 28.16$	$339.14 \pm 21.22^{**}$	$506.29 \pm 15.54$	$453.14 \pm 15.57$
KMAFanM1, CFU / ml	$2.3 \pm 0.03 \cdot 10^5$	$2.1 \pm 0.03 \cdot 10^5^*$	$2.2 \pm 0.02 \cdot 10^5$	$2.9 \pm 0.02 \cdot 10^5$
Total bacterial insemination, CFU/cm <sup>3</sup>	> 150	> 100	> 150	> 100
The presence of inhibitors	non-available	non-available	non-available	non-available

Note: \* –  $P < 0.05$ ; \*\* –  $P < 0.01$ ; \*\*\* –  $P < 0.001$

In addition, the use of Forticept series drugs yields stable yields with a tendency to increase: gross hope in the experimental group increased by 9.6 % over the 30-day period, while in the control group it increased by 1.4 %.

#### 4. Conclusions

1. During the study, 83.3 % of cows were diagnosed with breast inflammation. Of the mastitis patients, subclinical progression of udder inflammation was found in 51.1 %, clinical in 32.2 %, and at the same time, subclinical and clinical in 12.2 % of animals. The risk factors for mastitis in the farm were violations of sanitary and hygienic conditions of keeping cows, the presence of pathologies (obstetric care, postpartum paresis, ketosis, heat stress).

2. Means for udder hygiene “Forticept Udder Wash” and “Forticept Udder Forte” when combined for 30 days in 96.0 % of cases prevent the development of subclinical mastitis and in 50.0 % lead to recovery of diseased animals.

3. Milk from cows whose nipples were treated with “Forticept Udder Wash” and “Forticept Udder Forte” by bacteriological parameters according to the highest standards (according to GOST 3662-97): in particular, the amount of SC was 200 thousand/cm<sup>3</sup>, the total bacterial contamination – > 100 thousand/cm<sup>3</sup>. Inhibitory substances were not detected in milk samples.

4. The use of Forticept series drugs yields stable yields with a tendency to increase: the gross hope in the experimental group increased by 9.6 % over the 30-day period, compared to 1.4 % in the control group.

In the future, the effectiveness of “Forticept Udder Wash” and “Forticept Udder Forte” as goat pre-dumping and dipping will be explored.

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