قسم : الأمراض الباطنة ٠
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رئيس القسم : أ٠د٠/ فوزية علي٠

دراسة العلاقة بين تركيز السلنيوم في مكونات الدم ومصل الدم وكرات الدم الحمراء في الاغنام قبل وبعد اضافة السلنيوم وفيتامين هـ في العليقة

صبحي المغاوري ، ابراهيم عاشور* ، محمد يوسف ، عبدالرحيم الغنام

أجري هذا البحث لدراسة معرفة تأثير اضافة السلنيوم وفيتامين هـ على تركيز السلنيوم في الدم ومصل الدم وكراته الحمراء في الاغنام ٠

وقد استخدم في هذه الدراسة عدد أربعون من اناث الاغنام يتراوح أعمارهم ما بين ١ ـ ٤ سنوات وقد قسمت الى أربعة مجاميع متساوية ٠

المجموعة الأولى: استخدمت كمجموعة ضابطة ، أما المجموعة الثانية تم اضافة السلنيوم فقط للعليقة ، والمجموعة الثالثة أضيف لها فيتامين هـ ، وأخيرا المجموعة الرابعة اضيف لها في العليقة كلا من السلنيوم وفيتامين هـ٠

وقد أخذت عينات الدم والمصل من كل المجموعات المذكورة قبل الاضافة وبعدها على فترات مختلفة مابين ٤، ٨، ١٢ اسبوعا ٠

وقد شملت الدراسة تقدير نسبة السلنيوم في الدم وكرات الدم الحمراء ومصل الاغنام في الفترات المختلفة من البحث فلوحظ أن هناك زيادة معنوية في معدلات السلنيوم في كل من الدم وكراته الحمراء وكذلك في مصل الدم بعد أربعة أسابيع من اضافة السلنيوم في العليقة ، وقد وجد أن هذه الزيادة تزداد بمعدلات حادة بعد ١٢ اسبوع من اضافة السلنيوم وذلك بالمقارنة لمجموعة ضوابط والمعطاة فيتامين هـ٠

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RELATIONSHIP BETWEEN SELENIUM CONCENTRATION IN WHOLE BLOOD, BLOOD SERUM AND ERYTHROCYTES OF SHEEP SUPPLEMENTED WITH SELENIUM AND/OR VIT. E.

(With One Table and Two Figures)

By
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(Received at 15/12/1987)

SUMMARY

Selenium (Se) concentration in whole blood, blood serum and erythrocytes of sheep were monitored for 12 weeks after selenium and Vit. E. supplementation. Significant increase in selenium concentration in whole blood, blood serum and erythrocytes was found after 4 weeks ($P < 0.05$) and 8 weeks ($P < 0.01$), followed by highly significant increase ($P < 0.01$) after 12 weeks in both selenium supplemented and Vit. E. Selenium supplemented groups, in comparison to control and Vit. E. suplemented groups.

The results suggested that, selenium concentration in both serum and erythrocytes respond to changes in dietary selenium intake, and the respond was parallel to whole blood selenium concentration. Selenium concentration in both serum and R.C.Cs. can be used to monitore selenium status in farm animals, as erythrocytes selenium concentration can be calculated using new formula.

INTRODUCTION

Selenium is a nutritionally essential element, and disorders resulting from selenium inadequacy in livestock are of world-wide distribution. Endemic areas has been related to the concentration of selenium in the soil, pasture and animal tissues (HOFFMAN et al., 1973). Blood selenium concentration in ruminants is very responsive to selenium intake and is measured as an indicator of selenium status of the grazing animal (JUDSON and OBSETS, 1975). Dietary requirement of selenium was estimated at least 0.1 ppm while the maximum tolerable level has been set at 2 ppm (National Research Counicel, 1980). Thus, there is a very narrow range between requirement and toxicity.

In sheep suffering from various Se-responsive diseases, selenium was as low as 0.01 to 0.02 Ug/ml serum (HARTLEY, 1967). Recently, SHEPPARD et al. (1984) stated that, whole blood from weaned lambs with severe selenium responsive unthriftiness usually contains < 5 Ug/ml selenium. Mildly or moderately affected lambs have blood levels of 5 to 10 Ug/ml.

The present experiment was designed to study the relationship between selenium concentration in whole blood, blood serum and R.B.Cs. of sheep, in relation to dietary selenium supplementation.

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MATERIAL and METHODS

Animals :

Fourty ewes, 1-4 years old were used in this trial, these ewes were classified into 4 equal groups A) control, B) selenium supplemented group, C) Vit. E. supplemented group, and D) Selenium & Vit. E. supplemented group. Group A was maintained on a basic diet of propionic acid treated barley, balance hay or straw, while other groups were supplemented either with selenium or/and Vit. E.

Oral selenium was supplemented as sodium selenite to provide 0.2 ppm Se, while Vit. E. was supplemented as alphatocopherol acetate to provide 20 I.u/lb grain.

Blood and Serum Samples :

Blood samples were collected from ewes of different groups, before feeding and at 4, 8 and 12 weeks of experiment. Blood was sampled from jugular vein into 10 ml evacuated heparinized tubes, and other 10 ml evacuated blood serum tubes for erum assays*.

Selenium Estimation :

Selenium concentration in whole blood (WB), blood serum (S) were estimated according to the technique of KOH and BENSON (1983). Samples of 1 or 2 ml were digested with acid mixture of nitric acid and perchloric acid. The fluorescence of Se- 2,3 diaminonaphthalene complex was measured with FARRAND model A4 Fluorometer, using 364 nm primary filter and 510 nm secondary filter. The 2,3-diaminonaphthalene was purchased from Aldrich Chemicals Co., U.S.A.

The selenium concentration of erythrocytes (E) was calculated using the following formula (THOMPSON et al., 1980 & JUDSON and McFARLANE, 1984).

$$[E] \frac{[WB] - (1-HCT)\,[S]}{MCT}$$

where [E] is the erythrocyte Se. concentration, [WB] the concentration of Se in whole blood, [S] the serum Se. concentration, and HCT the haematocrit value, which was determined by micro-haematocrit method.

Diet Analysis :

For selenium was accomplished with a modification of official AOAC fluorometric method for selenium in plants (OLSON et al., 1975). Selenium levels were expressed as ppm on dry matter basis.

Statistics :

The results were analysed by one way analysis of variance and difference between mean values of treatment groups were tested by Duncan's multiple range test (SNEDECOR and COCHRAN, 1967).

RESULTS

The results of selenium concentration in whole blood, blood serum and erythrocytes of four groups of ewes were summarized in Table (1). The whole blood, blood serum and

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erythrocytic selenium concentration was significantly increased (P/ 0.05) after 4 weeks in selenium-supplemented and Vit. E-selenium supplemented groups, while after 8 weeks, the levels of selenium in the same blood fractions of these two groups increased significantly (P/ 0.01), followed by highly significant increase (P/ 0.001) after 12 weeks.

DISCUSSION

For most of medical history, the role of selenium (Se) in ruminant nutrition has been considered only that of a toxicant. The work of SCHWARZ and FOLTZ (1957), showed that selenium was the critical element in factor 3 that prevented liver necrosis in rats, began the work that, has subsequently shown selenium to be an essential nutrient in cattle and other species. Soonafter, JOQUE et al. (1962) and MUTH (1963) reported that selenium and Vit. E. administration prevented white muscle disease in young ruminants.

In the present work, selenium concentrations in whole blood, blood serum and erythrocytes of sheep were determined during 12 weeks of experiment, in different treated and control groups. Significant increases (P/ 0.05 to 0.01) in (Se) concentrations was recorded in selenium supplemented group and selenium Vit. E supplemented group, when compared to either control or Vit E supplemented groups after 8 weeks of experiment. Moreover, more significant increase (P/ 0.001) were recorded after 12 weeks of experiment (Table 1 & Fig. 1).

The most important observation therein, is the linear response in its concentration in whole blood, blood serum and erythrocytes, in relation dietary selenium intake (Fig. 2). In the same time, it had been observed that, selenium concentration in whole blood, almost nearly twice the selenium concentration in both serum and erythrocytes.

Similar studies have been done in cattle by JUDSON and McFARLENE (1984). While FISHER et al. (1980) studied the changes in blood, serum and milk levels in cows fed diets supplemented with 0.1, 0.2 and 0.5 ppm selenium. They observed a linear response of selenium in whole blood and milk to increase the dietary intake of selenium, and plateau of response occurred.

It is worthy, to mention that, diet analysis revealed that basal diet offered to control group, had 0.0214 ppm selenium, while these supplemented with selenium had 0.2213 ppm selenium on dry matter basis.

Accordingly, it can be concluded that, there were a good relationship between whole blood, blood serum and erythrocytes selenium concentrations to dietary selenium intake, and the response were linear or paralell and selenium concentration in serum or R.B.Cs can be used for monitored selenium status of farm animals.

REFERENCES

Fisher, L.J., Hoogendoorn, C. and Montemurro, J. (1980): The effect added of dietary selenium in the selenium content of milk, blood and serum Can. J. Anim. Sci., 58, 80-88.

Hartley, W.J. (1967): Syomposium: Selenium in Biomedicine. Chapter 5. Levels of selenium in animal tissues and methods of selenium administration. E.D.O.H. Muth. USA.

Hoffman, I., Jenkins, K.J., Meranger, J.C. and Pigden, W.J. (1973): Muscle and kidney selenium levels in calves and lambs raised in various parts of Canda. Can. J. Anim. Sci. 53: 61-66.

Jogue, D.E., Proctor, J.F., Warner, R.G. and Loosli, J.K. (1962): Relation of selenium, Vit. E. and an unidenitified factor to muscular dystrophy (stiff-lamb or white muscle disease) in lambs. J. Anim. Sci. 21 (2): 25-29.

Judson, G.J. and Obsets, J.M. (1975): Selenium. In Trace Elements in Soil Plant and Animal Systems. p. 385. Ed. D. J.D. Nicholls & A.R. Egan. New York: Academic Press.

Judson, G.J. and McFarlane, J.D. (1984): Selenium status of cattle given rminal bullets. Aust. Vet. J. Vol. 61, No. 10, pp. 333.

Koh, T.S. and Benson, T.H. (1983): Critical re-appraisal of fluorometric method for determination of selenium in biological materials J. Assoc. of. Anal. Chem. 66 (4), 918-926.

Muth, O.H. (1963): White Muscle Disease, a selenium responsive myopathy JAVMA, Vol. 142 (3), 272-277.

National Research Council (1980): Mineral tolerance of domestic animals. NRC, Washington,D.C.

Olson, D.E., Palmer, I.S. and Gary, E.E. (1975): Modification of the official flurometric method for selenium in plants J. Assoc. Anal. Chem. 58: 117-121.

Schwarz, K. and Foltz, C.M. (1957): Selenium as an integral part of factor 3 against dietary necrotic liver degeneration. J. Am. Chem. Soc. 79: 3292-3292.

Sheppard, A.D., Lucy Blood and Grant, A.B. (1984): Levels of selenium in blood and tissues associated with some selenium deficiency diseases in New-Zealand sheep, N.Z. Vet. J., 32: 91-95.

Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods. 6th Ed., Ames, Iowa State, Univ., 280.

Thompson, K.G., Farser,A.J., Harrop, B.M. and Kirk, J.A. (1980): Glutathione peroxidase activity in bovine serum and erythrocytes in relation to selenium concentration of blood serum and liver. Research in Vet. Science 28, 321-324.

Table (1): Selenium concentrations (Ug/ml) in blood fractions of sheep given an oral selenium and Vit E. supplementations (Mean ±S.E.).

Week of trial	Blood fraction	GROUPS OF SHEEP: Control group (-Se-E)	Vit E supplemented group (-Se+E)	Selenium supplemented group (+Se-E)	Vit E + Se group (+ Se + E)
	Serum	0.0156±0.0005	0.0155±0.0006	0.0155±0.0004	0.0156±0.0005
O	Blood	0.0259±0.0004	0.0258±0.0004	0.0259±0.0016	0.0059±0.0014
	R.B.Cs	0.0159±0.0005	0.0159±0.0004	0.0158±0.0014	0.0158±0.0016
	Serum	0.0158±0.0004	0.0155±0.0005	0.0245±0.0013	0.0239±0.0004*
4	Blood	0.0261±0.0004	0.0259±0.0005	0.0498±0.0006	0.0499±0.0016
	R.B.Cs	0.0159±0.0004	0.0160±0.0004	0.0255±0.0011	0.0241±0.0005
	Serum	0.0157±0.0005	0.0158±0.0004	0.0420±0.0007*	0.0412±0.0008*
8	Blood	0.0260±0.0005	0.0260±0.0005	0.0799±0.0007	0.0802±0.0018
	R.B.Cs	0.0158±0.0004	0.0160±0.0004	0.0412±0.0008	0.0432±0.0016
	Serum	0.158±0.0004	0.0158±0.0003	0.0755±0.0014**	0.0801±0.0021
12	Blood	0.0261±0.0004	0.0261±0.0006	0.1594±0.0006	0.1602±0.0042
	R.B.Cs	0.0156±0.0005	0.0161±0.0004	0.0794±0.0017	0.0819±0.0023

O : Before feeding Selenium concentration (Ug/ml)

* Significant < 0.05 ** Significant < 0.01

*** Significant < 0.001.

Fig. 1 Selenium Concentrations in Serum and Whole Blood of Sheep of Control and Supplemented Groups

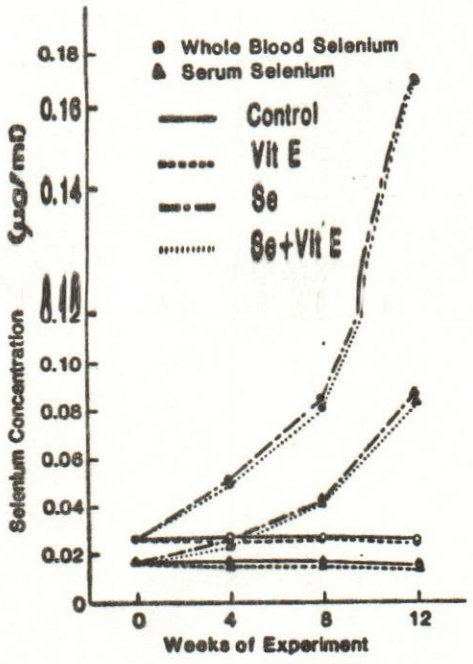

Fig. 2 Relationship Between Selenium Concentration in Whole Blood, Serum and R.B.C$_s$ in Sheep of Different Groups.