



*Original Contribution*

## HYGIENE STATUS OF DAIRY COWS REARED IN A SPACIOUS BUILDING AND RESULTING QUALITY OF PRODUCED MILK

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### ABSTRACT

Important factors for spread of infections in rearing dairy cows are the buildings, rearing technology and the cleaning method. The exposure of the animals to dampness, mud and manure in the premises increases the percentage of subclinical and clinical mastitis. The objective of the study was to establish the relationship between the conditions in a large and spacious building and the hygiene of the reared dairy cows and the quality of the obtained milk. The studies were carried out in a building housing 500 dairy cows from three breeds. The building was one of the most innovative cattle buildings with a state of the art construction in Bulgaria. The dirtiness of cows, scaled 1-4, was assessed. The average values of the assessments showed that the upper-side thigh and the hind limbs were the dirtiest. Comparing the results from the individual milk samples, a positive correlation was registered between the hygienic status of the various regions and the number of somatic cells. It was established that, as a whole, the technological solution to the building and the method of cleaning the manure prevented a high degree of dirtiness in the animals.

**Key Words:** cow, hygiene, cowshed, bedding materials, subclinical mastitis, quality milk

### INTRODUCTION

In recent years dramatic changes have taken place in the dairy industry worldwide. Highly efficient managing strategies are implemented everywhere in the dairy herds which make it possible to produce milk in large quantities and in high quality. Nowadays cows have high genetic potential and are reared and fed in a different way compared to previous years. The on-going tendency for reducing the number of herds and increasing the size of the individual herd has resulted in labour and management specialization for the groups of animals, not for the individual specimen.

Normally the milk from healthy cows at first lactation contains up to 100 000 cells/ml, up to 200 000 cells/ml in subsequent lactations and if these exceed 250 000 cells/ml there is already an indication that an infection is taking place in the udder. The main causes of mastitis are the contagious pathogenic microorganisms - *Staphylococcus aureus*, *Streptococcus agalactiae*, etc. that increase to

a large extent the number of somatic cells and microorganisms from the surrounding environment - *Streptococcus uberis*, *Escherichia coli* and *Streptococcus spp.*, resulting in slower increase of somatic cells (1-4). Clinical mastitis continues to be a problem for many dairy farms, including the ones with the lowest values of somatic cells (5, 6).

Other important factors in the spread of infections are the buildings, the technology of rearing and cleaning. The exposure of the animals to dampness, mud and manure in the premises (places for rest, aisles for exercise and food) increases the percentage of subclinical and clinical mastitis (6-8). The bedding maintenance (type, nature, frequency of change, etc.) is basically a determining factor in the cleanliness of papilli and the number of bacteria on their tips (9). The presence of a large number of bacteria in the bedding often results in an outbreak of mastitis caused by the surrounding (10). The high values of organic matter and dampness in the bedding are a predisposing factor for the increased number of bacteria (11). The sand bedding has low values of organic matter and usually contains small populations of bacteria

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(12).

The objective of the study is to establish the relationship between the condition created in a large-dimensioned building to the hygiene of reared dairy cows and the quality of milk obtained from them.

## MATERIAL AND METHODS

Studies were conducted in a large-dimensioned farm for free-stall rearing with capacity of 500 dairy cows of three breeds (Holstein-Friesian cattle-123, Brown cattle-67 and Simmental mixed type-29), aged 2-5 years and average weight of 450 – 650 kg. The farm is one of the most innovative cattle buildings and of a high technical, technological and construction level in Bulgaria; it has six lines of individual cubicles on both sides of a central feeding aisle. Cubicles are covered with three layers of dry cattle manure and compacted (rolled) straw. The manure from the four technological aisles is transported by two scraper installations on both ends towards the middle of the building and enters a transverse two-course canal. All cows from the production group are milked in a milking parlour..

To assess the dirtiness of cows a four-point scale was adopted monitoring five regions of the body of the cow (udder, abdomen, upper-side thigh, hind limbs and tail) (13). According to the scale the four degrees are to be determined as follows: 1-clean, 2-slightly soiled, 3-medium-soiled and 4-heavily soiled.

The somatic cell count in the individual milk samples was determined by direct count according to IDF Standard 148 A:1995, Enumeration of Somatic Cells. The isolation and differentiation of mastitis pathogens is done according to the accredited method of the National Mastitis Council, 1999, Laboratory Handbook on Bovine Mastitis. NMC Inc., Madison, WI.

The results were processed by the computer statistics programme StaSoft 1984–2000 Inc. (Copyright 1990-1995 Microsoft Corp.). Differences are statistically determined at level of reliability  $p < 0.05$ .

## RESULTS

The conducted study concerning the hygiene of cows with free stall rearing in a large-dimensioned farm established that croup soiling has the greatest relative share 34.97%, followed by hind limbs 32.88% and tail

25.17%, while the abdominal region 7.00% and udder 5.60% have lower share in animals of the Holstein-Friesian bred (**Table 1**). In cows of the Brown cattle breed the most heavily soiled region were the limbs and the upper-side thigh with 32.84% each, followed by the tail 23.88%, udder 14.92% and abdomen 8.96%. The worst hygiene regarding the studied regions was recorded in the Simmental mixed type breed, at the tail 51.72%, abdomen and hind limbs 48.28%, upper-side thigh and udder 37.94%.

The average values of assessments recorded in the study revealed that the upper-side thigh and the hind limbs had the worst hygiene, respectively, 2.33, 1.82 and 2.34 for upper-side thigh and 2.20, 2.00 and 2.44 for hind limbs for the studied dairy cow breeds (**Table 2**).

By comparing the results from the produced individual milk samples positive correlation was found between the hygienic status and the somatic cell count, both for the animal as a whole and according to the assessment of the various body regions. The somatic cell count in hygienic scores 1 and 2 vary from  $182 \pm 31$  thousand/ml to  $211 \pm 27$  thousand/ml for the Holstein cattle, from  $181 \pm 11$  thousand/ml to  $196 \pm 19$  thousand/ml for the Brown cattle and from  $201 \pm 18$  thousand/ml to  $274 \pm 21$  thousand/ml for the Simmental mixed type. For hygienic scores 3 and 4 increase of the somatic cell count was recorded for all studied animal body regions, but as absolute values the greatest increase was recorded with poor score for the udder and the hind limbs  $286 \pm 21$  thousand/ml,  $294 \pm 32$  thousand/ml and  $351 \pm 18$  thousand/ml, respectively for the three animal breeds (**Table 3**).

Microbiological study of the milk samples from the animals showed hygienic score 3 and 4 for the various regions, with the following microorganisms isolated – *S. agalactiae*, *S. dysgalactiae*, *S. uberis*, *S. aureus*, CNS and *E. coli*.

The analysis of the results showed that the relative share of concealed mastitis was 14.45% at the average. A higher frequency of occurrence was recorded in subclinical mastitis (increased somatic cell count and presence of pathogenic microorganisms-61.06%) and secretion disorder (only increased somatic cell count-38.94%). The occurrence of clinical mastitis in the course of the study was 3.04% of all dairy cows.

**Table 1.** Relative share of studied animal body regions referred to the scale of hygienic status assessment in the various breeds

<b>Holstein-Friesian cattle - n=143</b>										
<b>Body region</b>	<b>Udder</b>		<b>Hind limbs</b>		<b>Abdomen</b>		<b>Upper-side thigh</b>		<b>Tail</b>	
	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
1	82	57.34	43	30.06	96	67.13	34	23.78	31	21.68
2	53	37.06	53	37.06	37	25.87	59	41.25	76	53.15
Total	135	94.40	96	67.12	133	93.00	93	65.03	107	74.83
3	6	04.19	35	24.48	8	05.59	24	16.78	25	17.48
4	2	01.41	12	08.40	2	01.41	26	18.19	11	07.69
Total	8	05.60	47	32.88	10	07.00	50	34.97	36	25.17
<b>Brown cattle – n=67</b>										
1	35	52.24	19	28.34	48	71.64	19	28.34	13	19.40
2	22	32.84	26	38.82	13	19.40	26	38.32	38	56.72
Total	57	85.08	45	57.16	61	91.04	45	66.66	51	76.12
3	6	08.96	16	23.88	3	04.48	16	23.88	10	14.92
4	4	05.96	6	08.96	3	04.48	6	08.96	6	08.96
Total	10	14.92	22	32.84	6	8.96	22	32.84	16	23.88
<b>Simmental mixed type – n = 29</b>										
1	11	37.92	11	37.92	11	37.92	7	24.14	7	24.14
2	7	24.14	4	13.80	4	13.80	11	37.92	7	24.14
Total	18	62.06	15	51.72	15	51.72	18	62.06	14	48.28
3	7	24.14	4	13.80	7	24.14	4	13.80	8	27.58
4	4	13.80	10	34.48	7	24.14	7	24.14	7	24.14
Total	11	37.94	14	48.28	14	48.28	11	37.94	15	51.72

**Table 2.** Average values of hygienic scores of the studied body regions in the various animal breeds

<b>Region / Breed</b>	<b>Holstein - Friesian cattle</b>	<b>Brown cattle</b>	<b>Simmental cattle</b>
Udder	1.51	1.47	2.14*
Hind limbs	2.20	2.00	2.44*
Abdomen	1.40	1.21	2.34*
Upper-side thigh	2.33*	1.82	2.34*
Tail	1.95	1.89	2.17*

## DISCUSSION

The assessment of the hygienic status of the animal and particularly that of the udder can be done easily and efficiently during milking. Such systems of assessing cleanliness of animals have been developed and implemented with time by many authors (4-6, 14).

Our results regarding the cleanliness of the various animal regions compared to the somatic cells count in the milk samples revealed that the status of the upper-side thigh, abdomen and tail did not have a reliable effect on the milk quality. Reneau et al., 2003 showed that tail, flank and abdomen cleanliness did not have direct effect on the linear assessment of the somatic cell count but the status of regions such as udder and hind limbs had reliably significant effect concerning the somatic cell count in the

obtained milk. The dirtiness of these regions is basically accounted for by insufficient hygiene in the premises, as well as the disproportion of cubicles for rest. In this case cubicles are regulated by length with the back confining bar as for the largest breed reared – the Holstein-Friesian, but smaller animals can be kept in these cubicles as well.

Numerous studies have identified the relationship between cow hygiene and somatic cell counts in milk (4, 14, 15). Cows with low dirtiness score of the udder and the hind limbs have had lower values of somatic cell counts compared to those with such dirty regions that resulted in higher frequency of occurrence of subclinical mastitis. Each cow with score of udder cleanliness  $\geq 3$  has had 1.5 times greater risk to develop udder inflammation, that is why when the four-point scale is used the ideal goal was not to find cows with scores 3 and 4 (6-8). The same

tendency has been registered by us in the dimensioned farm. study of dairy cows reared in a large-

**Table 3.** Correlation between the hygienic score and the somatic cell count

<b>Holstein-Friesian cattle - n=143</b>				
<i>Region</i>	<i>Hygienic score 1 – 2</i>		<i>Hygienic score 3 – 4</i>	
	<i>n</i>	<i>Somatic cell count thousand/ml</i>	<i>n</i>	<i>Somatic cell count thousand/ml</i>
Udder	135	183±42	8	286±21*
Hind limbs	96	211±27	47	272±34*
Abdomen	133	193±31	10	216±23
Upper-side thigh	93	182±37	50	203±34
Tail	107	191±28	36	214±27
<b>Brown cattle – n=67</b>				
Udder	57	196±19	10	294±32*
Hind limbs	45	187±24	22	301±27
Abdomen	61	189±23	6	194±17
Upper-side thigh	45	190±27	22	197±21
Tail	51	181±31	16	189±19
<b>Simmental cattle – n = 29</b>				
Udder	18	274±21	11	342±23*
Hind limbs	15	228±14	14	351±18*
Abdomen	15	211±24	14	301±27*
Upper-side thigh	18	201±18	11	286±31*
Tail	14	234±23	15	293±25

\*  $p \leq 0.05$

Factors such as type of bedding, frequency of cleaning it, maintaining the exercise areas, lactation stages have been used for assessing udder status (12). The study carried out by us revealed that the cubicle structure has been correctly designed but various breeds of animals are reared in the building, as well as animals with exterior modifications. That is by no means a prerequisite for additional soiling of animals. At the same time we recorded that in the course of over six months no regular supplementing and changing of the bedding in the cubicles has been carried out.

Extremely important for the occurrence and spread of udder inflammations is the hygiene of the individual animal. The observations reveal considerable variations regarding cleanliness of animals in the herds (11). The feeding of concentrated rations or root crops is related to thin consistency of the faecal matter and reducing the number of cows with good body hygiene (10). At the same time in milk samples obtained from cows with soiled udder pathogenic microorganisms from the environment have been found in the microbiological test (score 3 and 4) compared to animals with clean udder (score 1 and 2) (14). The microbiological results obtained by us correspond to these of a number of other teams that had carried out similar studies. That had necessitated the hygienic assessment of the udder to be

implemented in practice as a routine method in order to control milk quality as assessment of the animal body status is performed to control the feeding quality of farm animals (16).

The frequency of occurrence of concealed mastitis, 14.45% recorded by us, during the studied period is within admissible limits. The studies (1-3) show that the relative share of subclinical mastitis is about 20% of the cows in herds with isolates as follows: coagulase-negative staphylococci 28 %, coliforms 17% and streptococci from the environment 14 %. In our study the leading role with regard to pathogenic microorganisms from the environment was performed by *S. uberis*.

## CONCLUSION

The selected type of building for free rearing of cows in individual cubicles and mechanical scrapper cleaning of the manure mass are a good technological solution for preventing high level of soiling of the various body regions of the cows, thus reducing significantly the number of somatic cell count in the produced milk.

The established soiling of the various body regions of cows is accounted for mainly by negligence of the requirements for daily cleaning of individual cubicles and the regular supplementation and change of the bedding in

them.

A prerequisite for reducing soiling of animals and improving milk quality is the rearing of animals from breeds with close exterior dimensions for each individual production group.

The presence of high number of animals with level of dirtiness 3 and 4 is the precondition for presence of high number of somatic cells in milk and increased risk of subclinical mastitis.

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