

EFFECT OF SUPPLEMENT OF SELENIUM AND IODINE ON BIOCHEMICAL STATUS OF SHEEP

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Abstract: Trace element disbalance in animal organism can provoke different disease states in development of some internal organs. Degenerative processes are also related to increase of activity of some enzymes. Therefore the objective of this study was to follow the effect of the supplement of selenium and iodine on activity of some indicator enzymes. The study was conducted with sheep of Karakachan and Tsigai breeds that use mountain and high-mountain pastures of Central Rhodope Mountains. Biochemical status of sheep was studied at the end of grazing period through the analysis of the activities of the following indicator enzymes: Aspartate aminotransferase (ASAT), Alanine aminotransferase (ALT), Creatine phosphokinase (CpK), Cholesterol and Triglyceride. It was found that the supplement of 0.250 mg Se/kg and 0.10 mg J/kg exerted a positive influence on the biochemical status of Tsigai sheep, during which the activities of indicator enzymes ASAT, ALT, CpK, cholesterol and triglycerides returned to normal from 13% to 29%. Se and J supplementation in Karakachan sheep decreased the ALT and ASAT activity by 18% and 8%, respectively. The Karakachan sheep reacted to a smaller extent to the trace element supplement, as compared to the Tsigai breed.

Key words: sheep, biochemical status, selenium, iodine, enzymes

Introduction

The problem of guaranteeing the mineral provision for agricultural animals during the grazing period in the mountainous regions is closely related to the concentration of essential trace elements in meadow-pasture vegetation (*Anke et al., 1993*). The reasons for existence of abnormalities in the content of certain trace elements in herbaceous vegetation and hence in the animal organism, can be due to a number of factors (*Giessel-Nielsen et al., 1984, Kadar and Koncz, 1994, Mertz, 1993; Welch, 1996*). Species diversity of natural meadows and pastures and

altitude also exert an influence on the concentration of trace elements in pasture grass, besides the environmental factors.

The trace element disbalance of the organism can provoke development of necroses of parenchymal cells of liver, heart and skeletal musculature. Degenerative processes are accompanied by disturbances in cell membranes and increase of the activity of some indicator enzymes.

The increased enzymatic activity of Aspartate aminotransferase (ASAT), Alanine aminotransferase (ALT), Creatine phosphokinase (CpK), Cholesterol and Triglycerides in sheep is a symptom of cell damage and can be used as a criterion of identification of selenium status of the organism.

The objective of this study was to follow the effect of the supplement of selenium and iodine on the activity of some indicator enzymes.

Materials and Methods

The study was conducted in the region of CES, town of Smolyan with sheep of Karakachan and Tsigai breed that use the mountain and high-mountain pastures in the localities of “Kaynadina” and “Novak” (Central Rhodope Mountains) in May-September. The pasture in the locality “Kaynadina” is located at 1200 m a.s.l. The natural sward mainly consisted of grasses that occupied about 80% and were mainly represented by *Agrostis capillaris* and *Festuca fallax*. The species *Anthoxanthum odoratum*, *Poa pratensis*, *Phleum pratense* and *Nardus stricta* had insignificant participation. Legumes were represented by the species *Trifolium repens*, *Trifolium pratense*, *Trifolium hybridum* – about 8%. *Taraxacum officinale*, *Veratrum lobelianum Bernh* and other species were found among the miscellaneous herbs with 12%.

The pasture in the locality “Novak” is located over 1400 m a.s.l. The botanical composition of sward changed and herbaceous species having a minor forage value, such as *Nardus stricta*- 84%, *Anthoxanthum odoratum* and *Deschampsia caespitosa* appeared with increase of altitude.

The biochemical status of Tsigai and Karakachan sheep was studied at the end of grazing period through the analysis of the activities of the following indicator enzymes: Aspartate aminotransferase (ASAT), Alanine aminotransferase (ALT), Creatine phosphokinase (CpK), Cholesterol and Triglyceride. The study was conducted with 12 sheep of each breed divided into two groups. The control groups (6 Tsigai and 6 Karakachan sheep) received every day a trace element supplement of 0.250 mg Se per day in the form [U/I] of NaHSeO₃ and 0.10 mg J per day in the form of KJ (per os). Blood samples were taken in the morning on an empty stomach from *vena jugularis* and were analyzed till six hours after their centrifugation.

The enzymatic activities were determined on an automatic analyzer model RA-1000 with reagents of "Human" Company

- aspartate aminotransferase (ASAT, E.C.2.6.1.1) U/l, standardized method, according to the recommendations of IFCC (1976);
- alanine aminotransferase (ALT, E.C.2.6.1.2.) U/l, standardized method, according to the recommendations of IFCC (1980);
- creatine phosphokinase (CK, E.C.2.7.3.2.) U/l, standardized method, according to the recommendations of IFCC (1986);
- cholesterol - mmol/l - CHOD-PAP method;
- triglycerides - mmol/l - CPO-PAP method.

Results and Discussion

The results of the influence of Se-J supplement on the activities of the enzymes in Tsigai sheep are presented in Table 1.

Table 1. Activity of ASAT, ALT, CpK, cholesterol and triglycerides in blood plasma of sheep of Tsigai breed (U/l, mmol/l)

Characteristics	Control group (n= 6) x ±Sx	Deficient group (n= 6) x ±Sx	P	%
ASAT	152.2 ± 16.5	190.3 ± 7.5	< 0.05	125
ALT	25.7 ± 1.1	29.2 ± 2.9	> 0.05	113
CpK	231 ± 35	325 ± 22	< 0.05	129
Cholesterol	2.02 ± 0.14	2.52 ± 0.08	< 0.001	124
Triglycerides	0.358 ± 0.04	0.430 ± 0.05	< 0.05	120

The ASAT levels in the deficient group were 25% higher and were statistically significant at $P < 0.05$. The average values of the control animals, 152.17 U/l, were higher than the normal reference values for sheep (*Braun, 1995*). The ASAT activity was influenced by the physiological state of sheep. During the period of fertilization the enzyme values were higher, as compared to pregnancy and lactation (*Klitsenko, 1982*). ASAT values lower than 100 U/l were found in similar trials with clinically healthy sheep supplemented with 0.20 mg Na selenite. The significant decrease in the ASAT activity demonstrated the positive effect of the supplement. The diagnostic importance of that nonspecific enzyme consisted in the preliminary prediction of the occurring degenerative processes in consequence of secondary Cu toxicosis. The relatively higher values in the deficient group were due to the occurring tissue degeneration in sheep. The selenium supplement delayed that process, but the relatively short period of Se protection did not allow full restoration of enzymatic status. An analogous effect was observed in the

control group having received a supplement of Se and J. During the ALT analysis the enzyme activity of the deficient group was 13% higher than that of the control one. The average values of 25.66 U/l for the control group and 29.16 U/l for the deficient one were within the limits of the normal values for sheep. The ALT activity depended on the physiological state and live weight of the animals (*Klitsenko, 1982*).

The increased levels of transaminases (ASAT and ALT) in the deficient sheep could be due to tissue degeneration and served as a diagnostic test in liver damages. The non-significant differences in the ALT activities in the two studied sheep groups were probably an expression of the presence of enzymatic adaptation. The CpK levels showed a considerable change in the enzyme activity in the deficient animals. The difference of 29% was statistically confirmed ($P < 0.05$). CpK is a highly specific enzyme reflecting the degeneration of the skeletal and cardiac musculature. The increased enzymatic activity due to the chronic Se deficiency was an indication of the occurring dystrophic changes in the skeletal musculature that confirmed the results of Ibrishimov and Lalov (1) and Braun (4). The higher enzymatic activity found in the control group, 231 U/l, as compared to the cited normal values was related to the slow restoration of the organism.

Similar reactions of the organism when feeding ruminants with Se-deficient rations were also found by Osame (9), Takahashi et al. (10). The control sheep were susceptible to the selenium supplement when analyzing the cholesterol and triglycerides in blood serum. The cholesterol increase by 24% and that of triglycerides by 20% for the deficient sheep was an indication of the existence of fatty degeneration in the animal organism

The results obtained for the biochemical parameters in the Karakachan breed are given in Table 2.

Table 2. Activity of ASAT, ALT, CpK, cholesterol and triglycerides in blood plasma of sheep of Karakachan breed (U/l, mmol/l)

(n= 6)

Characteristics	Control group $\bar{x} \pm Sx$	Deficient group $\bar{x} \pm Sx$	P	%
ASAT	170 ± 18.9	185 ± 14.3	> 0.05	108
ALT	24 ± 2.34	28.50 ± 4.67	> 0.05	118
CpK	251 ± 32	334 ± 16	< 0.05	133
Cholesterol	2.13 ± 0.12	2.20 ± 0.22	> 0.05	103
Triglycerides	0.31 ± 0.03	0.43 ± 0.05	< 0.05	125

The variation in the transaminase activity in sheep was influenced within more narrow limits, as compared to the Tsigai breed. The Se and J supplementation in Karakachan sheep led to 18% decrease for the ALT activity and 8% for the ASAT one. It is known that in liver damages the ALT activity increases more strongly, as

compared to ASAT. The changes occurring with the activity of creatine phosphokinase in the deficient group were most considerable.

In consequence of the occurring muscular damages in sheep of the deficient group the plasmic activity of CpK increased by 32.7%, as compared to the supplemented animals. *Gooneratne and Howell (1985)* found similar regularities only when supplementing with inorganic Se. The variation in the levels of cholesterol and triglycerides was insignificant. The selenium-iodine supplement led to statistical differences only in the triglyceride level in blood serum ($p < 0.05$). When studying the biochemical status of sheep, through determination of enzymatic activities, differences were found with a different degree of significance between the control and deficient groups. The positive effect on the biochemical status in the control sheep found expression in the gradual normalization of the values of the indicator enzymes. Analyzing the obtained data on the activity of ASAT, ALT, CpK, cholesterol and triglycerides, it was found that the Karakachan breed reacted to a smaller extent to the trace element Se-J deficiency (disbalance), as compared to the Tsigai breed.

Conclusion

The supplement of 0,250 mg Se/kg and 0,10 mg J/kg exerted a positive influence on biochemical status of Tsigai breed sheep, during which the activities of indicator enzymes ASAT, ALT, CpK, cholesterol and triglycerides returned to normal from 13% to 29%.

The Se and J supplementation for Karakachan sheep decreased the ALT and ASAT activity by 18% and 8%, respectively. The changes occurring with the activity of creatine phosphokinase in the deficient group were most considerable (33%).

The Karakachan sheep reacted to a smaller extent to the trace element supplement, as compared to the Tsigai breed.

Uticaj dodavanja obroku selena i joda na biohemijski status ovaca

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Rezime

Odsustvo ravnoteže elemenata u tragovima u organizmu može dovesti do različitih bolesti i poremećaja u razvoju nekih unutrašnjih organa. Degenerativni procesi su također povezani sa povećanjem aktivnosti nekih enzima. Stoga, cilj

ovog rada je bio da se ispita uticaj dodavanja selena i joda na aktivnost nekih indikatora enzima.

Ovo ispitivanje je urađeno sa ovcama karakačanske i cigaja rase koje koriste planinske pašnjake i visoko-planinske pašnjake Centralnih Rodopskih planina. Biohemijski status ovaca je ispitan na kraju perioda ispaše analizom aktivnosti sledećih indikatora enzima: aspartat aminotransferaza (ASAT), alanin aminotransferaza (ALT), kreatin fosfokinaza (CpK), holesterol i trigliceridi.

Utvrđeno je da dodavanje 0,250 mg Se/kg i 0,10 mg J/kg imalo pozitivan uticaj na biohemijski status ovaca rase cigaja, gde je aktivnost indikatora enzima ASAT, ALT, CpK, holesterola i triglicerida vraćena na normalu sa 13% na 29%. Dodavanje Se i J kod karakačanskih ovaca je uticalo na smanjenje aktivnosti ALT i ASAT za 18% i 8%, respektivno. Karakačanska ovca je u manjoj meri reagovala na dodavanje elemenata u tragovima u poređenju sa ovcama cigaja rase.

References

- IBRISHIMOV N., LALOV (1984): Clinical laboratory studies in veterinary medicine, Sofia.
- KLITSENKO G. (1982): Mineral nutrition of agricultural animals Moscow, Kolos
- Anke M., B. Groppe, H. Görtler, M. Müller (1993), Spurenelementmangelerscheinungen bei Tier und Mensch. In: M. Anke und H. Görtler (Hrsg.) Mineralstoffe und Spurenelemente in der Ernährung, Verlag Media Touristik, 157
- Braun, J., 1995. Rev. Med. Vet. 146, 615-622.
- GIESSEL-NIELSEN G., GUPTA M.L., WESTERMARCK T. (1984): Selenium in soils and plants and importance in livestock and human nutrition. Adv. Argon., 37, 397.
- GOONERATHE S., HOWELL J. (1985): In "Trace Elements in Man and Animals" (C. F. Mills, I. Bremner and J. K. Chesters, eds), Commonwealth Agric. Bureaux, Farnham Royal, U. K., 187-191.
- KADAR I., KONCZ J. (1994): Effect of some trace elements on soil, crop and animals. In: I. Pais (ed.) New Perspectives in the Research of hardly known trace elements, 6. International Symposium, Budapest, Hungary, 1
- MERTZ W. (1993): The history of the discovery of the essential trace elements. In: M. Anke, D. Meissner, C. F. Mills (eds.) Trace Elements in Man and Animals, TEMA-8, Velag Media Touristik, 22
- OSAME S., ISHIJO S., MIJAKE T., SARASHINA T. (1988): J. of Japan Vet. Med. Ass., 41, 702-706.
- TAKAHASHI E., ISHIJO S., OSAME S., HOSHIMO Y. (1990): J. of Japan Vet. Med. Ass., 43, 99-103.
- WELCH R.M. (1996): Trace Elements Interaction in Foot Crops. In: W. F. Fischer, M. R. LrAbbe, K. A. Cockell, R. S. Gibson (eds.) Trace Elements in Man and Animals, TEMA-9, Banff, Alberta, Canada, 6-10