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THE INFLUENCE OF SELENIUM ON REPRODUCTIVE EFFICIENCY IN SHEEP

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Introduction

Selenium has been amply documented to significantly enhance animal development, a number of metabolic processes, and the reproductive success. On the other hand, Se deficiency may lead to pathogenic effects such as the white muscle disease, retention of placenta, spontaneous abortions, reduced fertility, and neonatal disorders (Bostedt et al. 1990, Hulland 1985, Hamliri et al. 1991, Gabbedy et al. 1977; Grela and Sembratowicz 1997).

Se is transported to the offspring (lambs) along two pathways: via the placenta during the foetal stage, and with the colostrum at the neonatal phase. Selenium, even at low concentration in the ewe's body, is efficiently passed on to the foetus (Koller et al. 1984). Parenteral administration of Se significantly increases its concentrations in the colostrum and milk (Cuesta at al. 1995, Maus et al. 1980). According to some authors (Hartley et al. 1961; Horton et al. 1986; Scales 1974), Se increases the ewe's fecundity and improves health and increases body weight of the neonatal lambs.

The present study was aimed at assessing effects of Se treatment on sheep reproductive characteristics (fecundity) and on some indicators of lamb utility in a Se-deficient area.

Material and methods

Effects of Se administration on certain characteristics of reproductive success and Se level in the blood serum were studied in 2001-2002 on the Polish merino sheep kept on a Western Pomeranian farm. A random sample of 100 4-year-old ewes was picked out and divided into two equal groups: treatment and control. The blood for assays (5 ml samples) was collected from the jugular vein (*vena jugularis*) before and 7 days after sodium selenide administration. The treatment group sheep received 5 ml 0.1% sodium selenide 10-14 days before servicing and 14 days prior to delivery. The blood serum Se level was assayed fluorometrically using the method developed by Watkinson (1966) and modified by Grzebula (1977). The lambs born in both groups were weighed on birth and 33 days later. The data

were processed statistically by calculating means ($\overline{X}$), standard deviations (SD), and coefficients of variation (V) and by testing for significance of between-groups differences with Student's *t* test run with the STATISTICA PL computer package. The following criteria developed by Grace (1997) were used to evaluate the sheep blood serum Se level: Se content below 0.041 µg/ml = Se deficiency; 0.041 – 0.079 µg/ml = threshold level; above 0.079 µg/ml = physiological (regular) level for a sheep herd.

The sheep obtained food by pasture grazing in summer, while in winter they were fed hay, beetroot, and fodder mix applied in rations of 200-250 g a sheep. In addition, salt-licks and mineral mixes were offered as well.

Results

The blood serum Se selenium content assays showed the herd to be affected by Se deficiency. Prior to Se application, 49 out of 50 ewes were either Se-deficient (41 ewes) or showed threshold Se levels (8 ewes). Sufficient blood serum Se content was shown by a single ewe only. A clear improvement was observed following sodium selenide application: as few as 2 ewes were Se-deficient, 3 showing the threshold level. The blood serum Se contents in the remaining 45 ewes exceeded 0.1µg/ml, which should be regarded, according to standards used by Grace (1997), as optimal for sheep. The mean Se blood serum content in the control was 0.038 µg/ml. Statistically significant differences ($P \leq 0.01$) in Se contents were detected between the control and the treatment groups (Table 1).

Table 1. Blood serum Se content in the Western Pomeranian sheep ($\overline{X}$ ±SD, V)

Group	No. of sheep assayed (n)	Se content (µg/ml) ($\overline{X}$)	SD	V (%)
K	50	0.038^{A}	0.017	44.71
D	50	0.175^{A}	0.063	36.41

$^{A, B}$ differences statistically significant at $P \leq 0.01$
K, control; D, treatment

Compared to the control group (K), the lambs born by the Se-treated ewes (D) experienced much lower mortality; their body weight on birth was higher, as was the number of lambs born live (Table 2). Se treatment applied to pregnant ewes improved their reproductive success (Table 2). The treatment group lambs were significantly ($P \leq 0.01$) heavier both on birth and 33 days later, compared to the control group lambs.

Table 2. Effects of selenium on sheep reproductive success and lamb body weight

Group	Number of lambs /ewe			Body weight on birth (kg)			Body weight 33 days after birth (kg)			Mortality (%)
	$(\overline{X})$	SD	V (%)	$(\overline{X})$	SD	V (%)	$(\overline{X})$	SD	V (%)	$(\overline{X})$
K	1.20^{A}	0.55	42.46	3.73^{B}	0.42	11.41	11.19^{C}	0.66	5.92	9.3
D	1.58^{A}	0.53	30.18	3.96^{B}	0.44	11.09	11.50^{C}	0.99	8.67	12.4

$^{A, B, C}$ results statistically significant at P≤0.01
K, control; D, treatment

Application of sodium selenide resulted in improvement of reproductive success indicators (fertility and fecundity) (Table 3).

Table 3. Effects of sodium selenide on sheep reproductive success

Ewes	Number of individuals	Number of lambs born	Number of barren ewes
K	50	60	3
D	50	79	1

K, control; D, treatment

Discussion

Ramisz and Buzek (1986) as well as Hemingway (2003) reported the sheep fecundity to be considerably dependent on the feed Se level.

Mauka et al. (1998) demonstrated the blood serum Se content in the sheep fed Se+vitamins-enriched feed to be by 25% higher (increase from 0.51 to 0.63 μmol/l), the increase in the liver amounting to 35%. The Se level increase was translated into lamb body weight gains: in month 5 of the experiment, the treatment lamb body weight was by 28.6 % higher than that of the untreated lambs.

Enzootic muscle degeneration was a cause of high lamb mortality in Morocco (Hamliri et al. 1991). Following a prophylactic Se treatment applied to ewes at advanced stage of pregnancy, the disorder was arrested and the lambs were born healthy. Comprehensive studies on Se deficiency in lambs were carried out in Poland as well. In Western Pomerania, Ramisz et al. (2001) observed food-related muscle dystrophy to have affected 20-30% of the lambs examined. A prophylactic Se treatment applied by those authors proved very beneficial for the lambs.

Conclusions

1. Sodium selenide applied in 5 ml doses of 0.1% solution 10-14 days prior to servicing and 14 days before delivery significantly improves the sheep's reproductive success.
2. Pre-fertilization application of sodium selenide enhances the herd production. The treatment group's fecundity was by 0.38 lamb/ewe higher than that in the control.

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