EFFECTS INDUCED BY A SOURCE OF ORGANIC SELENIUM AND E VITAMIN USAGE IN DAIRY CATTLE FEEDING

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Abstract

The study aimed to establish the effects given by the feed supplementation of dairy cattle having Se deficiency, with a product containing organic selenium (selenite yeast) and E vitamin. Thus, two experimental groups have been set up (LC and LE), each of the comprising 10 BNR lactating cows. Besides LC group cows diet, every animal from LE group received, through daily ration, a dose of 4g Se and 500 I.U. of E vitamin, throughout a period of 8 months. Studied traits were represented by: selenium content in milk, blood serum, hair as well as the activity of gluthatione peroxidase, as an indicator of the antioxidative status. Analysis of acquired data at certain moments - 1, 2, 4, 7 and 8 months after study onset revealed that Se slowly and progressively accumulated into the body of animals belonging to LE group, compared to those in LM treatment. Since the Se supplementation has been arrested, the values for the studied microelement were double in blood serum and milk, comparing with those detected in control group (blood serum: 0.026 ppm Se in LE group vs. 0.013 ppm Se in LM group; milk: 0.018 ppm Se in LE group vs. 0.008 ppm Se in LM group). Glutathione peroxidase activity, as detected in blood samples, was higher in LE group, compared to the control one (10.075 µmol/ml vs. 4.069 µmol/ml, distinguished significant differences), revealing thus an increased antioxidative protection in the dairy cows whose diet was supplemented with organic Se and E vitamin.

Key words: dairy cows, feeding, organic selenium

INTRODUCTION

Selenium existence in feedstuffs is conditioned by the inner soils content for this element, while deficiencies in animals could occur when its level within souls decreases below 0.45 mg/kg [6]. The selenium deficient areas could be found in Oltenia Plain, Bihor, Suceava counties and a wide region form central Dobrogea Plateau [7], [8]. The supplementation of diets with selenium premixes becomes compulsory, no matter the geographic area, species or animal categories. Thus, there are used, in our country, certain inorganic supplements, such as sodium selenite, hydrated sodium selenate and selenium dioxide, as well as organic supplements (selenised yeasts, L-selenomethionine) [2], [5].

The researches in this paper aimed to establish the effect of dairy cows diet supplementation with organic Se (selenised yeast) and vitamin E, after the deficiency was identified in cows.

MATERIAL AND METHODS

The researches were organised in a private farm from Cobadin place (Constanța county), using Black Mottled Romanian (BNR) cows. Two experimental groups were set up (LC and LE), each one comprising a 10 BNR cows. Compared to LC group, every animal from LE group received, through the daily feed vitamins and minerals premix a dose of 4 g organic Se (Se-Yeast product) and 500 U.I. vitamin E, throughout 8 months. Biological samples were taken from animals in both groups at 1, 2, 4, 7 and 8 months from the study onset. Certain parameters were investigated: Se content in milk, blood serum, hair and the activity of glutathione-peroxidase, as an indicator of the antioxidative status.

Blood samples were analysed in the labs of Veterinary Authority Constanța, while those consisting in feed, milk and hair in the National Pasteur Institute Bucureşti.

The biochemical blood serum investigations were run on Labsystem analyser; the haematological tests were performed with the Coulter Counter analyser; the selenium was assessed with the Spekol 11 Spectrophotometer, prepared for fluorometry.

Certain statistical parameters (mean, std. deviation, std. mean error, variability coefficient) were calculated. In depth assessment of experimental data was done through the t-Student test computation.

RESULTS AND DISCUSSIONS

Since the very beginning of researches, it was opportune to assess the Se content status within the plant-animal-product chain, in order to identify any possible deficiency. The results are detailed presented in table 1 and compared with reference values from literature. Thus, for Se in blood, the assessed values (0.010-0.011 ppm) were much less than the range specified by other authors (0.04 – 0.10 ppm) [4].

Table 1 Selenium content (ppm) in blood serum, hair and feedstuffs samples, at the beginning of the experiment

Notice	n	$\bar{x}$	s	Variation limits	Reference values	Authors
Pregnant cows (blood serum)	20	0.011	0.004	0.004-0.018	0.04-0.10	*Pârvu. 2003*
Lactating cows (blood serum)	20	0.010	0.005	0.005-0.015		
Milk	20	0.010	0.005	0.005-0.015	0.036	*Surai. 2000*
Hair	20	0.140	0.020	0.100-0.160	1.00-4.00	*Mahan. 1999; Pârvu. 2003*
Feedstuffs:						
- alfalfa hay	4	0.050	0.020	0.033-0.070	0.15-0.3	*Stoica. 1997*
- corn silage	4	0.040	0.010	0.030-0.050		
- wheat straw	4	0.048	0.015	0.027-0.071		
- corn seeds	4	0.086	0.022	0.041-0.129		
- barley seeds	4	0.045	0.014	0.029-0.068		

For milk samples, assessed Se values were under the mean value in literature (0.036 ppm) [11]. The same situation occurred for the studied hair samples (average = 0.14 ppm), knowing that other authors specified a Se content of 1.00-4.00 ppm [3], [4]. In feedstuffs, the average Se levels (0.040-0.086 ppm) were lower than those found in literature (0.15-0.30 ppm), [10].

Therefore, due to the Se deficiency we found in feedstuffs, animals body and their products (milk, hair), it was considered as opportune to proceed to our study, in accordance with the previously mentioned aim.

Thus, after diet supplementation of the experimental group with organic Se and vitamin E, blood samples have been taken at various time intervals (1, 2, 4, 7, 8 months from study onset). The issued data are presented in table 2 and fig. 1.

The data presented show progressive growth, but higher in the first two months of research for the serum selenium content of the experimental group, compared to the control group. Thus, after 30 days of its administration, increased serum levels of selenium were recorded in the group that received feed additive (LE) (0.017±0.007 ppm) compared with control group (LC) (0.007±0.002 ppm). After two months of organic Se supplementation, serum level showed a further increase in group LE (0.024 ± 0.012 ppm), than the control group, who had a value (0.009 ±0.002 ppm) close to that taken from the previous month. Maximum values for blood serum Se level were recorded after 8 months of treatment with studied products, being, on average, 0.028 ± 0.01 ppm (LE), compared to 0.016 ± 0.007 ppm (LC).

Table 2 Blood serum content of Se (ppm), in the animals from the studied groups

Timeline interval after experiment onset	LC group				LE group				t Test
	$\overline{x}$	s	V%	Variation range	$\overline{x}$	s	V%	Variation range	
1 month	0.007	0.002	24.47	0.006-0.012	0.017	0.007	42.12	0.009-0.022	p<0.001
2 months	0.009	0.002	24.47	0.006-0.012	0.024	0.012	47.82	0.008-0.030	p<0.001
4 months	0.006	0.002	31.34	0.003-0.009	0.024	0.007	33.68	0.014-0.037	p<0.001
7 months	0.012	0.030	26.55	0.007-0.018	0.025	0.015	59.29	0.005-0.059	p<0.001
8 months	0.016	0.007	42.80	0.006-0.026	0.028	0.010	34.23	0.013-0.050	p<0.001

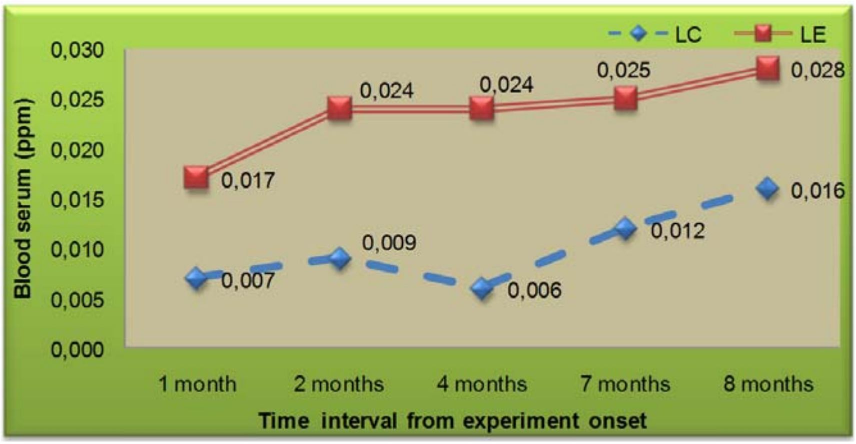

Fig. 1 Dynamics of Se content in the animals from both groups

Lower magnitude variation for Se blood serum content in group LC cows is an indication of constant but insufficient intake for this trace element in those animals fed with no additional source of Se.

In all five moments of the collection of biological samples, the differences recorded between the values measured and analyzed through Student test were statistically significant (p <0.001).

Determination of glutathione-peroxidase activity in blood samples collected during the same stage of study led to results presented in table 3 and Fig. 2. The average activity of glutathione-peroxidase in the experimental group was significantly higher (6.28 ±0.81 mole / ml) measured in comparison with the reference group (2.48 ± 0.48 mole / ml) between the two groups were recorded highly significant differences (p <0.001).

Table 3 Activity of glutathione-peroxidase (μmol/ml), in the studied animals, after 8 months of organic Se treatment

Timeline interval after experiment onset	LC group				LE group				t Test
	$\overline{x}$	s	V%	Variation range	$\overline{x}$	s	V%	Variation range	
8 months	2.47	0.48	19.31	1.77-2.99	6.28	0.81	12.88	5.43-7.86	p<0.001

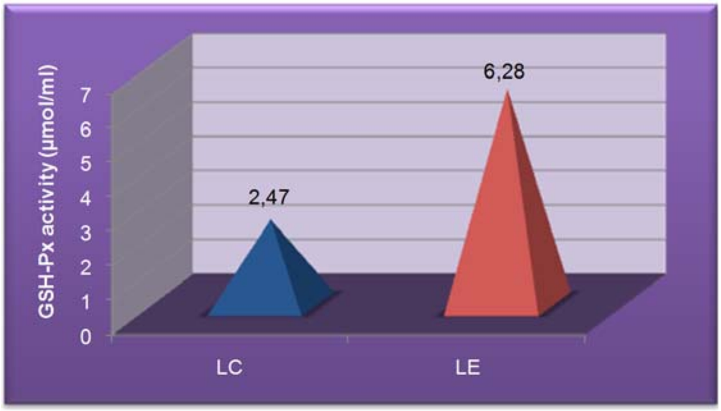

Fig. 2 Analytical values related to glutathione-peroxidase (GSH-Px) activity, in the animals from both groups, after 8 months of organic Se treatment

The data presented so far show a direct relationship between the amount of dietarySe, serum levels of this protective antioxidant action and intensity trace ofglutathione-peroxidase.

The literature stated that if a state of deficiency in selenium, GSH-Px activitydecreases, leading to oxidative processes that destroy the integrity of highlydegradable matters by oxidation, ultimately leading to myopathy and muscle degeneration [1],[9].

Regarding the content of selenium in milk, experimental results are presented in table.4 and Fig. 3.

Table 4 Se content (ppm) in milk, at the studied cows

Timeline interval after experiment onset	LC group				LE group				t Test
	$\bar{x}$	s	V%	Variation limits	$\bar{x}$	s	V%	Variation limits	
2 months	0.005	0.002	41.43	0.002-0.009	0.010	0.003	29.31	0.005-0.015	p<0.001
7 months	0.004	0.002	46.15	0.002-0.008	0.026	0.006	23.44	0.017-0.039	p<0.001
8 months	0.005	0.002	40.19	0.002-0.008	0.028	0.013	45.41	0.009-0.054	p<0.001

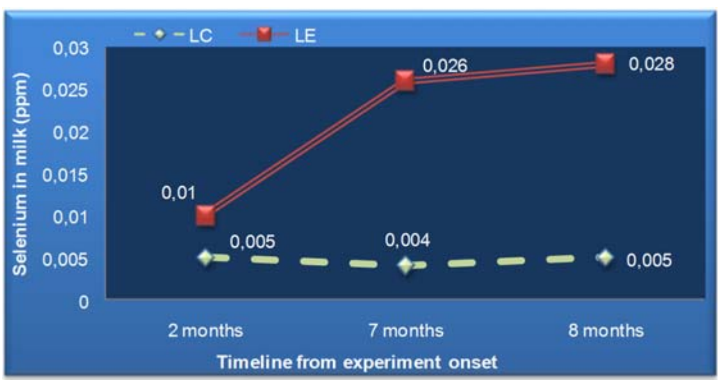

Fig. 3 Dynamics of Se excreted through milk, in the animals from both groups

After two months of administration of organic selenium premix, the values obtained were double in the experimental group (0.010 ± 0.003 ppm Se in milk) than those determined for the control group (0.005 ± 0.002 ppm Se). The discrepancy between the two groups studied, relatively to the content of Se excreted in milk was more evident when the usage of the studied product ceased (Fig. 3). Thus, after 8 months of use in dairy cows feeding of the organic Se supplement, the average value of this element in milk reached 0.028 ± 0.013 ppm for the experimental group, while in the control group, the assessed value was similar to that from the experiment onset (highly significant statistical differences between the two studied groups).

The efficiency of organic Se usage through food have been tested for its gradually accumulation into the hair. Data related to hair Se content in both groups of animals are revealed din table 5.

Table 5 Se content (ppm) in hair, in the animals from studied groups, after 8 months of organic Se usage through feed

Timeline interval after experiment onset i	LC group				LE group				t Test
	$\overline{X}$	s	V%	Variation limits	$\overline{X}$	s	V%	Variation limits	
8 months	0.368	0.077	20.85	0.218-0.473	0.602	0.190	31.55	0.174-0.797	p<0.001

Thus, the average of Se concentration in hair samples taken form the experimental group (0.602±0.190 ppm) was much higher (+64%) than that assessed in control group (0.368±0.077 ppm). The differences between the two groups were highly significant (p<0.001), proving thus the bio-efficacy of dairy cows diet supplementation with organic Se.

However, none of the samples taken from E group did not pass the limits of the reference range for Se content in hair (1.00-4,00 ppm) [4], even after 8 months of daily feed supplementation for this trace mineral.

CONCLUSIONS

Long-term administration of food supplements with vitamin E and organic selenium resulted in significantly improved and consistent levels of studied microelement in the organism, compared to the practicing of diets without added selenium.

Highly statistically significant differences between the averages of two groups for Se content in blood, hair and milk as well as the greatly enhanced activity of the enzyme glutathione-peroxidase shows high efficiency in dairy cattle feed supplementation with organic Se.

Increasing the selenium content of milk helps to improve the nutritional value of milk, for human consumers, but especially for baby calves, providing an increased intake of this nutrient in the body of calves, implicitly guaranteeing the premises to improve their antioxidant system, ie better viability, growth and development.

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