

PARENCHYMAL LEUKOCYTE INFILTRATION, SOMATIC CELL COUNT AND DUCTUS PAPILLARIS LENGTH IN DAIRY COWS UDDER

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SUMMARY: Parenchyma leukocyte infiltration is characterized by physical, chemical and bacteriological changes in the glandular tissue of the udder. Also that have affect on the quality and quantity of milk, too. Somatic cell count is a useful predictor of intramammary infection. Ductus papillaris is first defense line of udder. The aim of experiment was to determine relation between ductus papillaris length, somatic cell count and leukocyte infiltration in mammary gland parenchyma. During three years, 26 dairy cows were excluded from production and send to slaughterhouse. A week before sending cows to slaughterhouse, milk samples were took to determine somatic cell count. Udders from slaughtered cows were taken for measuring ductus papillaris length and for histopathology. From 104 mammary glands, 36 (52,94%) glands were with length of ductus papillaris less 5 mm, with parenchyma leukocyte infiltration between 50-75% and with milk somatic cell count above 400.000/ ml. According to statistical correlation test, show positive correlation between ductus papillaris length, leukocyte infiltration in parenchyma and somatic cell count. Also, to statistical test ANOVA, all results are less 0.05 that means there is a statistically significant difference between leukocyte infiltration and milk somatic cell count.

Key words: *parenchyma, ductus papillaris, somatic cell count, dairy cow.*

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INTRODUCTION

Udder is a skin organ and belongs to tubuloalveolar type of glands (Pobrić 1990; Boboš and Vidić 2005). Glandular parenchyma was pink-gray in color, firmer consistency as opposed to fatty tissue that surrounds the gland. Parenchyma is a complex character and consists of glandular tubes with alveolar enlargement (Boboš and Vidić 2005; Sordillo and Nickerson 1988; Davidov et al. 2011). Cow teats are cylindrical and slightly inclined towards the ventrocranial. Their function is the secretion of milk into the environment, as well as suckling, which is the only way of feeding calves. Their shape and size depend on the shape and size of udder and milk production. Cow teat has only one channel -ductus papillaris with one hole-ostium papillae and it is the link between the internal system of milk secretion and the environment. Ductus papillaris is the main barrier to infection (Boboš and Vidić 2005; Davidov et al., 2011). Length of ductus papillaris and proper length of papillae varies and increases with increasing number of lactation. Most authors (Davidov et al., 2011; Sordillo and Nickerson 1988; Pobrić et al., 1998), reported that the length of the ductus papillaris is about 10 mm, but varies from 3 to 18 mm (McDonald, 1973; Hamann, 1987; Geishauser and Querengasser, 2000; Pauriud and Rasmussen, 2004; Pauriud et al., 2004), depending on the breed, and even the stage of lactation (McDonald, 1979). Ductus papillaris in last teats are 5-10% longer than the ductus papillaris on frontal teats (Pauriud et al., 2004; Pobrić, 1990). In dairy cows, udder has a simple defense system consisting of teat and udder. When pathogenic microorganisms penetrate this barrier, they are in the parenchyma of the udder and produce the toxin, leading to damage the wall, causing inflammation and tissue injury. Mc Donald (1975) argued that the length of the ductus papillaris is not associated with the emergence of new infections because udder quarters that were infected have not a longer ductus papillaris than quarters who were infected. Opposite him, Gulyas i Ivancsics (2000) suggested that all biological characteristics (udder-morphologic, pigmentation of teats and length of *ductus papillaris*) together with those influencing somatic cell count are to be taken into account in the selection aimed towards decreasing somatic cell count. Milking microorganisms located in the immediate vicinity papilla take the opportunity to penetrate the ductus papillaris, causing trauma and damage to the keratin layer or even mucosal channels (Capuco et al., 1992). Ductus papillaris may remain partially open for 1-2 hours after milking and during this period microorganisms can get in it. Pathogenic microorganisms are able to enter through an open ostium papilla, avoiding antibacterial activity (Khan and Khan, 2006). If microorganisms pass the first line of defense and penetrate into the tank, they get to the second line of defense which is consisting of polymorphonuclear leukocytes and macrophages the main phagocytic cells of the udder. Macrophages are more dominate leukocytes in uninfected and infected udder tissue (Davidov et al. 2011).

The aim of experiment was to determine relation between ductus papillaris length, somatic cell count and leukocyte infiltration in mammary gland parenchyma.

MATERIAL AND METHOD

During three years (2010-2012), 26 dairy Holstein-Friesian cows were excluded from production and send to slaughterhouse. A week before sending cows to slaughterhouse, milk samples were took to determine somatic cell count. Udders from slaugh-

tered cows were taken for measuring ductus papillaris and for histopathology. All samples were fixed in buffered 10% formalin, and dehydrated through a series of growing concentrations of ethanol and xylol treatment infused as a medium for the introduction of paraffin wax-molding means. Made paraffin molds were cut on microtome, at a thickness of 5 μ m. Stained with hematoxylin oesin and all were performed microscopic with light microscope. Histological analysis was performed on the Leica microscope. Chakly's quantitative method described by Mayer and Klein (1961) was used for assessment of the degree of impairment of the alveolar epithelium, lumen and alveolar stroma. The degree of leukocyte infiltration was determined based on the presence of inflammatory response cell in the visual field. Several neutrophil granulocytes and lymphocytes revealed leukocyte infiltration from 0% to 25%. A significant number of neutrophils with few cells of lymphocytes are leukocyte infiltrate from 25.1% to 50%. A massive infiltration of lymphocytes, a significant number of macrophages and rare eosinophils are leukocyte infiltration of 50.1% to 75%, and massive infiltration of lymphocytes and macrophages with a few plasma cells and eosinophils are leukocyte infiltration of 75.1% to 100%. Milk from all four quarters was taken before morning milking and whole milk samples were taken with milk meter for somatic cell count. When quarter milk samples were taken the teat ends were disinfected. Milk samples for somatic cell count were analyzed by the fluoro-optoelectronic method (Fossomatic; Foss Electric, Hillerod, Denmark).

For statistical analysis we used test of correlation and ANOVA test by Microsoft Excel 2007.

RESULTS AND DISCUSSION

Comparing the ductus papillaris length, and leukocyte infiltrate in the mammary parenchyma, are shown in table 1. It is observe dominant presence leukocyte infiltrate in those complex with the mammary ductus papillaris length less 5 mm and 5 to 10 mm.

Table 1. Parenchyma leukocyte infiltrate, ductus papillaris length and somatic cell count

Length of ductus papillaris	Leukocyte infiltrate				Total
	0-25%	25,1-50%	50,1-75%	75,1-100%	
≤ 5mm					
No. of mammary parenchymal	5	8	36	18	68
% of mammary parenchymal	4,81	8,65	52,94	17,31	65,38
Somatic cell count	420.000	450.000	550.000	470.000	
5-10 mm					
No. of mammary parenchymal	3	4	12	8	28
% of mammary parenchymal	2,88	4,81	11,54	7,69	26,92
Somatic cell count	390.000	410.000	450.000	450.000	
> 10 mm					

No. of mammary parenchymal	1	1	3	3	8
% of mammary parenchymal	0,96	0,96	2,89	2,89	7,70
Somatic cell count in milk	330.000	330.000	340.000	330.000	
Total No. of mammary parenchymal	9	13	51	29	104
Total, %	8,65	14,43	49,04	27,88	100

Ductus papillaris length and proper length of papillae varies and increases with increasing number of lactation. Most authors (Davidov et al., 2011; Sordillo and Nickerson 1988; Pobrić et al., 1998) reported that the length of the ductus papillaris is about 10 mm and it is similar to results in this study. From a total of 104 mammary gland parenchyma, in 68 (65.38%) mammary complexes with the length of the ductus papillaris less 5 mm was found mass of leukocyte infiltration and with milk somatic cell count above 400.000/ ml. Mass of leukocyte infiltration of 50.1 to 75% was present in 36 (52.94%) parenchyma shown in table 1.

Table 2. Correlation test between ductus papillaris length, milk somatic cell count and mammary gland parenchyma

Ductus papillaris length ≤ 5 mm	Somatic cell count	No. of parenchyma
	420.000	5
	450.000	8
	550.000	36
	470.000	18
Correlation test	0.986998	
Ductus papillaris length 5-10mm	390.000	3
	410.000	4
	450.000	12
	450.000	8
Correlation test	0.904992	
Ductus papillaris length >10 mm	330.000	1
	330.000	1
	340.000	3
	330.000	3
Correlation test	0.57735	

Results from statistical correlation test, show positive correlation between ductus papillaris length, leukocyte infiltration in parenchyma and somatic cell count, which indicate that ductus papillaris length has no influence on leukocyte infiltration and milk somatic cell count.

Table 3. ANOVA test between ductus papillaris length, milk somatic cell count and mammary gland parenchyma

	Somatic cell count	No. of parenchyma
Ductus papillaris length $\leq 5\text{mm}/$	420.000	5
	450.000	8
	550.000	36
	470.000	18
ANOVA test	0.048386	
Ductus papillaris length 5-10mm	390.000	3
	410.000	4
	450.000	12
	450.000	8
ANOVA test/ <i>ANOVA test</i>	0.008461	
Ductus papillaris length $>10\text{mm}/$	330.000	1
	330.000	1
	340.000	3
	330.000	3
ANOVA test	0.038091	

According to statistical ANOVA test all results are less 0.05 and it means that there is a statistically significant difference between leukocyte infiltration and milk somatic cell count and no statistical significant in ductus papillaris length.

CONCLUSION

Ductus papillaris length has no indicate as first line or barrier to the udder infection. Presence of different percentage leukocyte infiltration in mammary gland parenchyma has influence on somatic cell count in milk.

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LEUKOCITNA INFILTRACIJA PARENHIMA, SOMATSKE ČELIJE MLEKA I DUŽINA DUCTUS PAPILLARIS U VIMENU MLEČNIH KRAVA

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Izvod

Do leukocitne infiltracije parenhima vimena mlečnih krava dolazi zbog fizičkih, hemijskih i bakterioloških promene u žlezdanom tkivu. Ove promene u parenhimau vimena utiču na kvalitet i kvantitet mleka. Broj somatskih ćelija u mleku je koristan indikator intramamarnih infekcije. Ductus papillaris je prva linija odbrane vimena mlečnih krava. Cilj eksperimenta je da se utvrdi odnos između ductus papillaris-a, somatskih ćelija u mleku i broja leukocitne infiltracije u parenhimu mlečne žlezde. Tokom

tri godine, 26 krave su isključeni iz proizvodnje i poslate na ekonomsko iskorišćavanje. Nedelju dana pre slanja krava na ekonomsko iskorišćavanje, uzimani su uzorci mleka da bi se utvrdio broj somatskih ćelija u mleku. Vimeni zaklanih krava su uzeta da bi se izmerila dužina ductus papillaris papila i da bi se uradila patohistološka analiza. Od 104 mlečne žlezde, 36 (52,94 %) žlezda su bile sa dužinom ductus papillaris manje od 5 mm i sa leukocitnom infiltracijom parenhima između 50-75%. Broj somatskih ćelija u mleku tih krava je bio iznad 400.000/ml. Statističkim testom korelacije, uočava se pozitivna korelacija između dužine ductus papillaris-a, infiltracije leukocita u parenhimu i broja somatskih ćelija u mleku. ANOVA testom su dobijene vrednosti manje od 0,05, koje ukazuje na statističku značajnost između leukocitne infiltracije parenhima mlečne žlezde i broja somatskih ćelija u mleku.

Ključne reči: parenhim, ductus papillaris, somatske ćelije, mlečne krave.

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