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ORIGINAL ARTICLE

The Effect of Supply of the Selenium in the Diet on the Concentration of Selenium in the Serum, Hoof and Hair in the Horse

Hassanpour, Ali

Department of clinical science, faculty of veterinary medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran.

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ABSTRACT

This study was conducted to evaluate the effect of addition the selenium in the diet on the concentration of this element in the serum, hair and hoof in the horse. 40 male horses were divided in two groups of control and treatment (each group was 20 horses). Sodium selenit was supplied in the treatment group for 2 months. Blood samples were taken from jugular vein in the all horses and serum seperated in the days 0, 15, 30, 45 and 60. Also Samples from hair and hoof were collected. The concentration of selenium in these samples was analyzed by atomic absorption spectrometry. In the control group, Mean serum level of selenium and concentration it on the hair and hoof didn't show significant changes, but in the treatment group, was upward and there was a significant statistical difference between mean of selenium levels in serum, hair and hoof on different days ($p= 0.000$, $p= 0.001$ and $p= 0.003$, respectively). By changing of selenium serum level on control group it was determined that on days 0, 15 and 30 the changes were un significant (respectively $r=0.676$, $r=0.424$ and $r=0.619$) and on days 45 and 60 significant changes on selenium concentration is produced (respectively $r=0.561$ and $r=0.454$) but the increasment of serum selenium was not significant by increasing of selenium concentration in hoof in control group in non of days except day 45 (respectively $r=0.118$, $r=0.209$, $r=0.240$, $r= 0.583$ and $r=0.949$). In treatment group by increasing serum selenium increasment of hair selenium on day 15, 30, 45 and 60 was significant (respectively $r=0.617$, $r=0.561$, $r=0.412$ and $r=0.863$) but on day 0 was no significant ($r=0.120$). Also by increasing of selenium serum level, hoof's selenium concentration showed a significant increasment on days 30, 45 and 60 (respectively $r=0.639$, $r=0.940$ and $r=0.844$) but on days 0 and 15 was no significant (respectively $r=0.142$ and $r=0.364$). The conclusion is that adding selenium supplement to horses' diet for 2 months results increasment of selenium serum level and also increasment of its concentration in horse's hoof and hair and considering the antioxidant properties of selenium, it is recommended in sport horses.

Key words: Horse, selenium, serum, hoof, hair

Introduction

Diseases seen in response to deficiency in selenium and vitamin E in farm animals come into existence because of selenium and vitamin E deficiency in diet [2,3,5,6,15]. The role of selenium and vitamin E as antioxidant is suggested primitively and using supplementation containing selenium could

have a protective role in animals [4,7,8,9]. Selenium is involved in hoof strength.

Today in horse industry the use this element and other elements such as zinc and copper consciously in diet to increase hoof strength and varnish of skin but it is not clear yet that how adding the recommended amounts of these elements in horses' diet affect the level of hoof and amount of hair, but

Corresponding Author

Hassanpour, Ali, Department of clinical science, faculty of veterinary medicine, Tabriz Branch, Islamic Azad University, Tabriz, Iran.
E-mail: A_hasanpour@iaut.ac.ir

it is clear that these elements help to each other's absorption. Considering the progress of horse industry in Iran, a lot of investment has been done on this animal and providing animal's strength and beauty in appearance and the hoof's strength is very important.

Therefore, this study was conducted to evaluate the effect of increasing dietary selenium on serum level and amount of this element in hair and hoof so basic strategies can be presented to increase the ability of the animal, the beauty of appearance and the horse's hoof strength.

Materials and methods

This study is an experimental and interventional study that has been conducted on 40 horses in stables in Tabriz. The horses are male with an mean weight of 400-500 kg and age range of 3-6 years. They were divided in 2 groups of control and treatment. In the beginning of plan we make sure about health of horses based on clinical examinations and to then to diet of treatment group was used in addition to supplements containing selenium for 2 months. (0.5 mg of sodium selenit per day for each horse)[10]. The control group horses just get the usual diet. Their diet was alfalfa, barley and straw. On the day zero, blood samples were collected of all horses through the jugular vein and serum was detached. Also samples of hair and hoof were collected. And also in the days 15, 30, 45 and 60 these samples were collected. Then serum value and its amounts in hair and hoof were measured by atomic absorption method (Unicam 939, autosampler; Fa. Unicam, Kassel, Germany).

Results and discussion

Mean serum level of selenium in control group from day 0 to 60 respectively was 106.47 ± 5.23 , 104.32 ± 3.87 , 108.26 ± 4.29 , 108.13 ± 6.33 , 106.07 ± 2.89 $\mu\text{g/L}$ that didn't show significant changes ($p=0.423$) but in treatment group this values were respectively 107.24 ± 3.96 , 113.27 ± 4.27 , 124.32 ± 3.17 , 153.04 ± 9.14 , 187.41 ± 9.53 $\mu\text{g/L}$ that from day 0 to 60 was upward and there was a significant statistical difference between mean of selenium serum level on different days ($p=0.000$). Mean concentration of selenium in hair in control group on different days didn't show significant differences ($p=0.674$) that these values were respectively 273.98 ± 11.65 , 278.46 ± 14.29 , 281.56 ± 17.81 , 284.43 ± 11.24 , 279.56 ± 9.76 $\mu\text{g/kg DM}$ but in treatment group were 275.93 ± 12.36 , 273.72 ± 13.73 , 277.62 ± 14.41 , 291.87 ± 12.49 , 343.19 ± 16.19 $\mu\text{g/kg DM}$ that the difference between values of mean concentration of selenium in hair in different days were significant in this group ($p=0.001$).

The mean concentration of selenium in hoof control group on different days of sampling were respectively 143.34 ± 8.24 , 147.57 ± 7.06 , 139.31 ± 10.29 , 144.94 ± 13.19 , 146.27 ± 8.21 $\mu\text{g/kg DM}$ and in treatment group were 140.64 ± 8.59 , 138.48 ± 7.37 , 141.26 ± 7.43 , 152.50 ± 7.09 , 188.57 ± 8.28 $\mu\text{g/kg DM}$ that in control group the difference between means was no significant but in treatment group was significant (respectively $p=0.807$ and $p=0.003$) (table 1).

The difference of mean in serum level of selenium between 2 groups is compared in table 2 that in days 0 and 15 is no significant but in days 30, 45, 60 is significant. Also the mean concentration of selenium in hair and hoof on days 0, 15 and 30 in no significant and on days 45 and 60 is significant (table 2).

In correlation study of selenium serum level to hair's selenium in control group was determined that on days 0, 15 and 30 the relationship was no significant (respectively $r=0.676$, $r=0.424$, $r=0.619$) and on days 45 and 60 was significant (respectively $r=0.561$, $r=0.454$).

The correlation between serum selenium and hoof's selenium in control group was no significant on all days except 45 (respectively $r=0.118$, $r=0.209$, $r=0.583$, $r=0.240$, $r=0.949$). In treatment group this correlation with hair selenium on day 0 was no significant ($r=0.120$) and on days 15, 30, 45 and 60 was significant (respectively $r=0.617$, $r=0.561$, $r=0.412$, $r=0.863$). Also correlation between selenium serum level with hoof's selenium in treatment group in days 0 and 15 was no significant (respectively $r=0.142$ and $r=0.364$) and on other days was significant (respectively $r=0.639$, $r=0.940$ and $r=0.844$) (table 3).

Discussion:

Mean selenium serum level in control group from time 0 to 60 of sampling didn't show a significant change ($p=0.423$) but in treatment group the mean from day 0 to 60 was upward that there was a significant statistical difference between mean of selenium serum level on different days ($p=0.000$). Mean concentration of selenium in hair and hoof in control group on different days didn't show a significant statistical difference (respectively $p=0.674$ and $p=0.807$) but in treatment group the difference between values of mean selenium concentration in hair and hoof on different days was significant (respectively $p=0.001$ and $p=0.003$) that in both hair and hoof after day 45 the increasment was significant.

These values in this time are acceptable in comparison to the values of other studies. Valberg and Hadgson [16] had expressed the values of selenium serum 7 mg/ml and vitamin E 1.1 $\mu\text{g/ml}$. in

the study done by Stowe and Herdet [11] the mean values of selenium serum has been reported more than this. In the study done by Richardson *et al* [13] by using selenium supplement after day 28 the significant increasment of selenium serum level has been titled and determined that as the amount of using selenium supplement in height the serum level increases more. In present study determined that amount of serum selenium in time 0 in both groups conforms with the values presented in NRC and in treatment group by using selenium, the amount of serum selenium increases that also these values are acceptable due to NRC values [10].

The difference of selenium serum level between two groups of control and treatment on day 0 was no significant (p=0.876), and on day 15 un significant (p=0.065), on day 30 significant (p=0.004), on day 45 significant (p=0.000) and on day 60 significant (p=0.000). Also the difference of mean selenium concentration on hair on day 0, 15 and 30 was no significant (respectively p=0.321, p=0.089 and p=0.264) and on day 45 and 60 was significant (respectively p=0.052 and p=0.000). The difference of mean selenium concentration in hoof on days 0, 15 and 30 was no significant (respectively p=0.453, p=0.065 and p=0.674) and on days 45 and 60 was significant (respectively p=0.016 and p=0.000).

Table 1: Comparison of the mean selenium concentrations in serum, hair and hoof in control and treatment groups between different days

Group	Number	Parameter	Time(day)	Mean	SE	P value
Control	20	Mean of selenium in serum($\mu\text{g/L}$)	0	106.47	5.23	0.423
			15	104.32	3.87	
			30	108.26	4.29	
			45	108.13	6.33	
			60	106.07	2.89	
		Mean of selenium in hair($\mu\text{g/kg DM}$)	0	273.98	11.65	0.674
			15	278.46	14.29	
			30	281.56	17.81	
			45	284.43	11.24	
			60	279.56	9.76	
		Mean of selenium in hoof($\mu\text{g/kg DM}$)	0	143.34	8.24	0.807
			15	147.57	7.06	
			30	139.31	10.29	
			45	144.94	13.19	
			60	146.27	8.21	
Treatment	20	Mean of selenium in serum($\mu\text{g/L}$)	0	107.24	3.96	0.000
			15	113.27	4.27	
			30	124.32	3.17	
			45	153.04	9.14	
			60	187.41	9.53	
		Mean of selenium in hair($\mu\text{g/kg DM}$)	0	275.93	12.36	0.001
			15	273.72	13.73	
			30	277.62	14.41	
			45	291.87	12.49	
			60	343.19	16.19	
		Mean of selenium in hoof($\mu\text{g/kg DM}$)	0	140.64	8.59	0.003
			15	138.48	7.37	
			30	141.26	7.43	
			45	152.50	7.09	
			60	188.57	8.28	

Table 2: Comparison of the mean selenium concentrations in serum, hair and hoof in different days between control and treatment groups

Parameter	Time (day)	Group	Number	Mean	SE	P value	
Mean of selenium in serum($\mu\text{g/L}$)	0	Control	20	106.47	5.23	0.876	
		Treatment	20	107.24	3.96		
	15	Control	20	104.32	3.78	0.065	
		Treatment	20	113.27	4.27		
	30	Control	20	108.26	4.29	0.004	
		Treatment	20	124.32	3.17		
	45	Control	20	108.13	6.33	0.000	
		Treatment	20	153.74	9.14		
	60	Control	20	106.07	2.89	0.000	
		Treatment	20	187.41	9.53		
	Mean of selenium in hair($\mu\text{g/kg DM}$)	0	Control	20	273.98	11.65	0.321
			Treatment	20	275.93	12.36	
15		Control	20	278.46	14.29	0.089	
		Treatment	20	273.72	13.73		
30		Control	20	281.56	17.81	0.264	
		Treatment	20	277.62	14.41		

Table 2: Continue

		Treatment	20	277.62	14.41	
	45	Control	20	284.43	11.24	0.052
		Treatment	20	291.87	12.29	
	60	Control	20	283.56	9.76	0.000
		Treatment	20	343.19	16.19	
Mean of selenium in hoof($\mu\text{g/kg DM}$)	0	Control	20	143.34	8.24	0.453
		Treatment	20	140.64	8.59	
	15	Control	20	147.57	7.06	0.065
		Treatment	20	138.48	7.37	
	30	Control	20	139.31	10.29	0.674
		Treatment	20	141.26	7.43	
	45	Control	20	144.94	13.19	0.016
		Treatment	20	152.50	7.09	
	60	Control	20	146.27	8.21	0.000
		Treatment	20	188.57	8.28	

Table 3: Correlation the mean of selenium in the serum with the mean of selenium concentration in hair and hoof between two groups in different days

Group	Correlation with	Time (day)		P value
Control	Mean concentration of selenium in hair	0	0.100	0.676
		15	0.105	0.424
		30	0.118	0.619
		45	0.561	0.000
		60	0.454	0.001

	Mean concentration of selenium in hoof	0	0.118	0.619
		15	0.209	0.312
		30	0.240	0.308
		45	0.583	0.051
		60	0.015	0.949
Treatment	Mean concentration of selenium in hair	0	0.120	0.601
		15	0.617	0.001
		30	0.561	0.055
		45	0.412	0.011
		60	0.863	0.000

	Mean concentration of selenium in hoof	0	0.142	0.546
		15	0.364	0.140
		30	0.639	0.001
		45	0.940	0.000
		60	0.844	0.000

By changing of selenium serum level on control group it was determined that on days 0, 15 and 30 the changes were un significant (respectively $r=0.676$, $r=0.424$ and $r=0.619$) and on days 45 and 60 significant changes on selenium concentration is produced (respectively $r=0.561$ and $r=0.454$) but the increasment of serum selenium was not significant by increasing of selenium concentration in hoof in control group in non of days except day 45 (respectively $r=0.118$, $r=0.209$, $r=0.240$, $r=0.583$ and $r=0.949$)

In treatment group by increasing serum selenium increasment of hair selenium on day 15, 30, 45 and 60 was significant (respectively $r=0.617$, $r=0.561$, $r=0.412$ and $r=0.863$) but on day 0 was no significant ($r=0.120$). Also by increasing of selenium serum level, hoof's selenium concentration showed a significant increasment on days 30, 45 and 60 (respectively $r=0.639$, $r=0.940$ and $r=0.844$) but on days 0 and 15 was no significant (respectively $r=0.142$ and $r=0.364$).

Also in other studies, the correlation between serum selenium with hair and hoof's selenium is

confirmed [1,12,14,17].

The conclusion is that adding selenium supplement to horses' diet for 2 months results increasment of selenium serum level and also increasment of its concentration in horse's hoof and hair and considering the antioxidant properties of selenium, it is recommended in sport horses.

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