

Rearing, fattening performance and slaughter indicators of lambs after selenium, zinc and vitamin E supplementation

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Abstract

The experiment was conducted on 80 Polish Merino ewes, their 82 lambs and 40 fattening rams. Merino ewes were divided into two groups: experimental (E) and control (C), each composed of 40 animals. Four weeks before lambing, 1 day, 3 weeks and 6 weeks after lambing 40 ewes of the experimental (E) group received intramuscular injection of 5 ml 0.1% Na₂SeO₄ (selenium [Se]: 2.09 mg), 10 ml 10% ZnSO₄ (Zinc [Zn]: 227 mg) and 250 mg vitamin E (α-tocopherol), and control group (C) – no received. From birth all the lambs were maintained with their dams and then weaned at the age of 8 weeks, placed in individual straw-bedded pens and fattened individually with a granulated concentrate mixture until reaching a body weight about 32 kg. During fattening 20 lambs from experimental group (E) was given per os 1 ml 0.1% Na₂SeO₄, 3 ml 10% ZnSO₄ and 60 mg vitamin E (α-tocopherol) daily, and control group (C) – no administered. The levels of Se, Zn and vitamin E in the blood plasma of ewes and ram- lambs were within the reference values. The lambs born by the treated ewes (E) experienced much lower body live weight at birth ($P \leq 0.05$), body weight on day 28 and 56 ($P \leq 0.01$), compared to lambs born from group (C). Also the daily live weight gain from birth to 4 week and from birth to 8 week were significantly lower ($P \leq 0.05$) in lambs born by the treated ewes. Se, Zn and vitamin E treated rams contained less fat in leg ($P \leq 0.05$), less fat thickness over ribs ($P \leq 0.01$) and less fat thickness over loin-eye than non treated rams.

Keywords: selenium, zinc, vitamin E, sheep, fattening

Zusammenfassung

Aufzuchtergebnisse, Mastleistung und Schlachtkörperqualität der Lämmern nach Selen-, Zink- und Vitamin-E-Versorgung

Die Untersuchungen wurden an 80 Mutterschafen, ihren 82 Aufzuchtlämmern und 40 Mastlämmern der Rasse Polnisches Merinoschaf durchgeführt. Die Mutterschafe wurden in zwei Gruppen aufgeteilt: Versuchsgruppe (E) und Kontrollgruppe (C) mit jeweils 40 Tieren. Vier Wochen vor der Ablammung und 1 Tag, 3 Wochen sowie 6 Wochen nach der Ablammung wurden den Mutterschafen der Versuchsgruppe (E) 5 ml 0,1% Na₂SeO₄ (Selen [Se]: 2,09 mg), 10 ml 10% ZnSO₄ (Zink [Zn]: 227 mg) und 250 mg Vitamin E (α-Tocopherol) intramuskulär gespritzt. Die Mutterschafe der Kontrollgruppe (C) wurden nicht behandelt. Alle Lämmer wurden bei den Müttern bis zum Alter von 8 Wochen

aufgezogen. Anschließend wurden die männlichen Tiere zur Kraftfuttermast *ad libitum* in Strohstreueinzelboxen aufgestellt und bis zu einem Endgewicht von 31-32 kg gemästet. In der Mastperiode erhielten die 20 Lämmer der Versuchsgruppe (E) täglich zusätzlich *per os* 1 ml 0,1% Na₂SeO₄, 3 ml 10% ZnSO₄ und 60 mg Vitamin E (α -Tocopherol), während die 20 Lämmer der Kontrollgruppe (C) nur mit Kraftfutter gefüttert wurden. Die Blutspasmawerte von Se, Zn und Vitamin E der Mutterschafe und Mastlämmer bewegten sich innerhalb der Referenzwerte. Die von der Mutterschafgruppe E stammenden Lämmer wiesen im Vergleich mit den Lämmern der Mutterschafkontrollgruppe, signifikant geringere Lebendgewichte nach der Geburt ($P \leq 0,05$), im Alter von 28 und 56 Tagen ($P \leq 0,01$) auf. Auch die tägliche Zunahme des Lebendgewichts von der Geburt, bis 4 Wochen und bis 8 Wochen danach war signifikant niedriger ($P \leq 0,05$) als bei den Lämmern der Mutterschafkontrollgruppe. Die mit Se, Zn and Vitamin E behandelten Mastlämmer wiesen einen kleineren Fettanteil in der Keule ($P \leq 0,05$) und eine kleinere Rückenfettdicke ($P \leq 0,01$) als die Kontrollmastlämmer auf.

Schlüsselwörter: Selen, Zink, Vitamin E, Schaf, Lämmermast

Introduction

It is widely documented that vitamins and minerals play an important role in the growth of animals and their physiological functions, as well as their reproductive performance (KOŁODZIEJ and JACYNO 2005). Selenium (Se) is necessary for growth and fertility in animals and for the prevention of variety of disease conditions, which show a variable response to vitamin E. The metabolic function Se is closely linked to vitamin E as biological antioxidant in tissue protection, but each nutrient cannot always fully compensate for a deficiency of the other (UNDERWOOD and SUTTLE 1999, KRŠKA *et al.* 2001). The deficiency of zinc (Zn) was associated in all species with severe inappetence and growth depression, impaired reproductive performance and abnormalities of skin and its appendages (UNDERWOOD and SUTTLE 1999). Se, Zn and vitamin E are primarily active as an antioxidant protecting tissues from free-radical attack (MCDOWELL 1992). Transfer of nutrients from dam to offspring occurs via two pathways, placental transfer and colostrum/milk digestion. The amount of nutrients transferred to offspring's depends on maternal nutrient status and efficiency of transplacental and mammary transport mechanisms. Se is well transmitted through the placenta to the fetus, even in the presence of low maternal concentrations (KOLLER *et al.* 1984). Contrary, placental transfer of vitamin E is inefficient as reported by NJERU *et al.* (1994). By contrast CAPPER *et al.* (2005) reported that the vitamin E status of the neonatal and suckling lamb may be manipulated by vitamin E supplementation of the ewe during pregnancy and lactation. Se and vitamin E prepartum injections result in higher colostrum and milk concentrations of these elements (CUESTA *et al.* 1995). Se or Se plus vitamin E may be improved reproduction performance of ewes (SCALES 1974, GABRYSZUK 1994, ANTUNOVI *et al.* 2004). Survivals of lambs, live weights at birth and at weaning were increased by Se supplementation (LANGLANDS *et al.* 1991). Single injection of Se before lambing significantly affect lamb body weight at 28 day and daily weight gain from birth to 28 day of age (GABRYSZUK *et al.* 2002). Injection of Se and vitamin E together does not increased

rearing performance in the flock considered not deficient in Se status (GABRYSZUK *et al.* 2002). Application of 5 ml 0.1% sodium selenide before mating and lambing significantly affect Se status in blood serum and reproductive performance of ewes and body weight of lambs at 33 day of age in a Se deficient area (BALICKA-RAMISZ *et al.* 2006). In our earlier study on ewes the Se, Zn and vitamin E intramuscular injection of ewes before and after lambing induced a decrease in cholesterol content of milk and blood, and led to increased the conjugated linoleic acid (CLA) isomers level in milk (GABRYSZUK *et al.* 2007b). The diet of growing ram-lambs enriched in Se, Zn and vitamin E improved of lipid profile of lamb's meat (GABRYSZUK *et al.* 2007a).

In light of this, it is interesting whether the combined supplementation with Se, Zn and vitamin E could influence on the growing and fattening of lambs. The aim of this study was to elucidate effects of Se, Zn and vitamin E supplementation of ewes and fattening ram-lambs on the rearing, fattening and slaughter performance of lambs.

Material and methods

The studies were conducted on 80 Polish Merino ewes, their 82 offspring (42♀ + 40♂) and 40 fattening rams in the two repetitions including. In the first and second year the experiment was carried out on 80 Polish Merino ewes divided into two groups: control (C) and experimental (E), each composed of 40 animals. Doses and the way of administration of Se, Zn and vitamin E to ewes and ram-lambs from the experimental group shows Table 1.

Table 1

Doses and the way of administration of Se, Zn and vitamin E to ewes and ram-lambs from the experimental group

Dosis und Art der Verabreichung von Se, Zn und Vitamin E an die Mutterschafe und Mastlämmer der Experimentalgruppe

Animals	Way of administration	Doses and reagents per animal			Time of administration
		Se	Zn	Vitamin E	
Ewes	intramuscular injection	5ml 1% Na ₂ SeO ₄ (Se: 2.09mg)	10ml 10% ZnSO ₄ (Zn: 227mg)	250 mg α-tocopherol	4 weeks before lambing; 1 day, 3 weeks and 6 weeks after lambing
Ram-lambs	orally (<i>per os</i>)	1ml 1% Na ₂ SeO ₄ (Se: 0.42mg)	3ml 10% ZnSO ₄ (Zn: 68mg)	60 mg α-tocopherol	each ram daily during fattening

The ewes from all groups were kept in the same shed with their lambs till the age of 8 weeks. The nutrition was based on local feeds: maize silage, meadow hay, feed concentrate (oats 20%, wheat bran 60%, and rapeseed oilmeal 20%) and minerals premix (about 10 g per ewes). The proximate analysis of feeds for ewes their nutritive value indicators, as well as Zn and Se content of dry matter show Table 2. In the high pregnancy period dietary intake of dry mater (DM) per ewes was 0.51 kg/d from meadow hay, 0.67 kg/d from maize silage and 0.86 kg/d from concentrate. In the lactation period dietary intake of DM per ewes was 0.68 kg/d from meadow hay, 0.67 kg/d from maize silage and 1.04 kg/d from concentrate. The declared content of Se, Zn and vitamin E in the mineral premix was 12 ppm, 6 000 ppm and 500 ppm respectively (Table 3). Blood samples from ewes were collected before treatment (10 samples) and at 8-week postpartum (10 samples from group E and 10 samples from group C).

Table 2
Chemical composition of feeds (g/kg DM) and nutritive values
Chemische Zusammensetzung des Futters (g/kg DM) und Futterwerte

Component	Feed concentrate ¹	Maize silage	Concentrate mixture ²	Meadow hay
Dry mater	862	336	871	850
In dry mater				
Crude ash	52	48	76	67
Crude protein	205	78	205	121
Crude fibre	101	211	76	315
Ether extract	39	34	52	18
N-free extractives	603	629	595	470
Metabolizable energy MJ/kg	12.6	11.8	12.5	10.2
Zn mg/kg DM	29.4	33.7	28.8	15.1
Se mg/kg DM	0.16	0.12	0.15	0.10

¹feed concentrate for ewes: oats 20%, wheat bran 60%, and rapeseed oilmeal 20%, ²concentrate mixture for fattening rams: ground barley 44.1%, ground oats 17%, ground field bean 10%, rapeseed oilmeal 25%, minerals 2.9% and beet molasses 1%

Table 3
Composition of mineral premix (in 1 kg)
Zusammensetzung des Mineralfutters (je 1 kg)

Ca, g	P, g	Na, g	Mg, g	Mn, g	Zn, g	Co, mg	J, mg	Se, mg	Vit. A, IU	Vit. D3, IU	Vit. E, mg	Vit. B1, mg
189	50	90	15	5.5	6	20	20	12	600 000	60 000	500	50

During the initial 8-week period of raising, the lambs (ewes and rams) were housed in groups with their mothers in straw lined boxes. From the second week of life all of the lambs were provided with constant access to feed concentrate and meadow hay. The amount of feed consumed during this period was not recorder. The lambs were weighed on days 1, 4 and 8 week of life.

In the age of 8 weeks 40 ram-lambs were weaned, placed in individual straw-bedded pens and fattened individually with a pelleted concentrate mixture offered ad libitum until the animals' mean live weight about 32 kg. Composition of concentrate mixture: ground barley 44.1%, ground oats 17%, ground field bean 10%, rapeseed oilmeal 25%, minerals 2.9% and beet molasses 1%. Additionally, about 100 g hay per lamb/day was offered. The hay was not fully consumed and its intake was not recorded. During fattening period the daily amount of concentrate consumed was recorded individually. The 40 ram-lambs were divided into two groups of 20: control (C) and experimental (E). The rams in C group origin from ewes of C group and rams from E groups origin from ewes from E group. During fattening, each lamb from group E was given daily *per os* Se, Zn and vitamin E (Table 1).

Proximate analysis of feeds was performed using standard methods. The level of metabolizable energy of feed was calculated on the basis of the results of proximate analyses using the equation proposed by MAFF (1975). The proximate analysis of feeds for fattening rams, their nutritive value indicators, as well as Zn and Se content of dry matter shows Table 2. During fattening the animals were weighed weekly. At the end of fattening (about 32 kg body live weight) all lambs were slaughtered and the carcasses subjected to cutting and dissecting. At the start and at the end of fattening blood was withdrawn once from jugular vein of lambs for determination of Zn, Se and vitamin E.

We collected 10 samples from group E and 10 samples from group C before fattening and 10 samples from group E and 10 samples from group C at the end of fattening. Samples of feeds and blood plasma were mineralised in a mixture of 5 ml HNO₃ and 1 ml H₂O₂ in hermetic high-pressure vessels by heating in microwave oven. The Zn content was determined by atomic absorption spectrometry. Total Se content was estimated by flame (air-acetylene) atomic absorption spectrometry using hydrogen generation system. Se hydride was generated with NaBH₄. Hollow cathode lamp (196.0 nm) with deuterium background correction was used. The α-tocopherol contents were determined in blood plasma by HPLC (MCMURRAY and BLANCHFLOWER 1979).

The results were subjected to multifactorial variance analysis using the least squares method (HARVEY 1990).

Assessment of the growth of all of the lambs (ewes and rams) in the rearing period was analysed using the model:

$$Y_{ijkl} = \mu + A_i + B_j + C_k + D_l + (AB)_{ij} + e_{ijkl} \quad (1)$$

Assessment of performance and slaughter value of rams was analysed using the model:

$$Y_{ijk(l)} = \mu + A_i + B_j + (AB)_{ij} + e_{ijk(l)} \quad (2)$$

where $Y_{ijk(l)}$ is the analysed trait, μ the overall mean, A_i the effect of year ($i=1, 2$), B_j the effect of group ($j=1, 2$), C_k the effect of type of birth – litter size ($k=1, 2$), D_l the effect of sex ($l=1, 2$), $(AB)_{ij}$ the interaction (year · group), and $e_{ijk(l)}$ the random error.

Means of Se, Zn and vitamin E contents in blood plasma and their standard errors were computed and differences between group means verified based on the t-test using Microsoft Excel and Statistica for Windows.

Results

Daily Se intake per ewe (groups pooled) from feeds and mineral premix in the advanced pregnancy and lactation amounted to 0.39-0.44 mg while that of Zn to about 115-123 mg (figures not tabulated). Daily Se intake per ram during fattening in C group was 0.15 mg and 0.57 mg in group E while the respective values for Zn were 29.2 mg and 97.2 mg.

Se, Zn and vitamin E concentrations in the blood plasma of sheep are presented in Table 4. Comparison with references values for Se: 1.01-1.95 $\mu\text{mol/l}$ (HIDIROGLOU *et al.* 1987, JUDSON *et al.* 1988) for vitamin E: 2.97-13.92 $\mu\text{mol/l}$ (DONCON and STEEL 1988) and for Zn: 12.24-18.36 $\mu\text{mol/l}$ (CAKAŁA 1981) shows that results obtained in this experiment were within the references values. The level of Se in the blood plasma of experimental ewes after injection of Se, Zn and vitamin E was significantly higher than control. The concentrations of Se, Zn and vitamin E in the blood plasma of rams from group E after fattening were significantly higher than control rams. The doses of Se, Zn and vitamin E applied in this experiment did not results in miscarriages, stillbirths, and the rate of twins was similar in the control and the treatment group. All lambs born were reared to 8 week in E and C group. The data presented in Table 5 show that the lambs born by the treated ewes (E) experienced much lower body live weight at birth than lambs born by control ewes. The body weight on week 4 and 8 were significantly lower ($P \leq 0.05$) in lambs born

from ewes which received Se, Zn and vitamin E compared to control group (C). Also the daily live weight gain from birth to 4 week and from birth to 8 week were significantly lower ($P \leq 0.05$) in lambs born by the treated ewes (Table 5). In the same age at start fattening (55.7 and 56.4 days) rams weaned from ewes treated Se, Zn and vitamin E were lower body weight initial fattening ($P \leq 0.01$) and lower ($P \leq 0.05$) body live weight gain from birth to start fattening than rams from control group (Table 6).

Table 4

Last square mean of Se, Zn and vitamin E contents ($\mu\text{mol/l}$) in blood plasma of sheep

Last square mean von Se, Zn und Vitamin E ($\mu\text{mol/l}$) im Blutplasma der Schafe

Group	Se		Zn		Vitamin E	
	LSM	SE	LSM	SE	LSM	SE
<i>Ewes</i>						
Before injection	1.25 ^a	0.11	14.22	1.67	3.41	1.16
8 weeks after lambing						
Group E	1.46 ^b	0.17	15.63	2.03	3.97	0.86
Group C	1.12 ^a	0.16	14.03	1.98	3.12	0.97
<i>Rams</i>						
Before fattening						
Group E	1.24 ^a	0.11	13.31 ^a	1.22	2.15 ^{ba}	0.16
Group C	1.13 ^a	0.09	12.97 ^a	2.13	1.44 ^{aA}	0.12
The end of fattening						
Group E	1.47 ^b	0.19	17.75 ^b	3.21	5.28 ^B	0.36
Group C	1.19 ^a	0.15	13.29 ^a	2.12	2.48 ^b	0.22

LSM last square mean, SE standard error of mean, ^{aA,bb}separately for ewes and rams, means superscripts differ significantly at a,b: $P \leq 0.05$, A,B: $P \leq 0.01$

Table 5

Body live weight and daily live weight gain of lambs to 8 weeks old

Lebendgewicht und tägliche Zunahme der Lämmer in Aufzuchtperiode

Item	Experimental Group (E)			Control Group (C)		
	<i>n</i>	LSM	SE	<i>n</i>	LSM	SE
Live weight, kg						
at birth	41	4.9 ^a	0.13	41	5.4 ^b	0.14
at the age 28 days	41	12.1 ^A	0.35	41	13.6 ^B	0.37
at the age 56 days	41	18.9 ^A	0.50	41	21.4 ^B	0.53
Daily live weight gain, g						
birth-4 week	41	265.0 ^a	11.5	41	303.8 ^b	12.1
4-8 week	41	252.2 ^a	10.0	41	281.6 ^b	10.6
birth-8 week	41	255.1 ^a	8.4	41	290.6 ^b	8.9

LSM last square mean, SE standard error of mean, ^{aA,bb}means superscripts differ significantly at a,b: $P \leq 0.05$, A,B: $P \leq 0.01$

Despite these differences, the body live weight gains during fattening were similar in both groups. Rams from E groups intake less concentrate per kg body live weight gain than control group. Slaughter value of carcass and results of leg dissection presented in Table 7. Dressing percentage in rams from experimental group was similar to that found in rams from control group. Se, Zn and vitamin E treated rams contained less fat in leg ($P \leq 0.05$), less fat thickness over ribs ($P \leq 0.01$) and less fat thickness over loin-eye than non treated rams (Table 7).

Table 6
Results of rams fattening
Mastleistung der Lämmer

Item	Experimental Group (E), n=20		Control Group (C), n=20	
	LSM	SE	LSM	SE
Age at start fattening, days	55.7	0.4	56.4	0.4
Age at slaughter	100.9	2.9	95.2	2.9
Days of fattening	45.3	2.9	38.8	2.8
Body weight initial, kg	17.2 ^A	0.9	20.5 ^B	0.8
Body weight final, kg	31.3	0.5	32.4	0.5
Body live weight gain during fattening, g	316.9	13.2	317.9	12.9
Birth – start fattening, g	229.2 ^a	13.1	276.3 ^b	12.7
Intake of concentrate/kg live weight gain, kg	3.5	0.2	4.0	0.2

LSM last square mean, SE standard error of mean, ^{aA,bb}means superscripts differ significantly at a,b: $P \leq 0.05$, A,B: $P \leq 0.01$

Table 7
Slaughter value of carcass and results of leg dissection
Schlachtleistung und Schlachtkörperqualität der Lämmer

Item	Experimental Group (E), n=20		Control Group (C), n=20	
	LSM	SE	LSM	SE
Dressing percentage	48.9	0.4	49.3	0.4
Tissue composition of leg, kg				
meat	1.403	0.029	1.463	0.028
fat	0.246 ^a	0.007	0.279 ^b	0.015
bones	0.284	0.006	0.293	0.006
Fat thickness on loin-eye, mm	1.72	0.13	2.03	0.13
Fat thickness over ribs, mm	4.13 ^A	0.30	5.44 ^B	0.30
Loin-eye area, cm ²	13.0	0.4	12.7	0.4

LSM last square mean, SE standard error of mean, ^{aA,bb}means superscripts differ significantly at a,b: $P \leq 0.05$, A,B: $P \leq 0.01$

Discussion

The initial Se, Zn and vitamin E status in blood plasma of ewes before treatment were 1.25, 14.22 and 3.41 $\mu\text{mol/l}$. Comparison with the references values showed that the results obtained in this flock were within the physiological (regular) levels for a sheep herd. The contents of Se and Zn in the feeds were from 0.1 to 0.16 mg/kg DM Se and 15.1 to 33.7 mg/kg DM Zn. All feeds would be considered as standard. All ewes received per day addition 0.12 mg Se, 60 mg Zn and 5 mg vitamin E from mineral premix. The doses of Se, Zn and vitamin E applied in this experiment did not result in miscarriages, stillbirth and cases of prolapsus uteri or vaginae. Daily Se intake per ram during fattening in C group was 0.15 mg and 0.57 mg in group E while the respective values for Zn were 29.2 mg and 97.2 mg. Minimal dietary Se requirements of animal species cannot be given with any accuracy. However, National Research Council (USA) suggested that Se requirement range for sheep are from 0.1 to 0.2 ppm of feed DM (MCDOWELL 1992). Some animal experiments have suggested that dietary Se may have some beneficial effects at levels above those generally accepted as adequate (MCDOWELL 1992). Current estimates put maximum tolerable level of Se at 2 mg/kg DM for the major livestock species, and no differentiation exists for tolerable levels between ruminants and nonruminants

(MCDOWELL 1992, DAVIS *et al.* 2006). The maximum tolerable level of inorganic Se for sheep is much greater than 2 mg/kg DM as was suggested previously. Feeding up to 12 mg of selenite/kg feed DM to ewes under the stresses of production (i.e., gestation and lactation) for 72 weeks did not produce any clinical or pathologic signs of Se intoxication (DAVIS *et al.* 2006). The NRC suggested that Zn requirements for sheep vary from 20 to 33 mg/kg feed DM. For ruminants, overt Zn toxicosis first appears when levels around 1000 ppm are incorporated into a natural-ingredient diet (MCDOWELL 1992).

The administration of Se, Zn and vitamin E had significant negative effects on the body live weight at birth day, the body weight on week 4 and 8 and the daily body live weight gain from birth to 4 week and from birth to 8 week.

In our earlier study (GABRYSZUK 1994) conducted in the years 1987-1988 intramuscular injection of 5 ml 0.1% Na₂SeO₄ and 250 mg of vitamin E 4 weeks before the mating season and 4 weeks before the lambing increased fertility when the Se plasma deficit was high. However, when the Se level in blood plasma was within the normal range, the injection of vitamin E and Se together decreased fertility and lamb body live weight at birth (GABRYSZUK 1994). The data obtained in earlier study indicate that single injection of Se given before mating and lambing significantly affect oestrus, fertility, lamb body weight at 28-day and daily weight gain in 0-28 days period in 3-year-old ewes (GABRYSZUK and KLEWIEC 2002). Injection of Se and vitamin E together does not significantly increase reproduction and rearing performance in 2 and 3 year old ewes in the flock considered not deficient in Se status (GABRYSZUK and KLEWIEC 2002). This may have been caused by the fact that after pregnancy and lactation the 3 year old ewes were unable to replenish the lost stores of Se and vitamin E before entering the next pregnancy. Despite that the Se and vitamin E content in blood plasma were within the normal range (GABRYSZUK and KLEWIEC 2002). A positive effect of Se or Se-vitamin E on fertility was observed by several authors (SCALES 1974, MIHAILOWIĆ *et al.* 1991, SEGERSON and GAUPATHY 1980), but not confirmed by the others (DAVIS 1966, SEGERSON *et al.* 1986). A divergence of opinion as regards the effect of Se on fertility was often presented in the literature. One of the reasons is due to the fact that the level of Se was rarely examined simultaneously with that of vitamin E what made interpretation difficult (HIDIROGLOU 1979).

Application of 5 ml 0.1% sodium selenide before mating and lambing significantly affect Se-status in blood serum and reproductive performance of ewes and body weight of lambs at 33 days of age in a Se-deficient area (BALICKA-RAMISZ *et al.* 2006). The mean Se blood serum content increased from 0.038 to 0.175 µg/ml after Se application. Body live weight lambs on birth and body live weight at 33 day significantly increased from 3.73 and 11.19 kg to 3.96 and 11.50 kg in treatment group, respectively (BALICKA-RAMISZ *et al.* 2006). Another study has shown that Se-vitamin E injection (with 0.31 mg Se + 4.2 UI vitamin E per kg body weight) increased the blood Se concentration in pregnant goats in selenium-deficient dairy goats (RAMIREZ-BRIBIESCA *et al.* 2005). It also concluded that the treatment with the single dosage as sodium selenite-vitamin E mixture injected in to kids is effective to enhance the survival of kids until weaning (RAMIREZ-BRIBIESCA *et al.* 2005). An increased dose of Se in lambs diet up to 0.25 ppm, as sodium selenite added to the basal natural diet containing marginally low Se (0.082 ppm), appears to be at or near

the Se requirement, as evidence by the level of Se in tissue, blood, serum and the maximal tissue glutathione peroxidase activities. In sheep with higher dietary Se levels (0.41 and 0.58 ppm), the increase in the concentration of Se and in enzyme activity was not so evident (ZACHARA *et al.* 1993).

The results presented here show that before offering Se and vitamin E it is necessary to determine their actual level in the flock in question. OVERNES (1993) reported that adequate measures should therefore be taken to ensure that animals receive an optimal supplementation of both Se and vitamin E. The reasons for the discrepancies in various reports may be related to the level of Se and the interaction of Se or Se-E with other nutrition factors. Se and Se+E supplementation, when plasma Se concentration was within the standard range, appeared to contribute to a healthier udder status, but neither lamb weaning weights nor ewe productivity were enhanced by the treatment applied (APPEDDU *et al.* 1994).

In study of GABRYSZUK *et al.* (2005) simultaneous injections of Se, Zn and vitamin E at 4 weeks before lambing does not increased level of these nutrients in colostrum. The second injection on 1 day after lambing slightly increased Se and Zn levels one week after lambing. The level of vitamin E also increased, but not significantly. The next injections at 3 and 6 weeks after lambing significantly increased Se levels at 4, 6 and 7 weeks after parturition, vitamin E levels at 4 and 7 weeks, and Zn levels significantly increased 7 weeks after lambing (GABRYSZUK *et al.* 2005). MENESES *et al.* (1994) showed that ewes injected with vitamin E and Se at lambing had a significantly higher vitamin E and Se in the milk than control group up to 14 day of the lactation. Ewes receiving two prepartum injection of the highest Se dose had higher milk Se concentration than controls at both parturition and 1 month later (CUESTA *et al.* 1995). Se, Zn and vitamin E administered intramuscular to pregnant and lactating ewes induced a decrease in cholesterol content of milk and blood, and led to increased the conjugated linoleic acid (CLA) isomers level in milk (GABRYSZUK *et al.* 2007b).

The initial Se, Zn and vit. E status in blood plasma of fattening rams were within the physiological (regular) levels for a sheep herd (Table 4). The concentrations of Se, Zn and vit. E in the blood plasma of rams from group E after fattening were significantly higher than control rams, but within the reference values (Table 4). In the same age at start fattening rams weaned from ewes treated Se, Zn and vitamin E were lower body weight initial fattening and lower body live weight gain from birth to start fattening than rams from control group (Table 6). Despite above differences the daily live weight gains during fattening were similar in both groups. Rams from E groups intake less concentrate per kg body live weight gain than control group, but not statistically confirmation. The results of fattening and slaughter value of all lambs examined in the current work was satisfactory and comparable to the results reached in the other experiment conducted on growing lambs (BARANOWSKI *et al.* 2007). Dressing percentage in rams from experimental group was similar to that found in rams from control group. In comparison to the C diet, enrichment of diet E with Se, Zn and vitamin E (0.42, 68 and 60 mg/lamb/day, respectively) significantly decreased the fat in leg, fat thickness over ribs and fat thickness over loin-eye (Table 7). In study of GABRYSZUK *et al.* (2007a) demonstrated that Se, Zn and vitamin E administered orally to growing ram-lambs induced a decrease in total

cholesterol content of blood and meat and increase the high density lipoproteins fractions level in blood. Additionally enrichment the diet of Se, Zn and vitamin E, led to increased the CLA isomers level in meat and liver.

BORYS *et al.* (2004) reported, that the experimental diets (10% of rapeseed and linseed oil) enriched with vit. E decreased fat layer over the loin eye (by 41,7%), over the ribs (31.7%), and decreased by the average of 11.5% of intramuscular fat of lambs meat, but no statistically confirmation. The use of 10% oilseeds in complete diets for lambs did not significantly affect fattening results and slaughter value. Generally more favourable parameters were obtained when feeding rapeseed and linseed at a 1:1 ratio than at a 2:1 ratio and when the diets were supplemented with vitamin E (BORYS and JARZYNOWSKA, 2005).

The male Polish Merino lambs fed the experimental diets enriched in 5% linseed oil (LO) or 2 ppm Se (SE) numerically increased the body weight of lambs. While the combined addition of 5% LO and 2 ppm Se (LOSE) significantly elevated body weight after 35 days of feeding (CZAUDERNA *et al.* 2004). Feeding the diet enriched in LO or in LO and Se (LOSE) resulted in numerically increased mass of the liver, lungs, spleen, kidneys, M. longissimus dorsi and M. biceps femoris (CZAUDERNA *et al.* 2004).

This study demonstrated that levels of Se, Zn and vitamin E in blood plasma were within the reference values before and after Se, Zn and vitamin E administered to ewes and fattening rams. Se, Zn and vitamin E administered intramuscularly to pregnant and lactating ewes induced a decrease body live weight at birth, body live weight at 4 and 8 week, daily live weight gain from birth to 4 week and from birth to 8 week. Administered of Se, Zn and vitamin E orally to growing ram-lambs induced a decrease content of fat in leg, fat thickness on loin-eye and fat thickness over ribs. The daily body live weight gain during fattening was similar in experimental group and in control group. The results presented here show that before offering Se, Zn and vitamin E it is necessary to determine their actual level in the flock in question.

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