

INFLUENCE OF DIETARY SELENIUM SUPPLEMENTATION TO EWES AND LAMBS ON PRODUCTION PERFORMANCE AND EXTERIOR CHARACTERISTICS OF LAMBS

UTJECAJ DODATKA SELENA U HRANU OVACA I JANJADI NA PROIZVODNA SVOJSTVA I EKSTERIJERNE ODLIKE JANJADI

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SUMMARY

The aim of this research was to determine the effect of dietary selenium supplementation (organic, inorganic) to high pregnant and lactating ewes on the production performance and exterior characteristics of their lambs. The research included 30 pregnant Merinolandschaf ewes and lambs. The control group of ewes and lambs ration (group I) was composed of 300 g/day/animal feed mixture without the addition of selenium and 150 g/day/animal, barley and alfalfa hay which they had ad libitum. Feed mixture of group II was supplemented with 0.3 mg/kg of Selplex[®], and the third group with the same amount of Sodium selenite. The average body weight of lambs at the age of 23 days was significantly ($P < 0.05$) bigger in the group given inorganic selenium in comparison to the control group. Addition of inorganic ($P < 0.01$) or organic ($P < 0.05$) selenium led to a significantly better exterior characteristics in lambs at the age of 63 days comparing them with the control group of lambs. A significant by ($P < 0.05$) better indices of body proportions and body mass are evident in younger lambs whose mothers, and they, were fed mixtures with the addition of inorganic selenium. Indexes of anamorphosis, body condition and massiveness were better ($P < 0.05$) in older lambs which had organic form of selenium added to feed mixture. Results of current study suggest that the form of Se source used in this research, has a limited potential for improving the production performance of lambs especially if there was no significant lack of selenium.

Key words: ewes, lambs, selenium, production performance, exterior characteristics

INTRODUCTION

Selenium is an essential trace element, component of multiple enzymes and selenium proteins. The concentration of selenium in the soil is low in many parts of the world including the area of the Pannonian Basin to which Croatia belongs. Selenium deficiency affects the reduction of fertility, abortion, placental retention, (Gabryszuk and Klewicz, 2002; Surai, 2006.), health problems in young animals such as neonatal mortality, poor

health of newborns, nutritional myopathies, generally increased occurrence of diseases. Among the various methods for the prevention and removal of these disorders in animals, optimization of selenium concentration in feeds is the most important. Also for good vitality and growth of newborn lambs of great importance is the transfer of selenium from mother through the placenta and milk. The most commonly used inorganic selenium supplements in animal feed are sodium selenite and organic selenized yeast.

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According to research (Weiss, 2005.) true digestibility of Se from diets containing selenite has shown to be about 50% in the sheep while that from Se-yeast would be about 66% with regard to different metabolism. Inorganic selenium is exclusively used for the synthesis of seleno-enzymes while organic selenium can be incorporated into any protein, serving as a possible Se storage capacity (Vignola, 2007). The aim of this research was to study the effect of sodium selenite compared to selenium yeast supplement on production properties and exterior characteristics of lambs.

MATERIALS AND METHODS

Research was conducted on 30 pregnant Merinolandschaf breed ewes. Ewes, used for research were selected from the flock of 200 animals. Selected ewes were an average age of four years, healthy and in a good physical condition. The research

lasted four months, two months with ewes in the period of high pregnancy and two months with lactating ewes and their lambs in the suckling period. Ewes were divided into three groups of 10 highly pregnant animals (the last trimester of pregnancy). After lambing, the lambs remained with their mothers until the end of the research. Each group consisted of 10 healthy lambs. Ewes and lambs within the group (first, second and third) had their own feeding place in separated pens. The control group of ewes and lambs (group I) was given a ration which consisted of 300 g/day/animal feed mixtures without selenium supplement and 150 g/day/animal of barley and alfalfa hay, which, like water, they had ad libitum. The second group ration was enriched with the addition of 0.3 mg/kg diet of organic selenium (Selplex®, Alltech), and the third group by the same amount of inorganic selenium (sodium selenite). Ingredients and chemical composition of basal feed mixture are shown in Table 1.

Table 1 Ingredients and chemical composition of basic feed mixture

Tablica 1. Kemijski sastav osnovne krmne smjese

Ingredient – Sastojci	g/kg dry mater g/kg suhe tvari
Corn – Kukuruz	511
Wheat flour – Stočno brašno	150
Molasses – Melasa	40
Yeast – Stočni kvasac	30
Dehydrated alfalfa meal – Dehidrirano brašno lucerne	20
Sunflower meal – Suncokretova sačma	90
Soybean meal – Sojina sačma	90
Animal salt – Stočna sol	4
Limestone – Stočna kreda	20
Monocalcium phosphate – Monokalcij fosfat	10
Nuklospray – Nuklosprej	25
Premix – Premiks	10
Chemical composition – Kemijski sastav (g/kg DM)	
Dry mater – Suha tvar	880
Crude protein – Sirove bjelančevine	177
Crude fiber – Sirova vlakna	64
Crude fat – Sirova mast	30
Ash – Pepeo	70
Metabolize energy – Metabolička energija (MJ/kg)	11.2

Body measurements of lambs (height of withers - HW, chest circumference - CC, body length - BL, chest width - CW, pelvis circumference - PC, pelvis height - PH) were determined by the Lydthin's stick or stock tape, while the body weight was measured on a balance. In addition, the following indexes of body development in lambs were determined: IA - index of anamorphosis ($CC \times CC/HW$), IBP - index of body proportion ($BW/HW \times 100$) according to Chiofalo et al. (2004) and IC - index of compactness ($CC/BL \times 100$), IM - index of massiveness ($CC/HW \times 100$), BIM - index of body mass according to Činkulov et al. (2003.). Body condition index was determined according to Russel (1991.) with scores of 1-5. Research results were processed by SAS (SAS Inst. Inc., Cary NC) software. Effects of treatment (I-group without selenium, II-group 0.3 mg/kg of organic selenium feed supplement, III- group 0.3 mg/kg of inorganic selenium feed supplement) on the lambs production properties and exterior characteristics were analyzed by fixed statistical model using GLM (General Linear Model) analysis of variance PROCEDURE (ANOVA).

Where the analysis of variance showed significant difference LSD test was performed. Statistical differences were determined at $P < 0.05$ or lower.

RESULTS AND DISCUSSION

By analyzing ewes milk taken in the third week of lactation, significant increase in the concentration of selenium in ewes which had selenium supplement in feed was determined 15.85, 28.73 and 20.82 mg/L in first (control), second (Selplex®, Alltech) and third (sodium selenite) group of ewes. Selenium supplement did not significantly affected final growth performance of lambs, similar to the research of Arzola et al. (2006.) and Vignola et al. (2009.).

The average body weight of lambs at the age of 23 days was significantly ($P < 0.05$) bigger in the group with addition of the inorganic selenium in comparison to the control group (Table 2). Bigger body weight was also evident in lambs whose mothers and themselves were fed mixture supplemented with organic selenium, but the differences were not

Table 2 Growing performance of lambs

Tablica 2. Proizvodni pokazatelji janjadi

Indicator - Pokazatelj	Group – Skupina			SEM
	I	II	III	
	Mean ± sd	Mean ± sd	Mean ± sd	
Birth weight – Porodna masa, kg				
	4.76 ± 1.12	4.92 ± 0.73	5.02 ± 0.73	0.16
Body weight – Tjelesna masa, kg				
23 day - 23. dana	8.81 ^a ± 2.44	10.00 ^{ab} ± 2.11	11.03 ^b ± 2.23	0.43
63 day - 63. dana	21.59 ± 4.76	21.08 ± 5.53	21.76 ± 5.34	0.92
Daily gain – Dnevni prirast, g				
1 st – 23 th day - 1 – 23 dana	176.08 ± 111.62	220.78 ± 88.12	261.56 ± 95.72	18.60
23 th – 63 th day - 23. – 63. dana	319.72 ± 93,75	276.82 ± 147. 02	268.07 ± 89.48	20.37
Average daily gain – Prosječni dnevni prirast, g				
1 st – 63 th day - 1. – 63. dana	267.28 ± 70.33	256.35 ± 80.37	265.69 ± 81.68	13.71

Mean = mean value; Sd = standard deviation; SEM = standard error of mean; I - control group; II - addition of Selplex®; III - addition of sodium selenite; ^a, ^b. $P < 0.05$

Table 3 Exterior characteristic of the lambs

Tablica 3. Eksterijerne karakteristike janjadi

Indicator - Pokazatelj, cm	Age, Day - Dob, dan	Group - Skupina			SEM
		I	II	III	
		Mean ± sd	Mean ± sd	Mean ± sd	
Height of ithers - Visina grebena	23	46.55 ± 7.95	43.45 ± 5.47	46.65 ± 5.02	1.14
	63	50.32 ^A ± 3.96	51.12 ^{Aa} ± 2.07	53.91 ^{Bb} ± 1.52	0.84
Body length - Dužina trupa	23	46.50 ± 11.41	44.67 ± 4.93	50.45 ± 6.42	1.49
	63	52.64 ^{Aa} ± 2.82	56.74 ^b ± 4.62	59.20 ^B ± 3.30	1.06
Chest circumference - Opseg prsa	23	53.77 ± 14.96	52.24 ± 6.01	58.00 ± 6.73	1.83
	63	58.50 ^{Aa} ± 5.49	63.74 ^b ± 6.97	66.10 ^B ± 3.47	1.55
Chest width - Širina prsa	23	12.22 ± 3.64	11.47 ± 1.83	13.31 ± 1.98	0.48
	63	13.14 ^{Aa} ± 1.61	15.00 ^b ± 1.84	15.95 ^{Bb} ± 1.34	0.39
Thigh length - Dužina buta	23	22.88 ± 4.17	22.86 ± 2.18	23.50 ± 2.54	0.54
	63	32.32 ^A ± 3.67	36.62 ^B ± 3.79	37.07 ^B ± 2.57	0.91
Thigh circumference - Opseg buta	23	31.77 ± 7.88	30.12 ± 4.38	33.80 ± 3.70	1.03
	63	25.32 ^A ± 2.09	26.74 ^{AB} ± 1.47	29.70 ^B ± 1.76	0.59

Mean = mean value; Sd = standard deviation; SEM = standard error of mean; I - control group; II - addition of Selplex®; III - addition of sodium selenite; a, b, P<0.05; A,B, P<0,01

Table 4 Indices of lambs body development

Tablica 4. Indeksi tjelesne razvijenosti janjadi

Indicator Pokazatelj	Age, day Dob, dan	Group - skupina			SEM
		I.	II.	III.	
		Mean ± sd	Mean ± sd	Mean ± sd	
I. A.	23	62.81 ± 24.76	63.31 ± 10.64	73.09 ± 15.61	3.28
	63	68.12 ^a ± 8.21	80.05 ^b ± 15.81	81.18 ^b ± 7.58	2.87
I. B.P.	23	19.22 ^a ± 6.05	22.99 ^{ab} ± 3.33	23.76 ^b ± 4.50	0.91
	63	42.83 ± 8.79	40.29 ± 9.76	40.27 ± 9.39	1.73
I. B. C.	23	3.50 ± 0.70	3.62 ± 0.20	3.25 ± 0.35	0.08
	63	3.24 ^a ± 0.47	3.86 ^b ± 0.39	3.63 ^{ab} ± 0.45	0.09
I. C.	23	114.98 ± 5.25	117.30 ± 7.03	115.61 ± 11.70	1.49
	63	110.91 ± 4.66	112.15 ± 4.94	111.79 ± 5.40	0.97
I. M.	23	113.89 ± 1245	120.86 ± 11.48	125.04 ± 15.85	2.50
	63	116.22 ^a ± 5.06	124.54 ^b ± 11.26	122.60 ^{ab} ± 5.25	1.79
I. B. M.	23	0.192 ^a ± 0.06	0.229 ^{ab} ± 0.03	0.237 ^b ± 0.04	0.009
	63	0.42 ± 0.08	0.40 ± 0.09	0.40 ± 0.09	1.73

I.A. - index of anamorphosis; I.B.P. - index of body proportion; I.B.C. - indeks of body condition; I.C. - index of compactness; I.M. - index of massiveness; I.B.M. - index of body mass; Mean = mean value; Sd = standard deviation; SEM = standard error of mean; I - control group; II - addition of Selplex®; III - addition of sodium selenite; ^{a, b} P<0.05

significant ($P > 0.05$). Selenium supplementation influenced the increase in average daily gain from birth to the age of 23 days, after which their decline was visible, but the differences were not significant. Mauka et al. (1998.) found a 28% bigger body weight in lambs from ewes that had fed selenium supplement. The influence of selenium supplements in feed of high pregnant animals had previously been investigated by many authors, some of which found bigger gains (Castellan et al., 1999; Hefnawy et al., 2008.) while others did not notice any influence on the performance of lambs and calves (Rowntree et al., 2004; Antunović et al., 2009.). The reason for this could be the fact that the selenium contents in the control diet (Group I) probably the needs for selenium in lambs from the control group, i.e. there was no great lack of selenium. Munoz et al. (2008.) found that lambs of ewes that had selenium supplement yeast in feed could significantly ($P < 0.05$) earlier get up and stand up straight in comparison to the control group lambs. Bigger daily weight gain in lambs supplemented with selenium yeast was probably associated with a lower incidence of lambs in which the diarrhea was observed in comparison with the control group of lambs (Pilarczyk et al., 2013.).

Addition of selenium in diet of ewes and lambs had a significant influence on their exterior characteristics. This influence was particularly noticeable in the second final measurements in lambs of average age of 63 days (Table 3). Addition of inorganic ($P < 0.01$) or organic ($P < 0.05$) selenium led to a significantly better exterior characteristics in older lambs comparing them with the control group of lambs.

Significant by ($P < 0.05$) better indices of body proportions and body mass are evident in younger lambs whose mothers, and they were fed inorganic selenium supplemented mixture. Indexes anamorphosis, body condition and massiveness were better ($P < 0.05$) in older lambs who fed organic form of selenium supplemented feeds (Table 4). Antunović et al. (2008.) did not find a significant effect of selenium on the indexes of anamorphosis, body proportions and body condition, although there was a clear tendency to increase these indices of physical development. Meyer et al. (2010.) found that the enrichment of feed with selenium affected the average daily weight gain, the index of body condition, the amount and distribution of body fat in the abdominal cavity of lambs.

CONCLUSION

Addition of selenium in feed mixture of ewes and lambs did not significantly influence the final production performance of lambs. The growth trend of body weight and daily gain were determined in the group that had the addition of selenium in the feed mix but with no significant differences. In addition, some exterior characteristics and indices of body development were significantly better in experimental group of lambs. Results of current study suggest that the form of Se source used in this research, dietary Se had a limited potential for improving the production performance especially if there was no significant lack of selenium.

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SAŽETAK

Cilj ovoga istraživanja bio je utvrditi utjecaj dodatka selena (organskog, anorganskog) u krmnu smjesu visoko gravidnih ovaca i ovaca u laktaciji na proizvodna svojstva i eksterijerne odlike njihove janjadi. Istraživanje je provedeno na 30 Merinolandsšaf ovaca i janjadi. Obrok kontrolne skupine ovaca i janjadi (skupina I) bio je sastavljen od 300 g/danu/životinji krmne smjese bez dodatka selena te 150 g/danu/životinji ječma i sijena lucerne kojeg su imale *ad libitum*. U krmnu smjesu II skupine dodano je 0,3 mg/kg Selplexa®, a u treću ista količina natrij selenita. Prosječna tjelesna masa janjadi u dobi od 23 dana bila je značajno ($P < 0,05$) veća u skupini s dodatkom anorganskog selena u odnosu na kontrolnu. Dodatak anorganskog ($P < 0,01$) ili organskog ($P < 0,05$) selena vodi značajno boljim eksterijernim odlikama u janjadi prosječne dobi od 63 dana u odnosu na kontrolnu skupinu janjadi. Značajno bolji ($P < 0,05$) indeksi tjelesnih proporcija i tjelesne mase utvrđeni su u mlađe janjadi čije su majke a i oni imali dodatak anorganskog selena u krmnoj smjesi. Indeksi anamorfoznosti, tjelesne kondicije i mišićavosti su značajno ($P < 0,05$) bolji u starije janjadi čije su majke a i oni imali dodatak organskog selena u krmnoj smjesi. Rezultati upućuju da izvor selena u krmnoj smjesi u ovom istraživanju ima ograničavajući potencijal u poboljšanju proizvodnih svojstava janjadi osobito ukoliko prethodno nije prisutan veliki nedostatak, već samo manjak selena.

Ključne riječi: ovce, janjad, selen, proizvodna svojstva, eksterijerne odlike