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INFLUENCE OF SELENIUM ON MAMMARY GLANDS AND MILK SOMATIC CELLS IN DAIRY COWS

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SUMMARY: The proper functioning of the mammary gland requires high-quality diet, which is based on the presence of macro- and micro-nutrients, as well as proper sanitary conditions. One of the essential and most important micro-nutrients is selenium, which is part of the enzyme glutathione peroxidase, and has antioxidant effects. The research was conducted on two groups of cows, where group I was a control group, and group II received via food 50 mg / day of selenium. According to the blood test and blood serum analysis, we noticed that in the group I selenium levels were below the physiological limits, while in group II the level of selenium was within the margin of physiological values. Also, after conducting milk somatic cell count in groups I and II, we found that the majority of cows in the group I had a somatic cell count between 310.000 and 500.000/ ml and in the group II the majority of cows had somatic cell count between 210.000 and 300.000/ ml. According to the analysis of the correlation test, we noticed that there was a negative correlation with the second group of cows, because the increasing levels of selenium in blood serum cause a decline in the number of milk somatic cells. On the basis of these results we conclude that selenium is of great importance in the preservation and proper functioning of the mammary glands of cows.

Key wards: *selenium, somatic cell count, mammary gland, cow.*

INTRODUCTION

Selenium functions primarily as an antioxidant. Selenium is an integral component of the enzyme, glutathione peroxidase (Cortinhas et al., 2010; Joksimović-Todorović et al., 2007). This enzyme is an important part of the cellular antioxidant system, but glutathione peroxidase is water soluble and it is found in the cytosol of cells, not in cellular

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membranes. Selenium as a micronutrient is involved in the cellular antioxidant system (Engle, 2001; Spears and Weiss, 2008).

Cell processes, environmental insults and inflammatory responses produce compounds called free radicals. The major free radicals found in biological systems are superoxide, hydrogen peroxide, hydroxyl radical and fatty acid radicals. Free radicals are highly reactive compounds because they are missing an electron. Free radicals can react with nucleic acids causing mutations, with enzymes and render them inactive, and with fatty acids in membranes causing membrane instability. Free radicals can eventually kill cells and damage tissues (Knaapenet et al., 1999; Mukherjee, 2008).

In healthy dairy cows, about one-third of selenium in blood is in serum and two-third is in red cells. Selenium is incorporated into red cells only when the cell is made (Andrieu, 2008; Engle, 2001). Therefore, selenium content of the red cells reflects selenium intake 1 to 3 months ago. The selenium in serum mainly represents a transport pool and reflects the current status. Plasma or serum selenium will increase shortly after selenium is injected but the selenium content of red cells will not change for several weeks. Blood as a whole reflects longer term status but is somewhat sensitive to recent changes in selenium nutrition. The recommended level of selenium in blood serum of dairy cows is 8 to 10 mg/100 ml (Erdeljan et al., 2011; Gunter et al., 2003; Juniper et al., 2006).

Dairy cows bred on the soil where concentration of selenium is very low, should be fed with supplemental selenium (Arvidson et al., 2005; Joksimović-Todorović et al., 2007). Potential benefits include reduced clinical mastitis and reduced milk somatic cells (Barbano et al., 2006; Davidov et al., 2011; Weiss, 2002). Diets fed to cows should be supplemented with 0,3 ppm of selenium (NRC, 2001). In most situations, feeding 0,3 ppm provides adequate selenium, but occasionally that amount is not adequate. Certain conditions reduce the availability of selenium or increase its requirement.

The aim of our investigation is to determine influence of selenium on mammary glands and milk somatic cells in dairy cows.

MATERIAL AND METHODS

The examinations were performed on 30 cows of Holstein-Friesian breed. The cows were in similar physical fitness, lactating and giving approximately the same amount of milk. During the experiment, cows were living under the same conditions and were divided into two groups of 15 cows. The first group of cows was the control group and this group was not treated during the experiment, while the other group received 50 mg of selenium via food per day. Blood samples were taken after the morning milking from the caudal vein by applying the principles of asepsis and antisepsis. Tubes with appropriate needle were used for taking blood. The blood in tubes was left at room temperature for 24 hours to separate the serum. The level of selenium in blood serum was determined using gas-chromatography.

Milk samples were taken during the morning milking from each district. Milk somatic cell count of each udder quarter was determined by using Draminski device.

RESULTS

After morning milking we took milk from all four quarters of each cow and counted milk somatic cells. The results of milk somatic cell count are shown in Table 1.

Table 1. The distribution of cows in group I and II according to somatic cell count
Tabela 1. Distribucija krava u I i II grupi prema broju somatskih ćelija u mleku

Milk somatic cell count /ml *Broj somatskih ćelija u mleku/ml*	Group / *Grupa*	
	I (n=15)	II (n=15)
210.000-300.000	(20.00%) 3/15	(60.00%) 9/15
310.000-400.000	(53.33%) 8/15	(33.33%) 5/15
410.000-500.000	(26.67%) 4/15	(6.67%) 1/15

The results in table 1 show the value of somatic cells in milk of both groups: in group I 4 cows had milk somatic cell count between 410.000-500.000/ml, while the same value of somatic cells in group II had only one cow. A significant decrease of somatic cells was recorded in the second group that received food supplement of selenium. The results indicate the possibility of positive effects of selenium supplement in food to reduce the number of milk somatic cells, and thus to reduce the incidence of subclinical mastitis. Table 2 shows the average value of selenium in the blood serum in the first and second groups of cows.

Table 2. The average value of blood serum selenium in dairy cows I and II group
Tabela 2. Prosečna vrednost selena krvnog seruma krava I i II grupe

Group / *Grupa*	Average amount of selenium in blood serum(mg/100 ml) *Prosečnan saržaj Se u krvnom serumu (mg/100 ml)*
I	5.016
II	8.881

The average value of selenium in the blood serum differed between groups I and II of cows, where the group I had a level of selenium in blood serum below the physiological limits, as opposed to group II which had a level of selenium in blood serum in the lower margins of physiological value. However, cows from group II, which received 50 mg / day of selenium via food, had an increase in the concentration of selenium in blood serum and had a mammary gland in better functioning then cows from group I, which can be seen in Table 2. For better understanding of the influence of selenium on mammary gland and on milk somatic cell count, we made a statistical test of correlation, which provided us with important information. That statistical information is shown in Table 3.

Table 3. Test correlation between value of blood serum selenium and milk somatic cell count
Tabela 3. Test korelacije prosečne vrednosti selena u krvnom serumu I i II grupe i broja somatskih ćelija mleka

Milk somatic cell count/ml *Br. somatskih ćelija mleka/ ml*	Group I / *I grupa*	Group II / *II grupa*
210.000-300.000	3	9
310.000-400.000	8	5
410.000-500.000	4	1
	0.188982*	-1**

* Positive correlation, ** Negative correlation.

From the statistical analysis of data in table 3, it can be seen that the existence of positive correlation in group I indicates that the level of selenium in blood serum under physiological conditions causes growth of somatic cells in cow's milk. Unlike group I, in group II, which received selenium as a supplement in foods, we noticed the existence of negative correlations, indicating that increasing levels of selenium in blood serum cause a decline of the number of somatic cells in cow's milk.

DISCUSSION

Selenium is found in grass, tinned products and home-grown feeds, and it can be governed by geological/geographical situations and may be inadequate throughout the whole year. The cows from group I, in our examination, were fed with that quality of food. Our results indicate that cows from group I had a level of selenium in blood serum below the physiological limits, which indicate that they need to be fed with supplements of selenium. Our result is similar with authors (Arvidson et al. (2005) and Joksimović-Todorović et al. (2007). Erdeljan et al. (2011), Gunter et al. (2003) and Juniper et al. (2006)) who reported that the recommended level of selenium in blood serum of dairy cows is 8 to 10 mg/100 ml. In our examination, cows from group I had an average value of selenium in the blood serum 5.016 mg/100 ml, and in group II 8.881 mg/100 ml. Also, cows from group I, 12 of 15, had milk somatic cell count between 310.000 to 500.000and ml, which indicate subclincal mastitis. Only one cow of 15 from group II who received supplement of selenium in 50 mg/ day in food, had milk somatic cell count between 410.000 to 500.000/ml. Davidov et al. (2011), Barbano et al. (2006) and Weiss (2002) reported reducing subclinical mastitis and milk somatic cell count in cows who received supplements of selenium via food. The same was noticed in our examination, because the group II had received selenium supplements in food and milk somatic cell count was between 210.000 and 300.000/ ml. By using test of correlation we notice that group I had positive correlation, which indicate that level of blood serum selenium had negative influence on mammary gland and on milk somatic cells as well. In group II which received 50 mg/ day selenium in food, we noticed negative correlation, which indicated that physiological level of blood serum selenium had a positive influence on mammary gland and on milk somatic cell as well.

CONCLUSION

Selenium as a natural antioxidant plays an important role in maintaining the health of the mammary glands of cows. It enhances the activity of neutrophils, improves its ability to engulf and phagocyte pathogenic microorganisms. Adding selenium to cow's feed can prevent the occurrence of clinical and subclinical mastitis, and based on our results we can conclude that selenium has a large impact on the proper functioning of the mammary glands of cows.

REFERENCE

ANDRIEU, S.: Is the role for organic trace element supplements in transition cow health? Vet. J., 176:77-83, 2008.

ARVIDSON, A., EKMAN, T., EMANUELSON, U., GUSTAVSSON, A.H., SANDGREN, C.H., PERSSON, H., WALLER, K., SVENSSON, K.: Feeding factors associated with clinical mastitis of first party cows. In: Hogeveen, H. (Ed.), Mastitis in Dairy Production. Wageningen Academic Publishers, Wageningen, The Netherlands, pp. 629-634, 2005.

BARBANO, D.M., MA, Y., SANTOS, M.V.: Influence of raw milk quality on fluid milk shelf life. J. Dairy Sci., 89:15-19, 2006.

CORTINHAS, C.S., BOTARO, B.G., SUCUPIRA, M.C.A., RENNO, F.P. and SANTOS, M.V.: Antioxidant enzymes and somatic cell count in dairy cows fed with organic source of zinc, copper and selenium. Livestock Sci., 127:84-87, 2010.

DAVIDOV, I., BOBOŠ, S., RADINOVIĆ, M., ERDELJAN, M.: Uticaj selena na zdravlje mlečne žlezde krava. Letopis naučnih radova, 35(1)87-91, 2011.

ENGLE, T.E.: The role of trace minerals in immunity and lipid metabolism in cattle. Proc. Alltech`s 17th Annual Symp. Science and Techology in the Feed Industry. Nottingham University Press, Nottingham, UK, pp. 267-283, 2001.

ERDELJAN, M., DAVIDOV, I., BOBOŠ, S., RADINOVIĆ, M.: Nalaz nivoa selena u krvnom serumu kod krava u laktaciji. Letopis naučnih radova, 35(1)92-97, 2011.

GUNTER, S.A., BECK, P.A., PHILLIPS, J.M.: Effects of supplementary selenium source on the performance and blood measurements in beef cows and their calves. J. Anim. Sci., 81:856-864, 2003.

JOKSIMOVIĆ-TODOROVIĆ, M., HRISTOV, S., BOŽIĆ, A., RELIĆ, R., DAVIDOVIĆ, V., STANKOVIĆ, B.: Uticaj selena i vitamina E na zdravlje mlečne žlezde krava. Savremena poljoprivreda, 56(1)122-127, 2007.

JUNIPER, D.T., PHIPPS, R.H., JONES, A.K., BETRIN, G.: Selenium supplementation of lacting dairy cows: effect on selenium concentration in blood, milk, urine and feces. J. Dairy Sci., 89:3544-3551, 2006.

KNAAPEN, A.M., NEHLS, P., BORM, A.J.: Neutrophils cause oxidative DNA damage in alveolar epithelial cells. Free Rad. Bio. Med. 27:234-240, 1999.

MUKHERJEE, R.: Selenium and vitamin E increases polymorphonuclear cell phagocytosis and antioxidant levels during acute mastitis in riverine buffaloes. Vet. Res. Commun., 32:305-313, 2008.

NATIONAL RESERCH COUNCIL (NRC): Nutrient Requirements of Dairy Cattle. Natl. Acad. Press, Washington DC, 2001.

SPEARS, J.W. and WEISS, W.P.: Role of antioxidants and trace elements in health and

immunity of transition dairy cows. Vet. J., 176:70-76, 2008.
WEISS, W.P.: Relatioship of mineral and vitamin supplementation with mastitis and milk quality. In: Proc. Annual Meeting, National Mastitis Concil, Orlando, Florida, USA, 37-44, 2002.

UTICAJ SELENA NA MLEČNU ŽLEZDU I BROJ SOMATSKIH ĆELIJA MLEKA KRAVA

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Izvod

Za pravilno funkcionisanje mlečne žlezde, pored pridržavanja zoohigijenskih mera, neophodna je i kvalitena iskrana prvenstveno u makro i mikro nutritientima. Jedan od esencijalnih mikro nutritienta je selen, koji ulazi u sastav enzima glutation peroksidaze i ima antioksidativni efekat. Istraživanje smo sproveli na na visoko mlečnim kravama, koje su bile podeljene u dve grupe. I grupa je bila kontrolna, dok je II grupa dobijala u hrani 50 mg /danu selena. Nakon vađenja krvi i izdvajanja seruma, krvni serum je analiziran. Uočili smo da je nivo selena u krvnom serumu I grupe bio ispod fizioloških granica, dok je kod II grupe bio na donjoj margini fizioloških vrednosti. Takođe, nakon brojanja somatskih ćelija mleka I i II grupe, uočili smo da je najveći broj krava I grupe imao broj somatskih ćelija između 310.000 i 500.000/ ml, dok je najveći broj krava II grupe imao broj somatskih ćelija između 210.000 i 300.000/ ml. Analizom testa korelacije uočili smo da postoji negativna korelacija kod krava II grupe, jer sa povećanjem nivoa selena u krvnom serumu dolazi do pada broja somatskih ćelija mleka. Na osnovu dobijenih rezultata možemo da zaključimo da selen ima veliki uticaj na pravilno funkcionisanje mlečne žlezde krava.

Ključne reči: selen, somatske ćelije, mlečna žlezda, krava.

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