University of Novi Sad - Univerzitet u Novom Sadu
Faculty of Agriculture - Poljoprivredni fakultet

CONTEMPORARY AGRICULTURE
SAVREMENA POLJOPRIVREDA

The Serbian Journal of Agricultural Sciences
Srpski časopis za poljoprivredne nauke

NOVI SAD
Vol. 61
No. 1-2
2012.

UDC: 63(497.1)(051)-"540.2"

ISSN: 0350 - 1205

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Publisher / *Izdavač*:
UNIVERSITY of NOVI SAD, FACULTY of AGRICULTURE
UNIVERZITET U NOVOM SADU, POLJOPRIVREDNI FAKULTET

Address of editorship / *Adresa uredništva*:
FACULTY of AGRICULTURE, 21000 Novi Sad, Trg Dositeja Obradovića 8, R. Serbia
POLJOPRIVREDNI FAKULTET, 21000 Novi Sad, Trg Dositeja Obradovića 8, R. Srbija
Phones/*Telefoni*:
++381 21 450-355; ++381 21 6350-711; ++381 21 485-3482; Fax: ++021/459-761.
http://polj.uns.ac.rs/ , E-mail: blagoje.stancic@stocarstvo.edu.rs

Four issues in two volumes per year / *Četiri broja u dva volumena godišnje.*
Cirrculation 200 copies / *Tiraž 200 primeraka.*

Print / *Štampa:* „Štamparija Atelje“, Iriški put 30, Sremska Kamenica, Serbia.

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CONTEMPORARY AGRICULTURE / *SAVREMENA POLJOPRIVREDA* 61 (1-2) 95-103, 2012.
UDC: 63(497.1)(051)-"540.2" ISSN 0350-1205

UDC: 613.287.5:546.23

BLOOD SELENIUM CONCENTRATION, SOMATIC CELL COUNT AND THEIR CORRELATION AT FIRST AND SIXTH MONTH OF LACTATION IN DAIRY COWS

IVANA DAVIDOV, MIODRAG RADINOVIĆ, MIHAJLO ERDELJAN, BRANISLAVA BELIĆ, MARKO R. CINCOVIĆ, STANKO BOBOŠ[1]

SUMMERY: For the proper functioning of the mammary gland before the sanitation requires is a quality diet based on the presence of macro and micro nutrients. One of the essential and important micro-nutrient is selenium, which became part of the enzyme glutathione peroxidase, and has antioxidant effects. The research was conducted on thirty dairy cows Holstein breed, who received 0,3 mg/kg selenium supplementation in food daily. Samples were colected two times: at first and at sixth lactating months. The mean estimate of selenium blood concentration at first lactating month was 0.536µmol/l and at sixth lactating month was 0.601µmol/l. Average somatic cell count at first lactating month was 450.000/ml of milk and at sixth lactating month was 355.000/ml of milk. According to the analysis of the correlation test, negative correlation within blood selenium concentration and milk somatic cell count has been found . The increased levels of selenium in blood caused a decline in the number of milk somatic cell count. On the basis of these results it could be concluded 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 is an integral component of the enzyme, glutathione peroxidase (Cortinhas et al., 2010; Joksimović-Todorović et al., 2007). This enzyme is also an important part of the cellular antioxidant system, but glutathione peroxidase is water soluble and is found in the cytosol of cell, not in cellular membranes. Selenium as a micronutrient

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Original scientific paper / *Originalni naučni rad*
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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 (Knaapen et al., 1999; Mukherjee, 2008).

For the healthy dairy cow, about one-third of the selenium in whole blood is in serum and two-third is in the red cells. Selenium is incorporated into red cells only when the cell is made (Andrieu, 2008; Engle, 2001). Therefore, selenium content of the red cell reflects selenium intake 1 to 3 months previously. 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. Whole blood reflects longer term status but is somewhat sensitive to recent changes in selenium nutrition. Recommended level of selenium in blood of dairy cows is 0,6 to 0,9 μmol /l (Erdeljan et al., 2011; Gunter et al., 2003; Juniper et al., 2006).

The dairy cows raised in 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., 2011b; Weiss, 2002). Diets for 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 dietary selenium requirement is important for livestock health, and has been associated with a reduction in somatic cell count and the incidence of mastitis (Weiss et al., 1990; Weiss, 2002). Selenium supplementation of livestock diets may also enhance the nutritional quality of livestock products. Selenium supplements are in two principal forms, inorganic mineral salts and organic forms such as Se-yeast (Juniper et al., 2006).

Under normal dietary conditions, the majority of endogenous selenium is present in body tissues and fluids (Suzuki and Ogra, 2002). Selenium absorption occurs in the small intestine (Weiss, 2003) and after that, selenium transport to the blood and whole body, including udder.

Concentrations of selenium in serum and whole blood have been used as an index of selenium status because increased concentrations of selenium in serum or whole blood have been related to reduced milk somatic cell count, reduced mastitis and improved neutrophil function (Smith et al., 1984; Erskine et al., 1987; Cebra et al., 2003; Weiss and Hogan, 2005). The positive effect of selenium supplementation on clinical mastitis is probably mediated via effects of selenium on neutrophils and other immune cells.

Davidov et al. (2011) were conducted in two groups of 15 cows, where group I was a control group, and group II received 50 mg/day of selenium. According to the blood test and blood serum analysis, authors 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, milk somatic cell count in groups I and II shows

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 between 210.000 and 300.000/ ml. According to the analysis of the correlation test, a negative correlation was found. The increasing levels of selenium in blood serum cause a decline in the number of milk somatic cells. It has been concluded that selenium is of great importance in the preservation and proper functioning of the mammary glands of cows.

Aim of this investigation is to determine affect of selenium on mammary gland health and production in dairy cows.

MATERIALS AND METHODS

The study was performed on thirty Holstein cows approximate same body weight, ages 3 to 5 years and in first to third lactation, and they giving approximately the same amount of milk. All cows were stabling with dry straw for bedding and with ad libitum access to potable water, and feed by total mixed ration. The total mixed ration contained maize silage, grass silage, cracked wheat, soyabean meal, rapeseed meal, sugar beet and hay. Before conception and trough all lactating months all cows received 0,3 mg/kg selenium supplementation in food.

Sampling

Blood samples were taken two times: at first and at sixth lactating months. The same sampling procedure was used each time. After the morning milking samples were taken from the caudal vein by applying the principles of asepsis and antisepsis. 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 by mineralizing 1g of sample in 4 ml of 16 M HNO_3 and 2 ml of 9.8 M H_2O_2 within a closed-vessel heating block system. The solution was further diluted with water and selenium was subsequently determined using inductively coupled plasma mass spectrometry (Perkin Elmer Elan 6100 ICPMS, Massachusetts, USA). 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 by Microsoft Excel 2007.

RESULTS AND DISCUSSION

The selenium content of grass and its conserved products and of home-grown feeds may be governed by geological/geographical situations and may be inadequate throughout the whole year.

Selenium blood concentration was measured on 60 samples as well as somatic cell count in milk. The results on selenium blood concentration at first lactating month are in figure 1 and at the sixth lactating month are in figure 2.

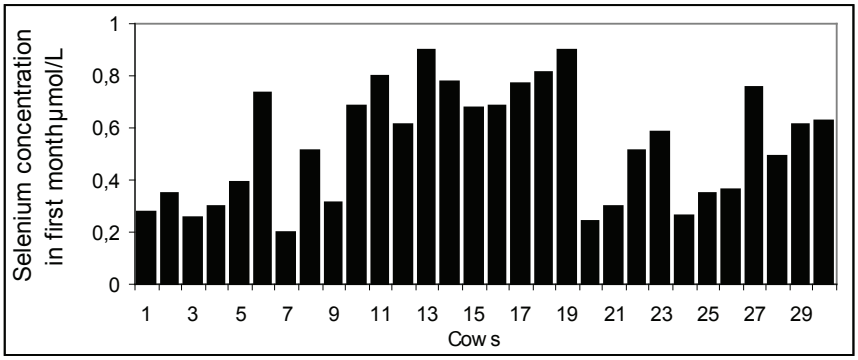

Fig.1. Selenium blood serum concentration at first lactating month of dairy cows
Graf.1. Vrednosti koncentracije selena u krvnom serumu krava u prvom mesecu laktacije

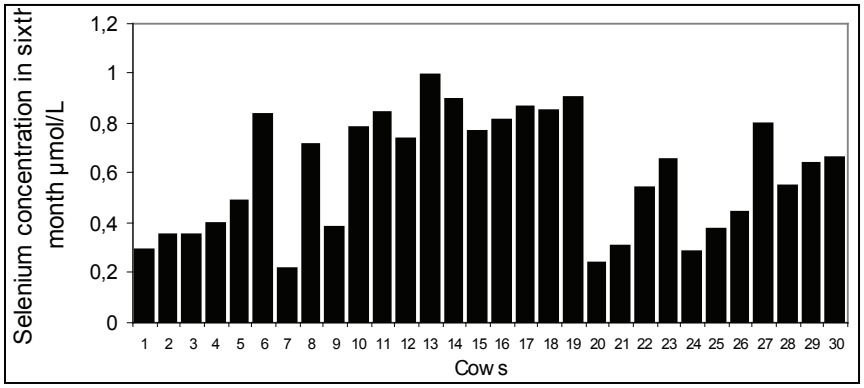

Fig. 2. Selenium blood serum concentration at sixth lactating month of dairy cows
Graf. 2. Vrednosti koncentracije selena u krvnom serumu krava u šestom mesecu laktacije

The mean estimate of selenium blood concentration at first lactating month was 0.536μmol/l and at sixth lactating month was 0.601μmol/l. Mean selenium concentrations were found to be lower within first lactating month, and then increased in the sixth lactating month. Results indicates that cows had a level of selenium in blood below the physiological limits, need to be fed with supplement of selenium. These results are similar to authors Arvidson et al. (2005) and Joksimović-Todorović et al. (2007).

Erdeljan et al. (2011), Gunter et al. (2003) and Juniper et al. (2006) reported that the recommended level of selenium in blood serum of dairy cows is 0,6 to 0,9 μmol /l. In this examination, cows at first lactating month had an average value of selenium in the blood 0.536μmol/l, and at sixth lactating month was 0.601μmol/l.

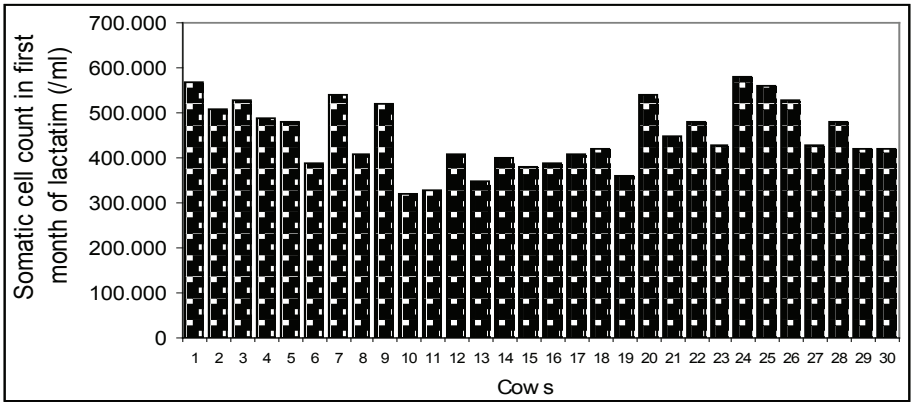

Fig. 3. Milk somatic cell count at first lactating month
Graf. 3. Broj somatskih ćelija u mleku u prvom mesecu laktacije

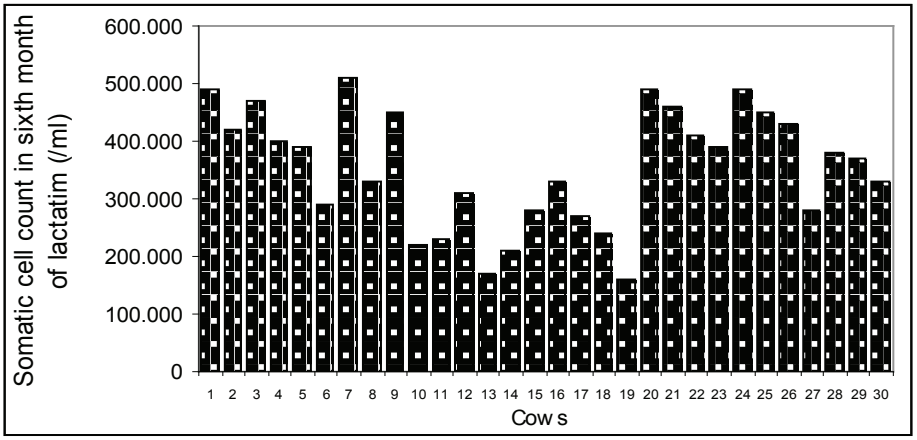

Fig. 4. Milk somatic cell count at sixth lactating month
Graf. 4. Broj somatskih ćelija u mleku u šestom mesecu laktacije

In figure 3 is value of milk somatic cell count at first lactating month, and in figure 4 is value of milk somatic cell count at sixth lactating month. Within first lactating month the somatic cell count of 43.33% (13/30) of the cows was over 450.000/ml. In the sixth month of lactating, 26.67% (8/30) of the cows had a somatic cell count over 450.000/ml. Average somatic cell count at first lactating month was 450.000/ml of milk and at sixth lactating month was 355.000/ml of milk.

A reduction in somatic cell count and the low incidence of mastitis are present with blood selenium concentration with estimate value 0.601µmol/l. This results are matched with group of authors Weiss et al. (1990), Weiss, (2002), Juniper et al. (2006), Phipps et al. (2008), Davidov et al. (2011), who claim that selenium has a important influence in reducing somatic cell count and incidence of mastitis.

Davidov et al. (2011b), Barbano et al. (2006) and Weiss (2002) reported reducing subclinical mastitis and milk somatic cell count in cows who received in food supple-

ment of selenium. That fact was noticed in this examination also, because the group of cow who had an average value of selenium in the blood 0.601µmol/l have milk somatic cell count between 150.000-240.000/ ml.

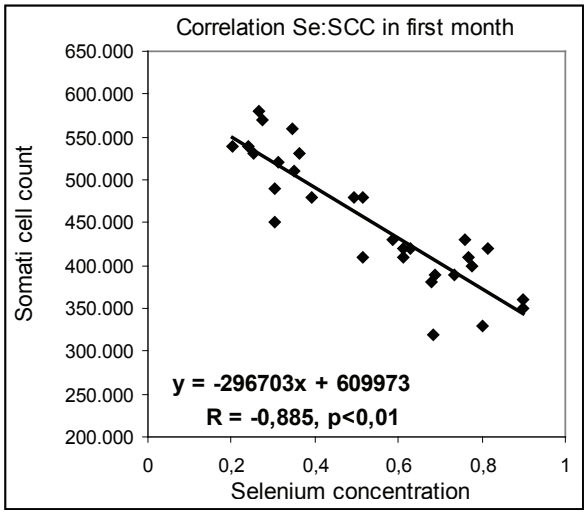

Fig. 5. Correlation test between selenium blood concentration and milk somatic cell count at first lactating month

Graf. 5. Test korelacije između koncentracije selena u krvnom serumu i broja somatskih ćelija u mleku u prvom mesecu laktacije

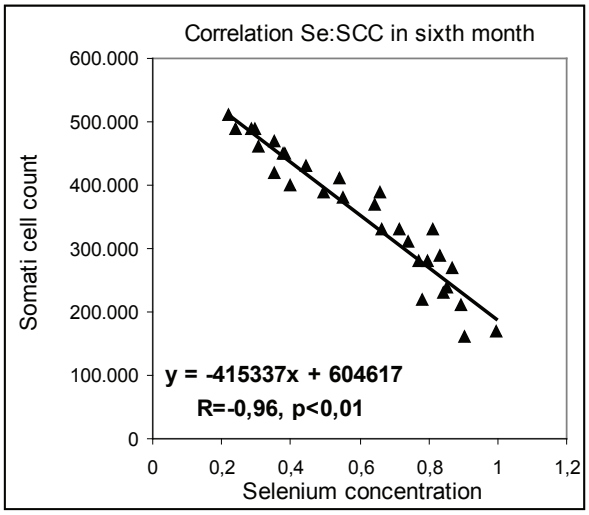

Fig. 6. Correlation between selenium blood concentration and milk somatic cell count at sixth lactating month

Graf 6. Test korelacije između koncentracije selena u krvnom serumu i broja somatskih ćelija u mleku u šestom mesecu laktacije

According to the analysis of the correlation test, a negative correlation within blood selenium concentration and milk somatic cell count in first and in sixth lactating month was found. The increased levels of selenium in blood caused a decline in the number of milk somatic cell count.

CONCLUSION

There is strong relationship between blood serum concentration of selenium and immune function. There are many interrelations of the nutrients and effects of supplementing selenium in daily food of cows. The cow`s uptake and requirement of selenium vary due to the lactating months and health status. On the basis of the results it can be concluded that selenium have affect in proper functioning of the mammary glands of cows, and in reducing somatic cell count and in improving milk quality.

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