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The prevalence of serum selenium deficiency in lambs in Al-Gabal Al-Akhdar area

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Abstract

Selenium is a trace element incorporated into selenoproteins which are required for several biological functions. This study investigated the prevalence rate of selenium deficiency in the serum of 100 lambs of both sexes (76 males and 24 females), their ages ranged from 1 to 4 months. Considering the area of study, samples were collected from two areas in the Al-Gabal Al-Akdar including the mountainous and south mountain areas. Samples were analyzed by using Atomic Absorption Spectrometry (AAS). Results showed that 12 % of lambs had a low level of selenium, 33% had a marginal level, and 55% had an adequate level. The prevalence rate in the age group of (1-2) months was significantly higher (56%) than in the age group (3-4 months). Selenium deficiency was more prevalent in 69% of samples collected from the mountainous areas. Selenium levels between both sexes did not differ significantly, although females had a higher prevalence level (54%) than males. There was no statistically significant difference in the effect of selenium on the blood parameters.

Keywords: Selenium deficiency, Prevalence, Blood serum, Lambs.

Introduction

Selenium (Se) has been identified for many years as a crucial micro mineral for humans and animals (*1, 2*). It is necessary for several functions of the body such as reproduction, growth, immunological response, preservation of tissue integrity, and coordination among different body parts (*3*). It is a fundamental component of various enzymes in animals and human bodies, where its essential function is to act as an antioxidant (*2, 4*). The most common selenoenzymes include glutathione peroxidases (GPxs), iodothyronine deiodinases (Dios) and thioredoxin reductases (TrxR) (*5*). Selenium has also a linked function with vitamin E, which is the protection of the biological membrane against damage caused by oxidative processes (*3*). Se concentration in soil and plants is often correlated to its level in animal tissues (*6*). Feed that contains selenium concentration of fewer than 0.05mg/kg is regarded to be inadequate for animal needs, where the optimal concentration of selenium agreed by the majority of scientific studies should be higher than 0.1 mg/kg (*3, 5*). Soils with Se of less than 500µg lead to produce feed poor in Se (*7*). According to (*8*), the level of selenium in blood was categorized into deficient (0.05) ppm, marginal (0.05–0.1) ppm and adequate (>0.1) ppm. Selenium-responsive diseases have been reported in ruminants in the majority of the world's regions under natural grazing circumstances (*9*). These diseases occur due to the alteration in the function of proteins that regulate Se, such as selenocysteine at their active parts (*3*). Marginal selenium deficiency has been associated with muscular weakness in the newborn, decreased weight, unthriftiness, diarrhoea, infertility, abortion, retained placenta, and immunosuppression (*10*). While severe selenium deficiency induces nutritional myodegeneration (white muscle disease), which frequently affects young animals, particularly calves, lambs, and goats. However, it has been reported in other animals (*10, 11*). Selenium deficiency complications have been observed in ruminants, particularly in lambs in the Al-Gabal Al-Akdar region. The reason for selenium deficiency and also animal selenium conditions in various areas in Al-Gabal Al-Akdar is scarcely investigated. Therefore, the study aimed to investigate the prevalence of low serum selenium levels among lambs, taking into consideration the various categories of selenium level (low, marginal, adequate), and to determine the

risk factors associated with selenium deficiency including the sex and age of animals as well as spatial variations. The haematological parameters change due to selenium deficiency was also evaluated.

Materials and Methods:

Study Area:

A cross-sectional study was conducted in various areas of the Al-Gabal Al-Akdar region and south mountain areas during the period from January to May 2020.

Animals:

A total of 100 local lambs were randomly selected from different flocks and grouped according to their gender (79 males and 21 females) and age (1-4 months). Data on animal supplementation with selenium was obtained by the investigator during sample collection.

Blood samples collection:

A total of one hundred blood samples were collected from lambs drawn from the jugular veins of each animal. The first set of blood samples was placed into tubes without anticoagulants and sent to the laboratory. Blood samples were allowed to clot at room temperature for 15 minutes and then centrifuged at 3,000 g for 10 minutes to obtain the serum. Selenium concentrations were determined in the serum by using an Atomic Absorption Spectrophotometer According to the methods described by**(*12*).** The second set of blood samples was collected into tubes containing ethylene diamine tetraacetic acid (EDTA) and taken to the laboratory for the analysis of haematological parameters. Haemoglobin (HB), white blood cells (WBC), erythrocytes (RBCs), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular haemoglobin (MCH) and hematocrit (HCT) were among the parameters measured. The haematological analysis was done by using Auto Hematology Analyzer (Mindary BC-2800, China).

Statistical Analysis:

The statistical analysis was performed by using SPSS software version 20, where data were analyzed by utilizing the T-test and descriptive statistics. The results were presented as a mean, standard deviation and frequency. The

prevalence was calculated by dividing the number of deficient lambs over all the examined lambs. All the results were assumed significant when $P< 0.05$.

Results:

In the present study, 12% of lambs were found to have low selenium levels, 33 % had marginal levels, and 55 % had an adequate level. The mean serum selenium concentration in 100 tested lambs was 0.053±0.022 as shown in Table 1.

Table 1: The prevalence and serum selenium concentration in lambs

Selenium level (mg/L)	Prevalence (%)	Mean ± SD	P Value
Low level (< 0.03)	12/100 (12%)	053 ± .022	0.000
Marginal level (0.03-0.06)	33/100(33%)		
Adequate level (0.06-0.40)	55/100 (55%)		

The prevalence of selenium deficiency based on gender was shown in Table 2. To sex, female lambs showed a higher prevalence rate of selenium deficiency 54% (13/24) compared to males 46% (35/76), although there was no significant association between sex and selenium deficiency.

Table 2: The prevalence of selenium deficiency according to the Sex

Sex	No. of samples	Deficient	Mean ± SD
Male	76	35 (46%)	.055 ±.022
Female	24	13 (54%)	.052 ±.022
Total	100	48 (100%)	

The prevalence rate of selenium deficiency according to age was higher in lambs aged 1 to 2 months at 37/66 (56%) than in lambs of (3-4 months) at 11/34 (32.3%) (Table 3).

Table 3: The prevalence of selenium deficiency according to the age

Age (Months)	Deficient	No samples	Mean ±SD
1-2 M	37(56%)	66	.048 ±.022
3-4 M	11(32.3%)	34	.062 ±.019
Total	48(88.3%)	100	

There were significant differences between both age categories at P value (<0.05) = (.002)

The prevalence rate of serum selenium deficiency as it relates to different areas was described in (Table 4). The prevalence of selenium deficiency in lambs living in the mountainous area 69.2% (27/39) is higher than those in the south mountain area 34.4% (21/61). A significant difference was found between the two areas.

Table 4: The prevalence of serum selenium deficiency in lamb serum according to sampling areas

Region	No. of samples	Deficient	Mean ± SD
Mountainous area	39	27(69.2%)	.043 ±.020
South mountain area	61	21(34.4%)	.059 ±.021
Total	100	48 (100 %)	

There were significant differences between two regions at P value (<0.05) = (.000)

In this study, there was a slight increase in the WBCs (13.36±3.83) in the deficient lambs. A decrease in RBC counts (9.34±2.00) was reported in the deficient lambs in comparison to non-deficient lambs, but the values were still within the normal range. There was also an increase in MCH (14.51±11.13) and MCHC (59.13±16.30) compared to the normal value. Other parameters were not affected (**Table 5)**. Statistically, blood parameters did not show any significant differences (p <0.05).

Table 5: The haematological feature in deficient and non-deficient lambs, (Mean ±SD).

Blood parameters	Control	Deficient lambs	Normal values
WBC×10^3/µl	11.20±3.40	13.36±3.83	4-12
HB(g dL-1)	11.86±1.49	11.65±2.55	9-15
RBC ×10^6/µl	10.05±1.74	9.34±2.00	9-15
HCT%	40.28±7.29	41.31±8.22	27.0-45.0
MCV (fL)	40.08±2.76	38.94±7.26	28-40
MCH (pg)	11.57±.89	14.51±11.13	8.0-12.0
MCHC (g dL-1)	29.75±19.26	59.13±16.30	31-34
PLT ×10^5/µl	7.53±1.53	7.48±1.85	2.5-7.5

Discussion:

According to the results of this study, 12% of lambs had a low level, 33% had a marginal level, and 55% had an adequate level of selenium. This was lower than the prevalence rates obtained by ***(4)*** for sheep with a low level of selenium 32.4% and with a marginal level of 53.3%. However, only 14.3% of sheep had an adequate level of selenium, which was in contrast with our results. Selenium deficiency in lambs‘ serum can be related to the low selenium level in ewe’s diet, as any changes in the dietary selenium concentration are reflected in the serum ***(13)*.**

Our data recorded a prevalence rate of 54.1% of selenium deficiency in females, which was higher than in males (46%). This finding was inconsistent with the result obtained by***(3),*** who found that male lambs had greater selenium levels than females, particularly in lactating sheep. This can be attributed to the physiological condition of the animals and the discharge of selenium in milk and faeces in higher quantities ***(3)***.

The present study found that the age group ranging from 1 to 2 months had a higher prevalence of selenium deficiency (56%) than the group aged 3-4 months (32.3%) as clarified in (Table 3). This was consistent with a

previous study conducted by **(*14*)**, who found that the selenium level was lower in juvenile goats than mature goats. Inadequate selenium levels in the mother's milk are more likely to have caused the low selenium concentrations measured in the serum. Numerous studies have discovered an association between the level of lambs' serum selenium and their mother's milk **((*15, 16*)**. As determined by **(*17*),** the milk selenium level in animals decreased from 0.015 mg/L two weeks after calving to 0.010 mg/L at eight weeks. Furthermore, even though milk Se levels were higher in ewes **(*18*),** it was found that the amount of Se in milk itself proved to be insufficient to cover any nutritional requirement for young animals who were nutritionally lacking. Regarding the region, this study observed that the prevalence of lambs examined from the mountains area was more deficient of selenium 69.2% than the south mountain (34.4%), with mean serum Se concentrations of (.043±.020) and (.059±.021) respectively (Table 4). The prevalence of selenium deficiency in mountainous areas was at the marginal level of the reference value. Our observation was consistent with previous studies conducted in other low-sea regions of the world **(*6, 19-21*)**. Spatial regional variation was reported in a study conducted in the United States, where 18% of cows in the southeastern state experienced marginal selenium deficiency in comparison to other regions. This variation in serum selenium concentration can be attributed to the selenium status of soil and plants between the two regions. Thus, it stands to reason that the low amounts of selenium in animal blood are a result of the low levels of selenium in natural soil **(*4*).** But unfortunately, we do not have information regarding the soil and plant se status in the areas of study at this time. This study recorded no significant effect of selenium on the haematological parameters of lambs. Compared to the normal value, an increase in the mean of MCHC was reported. These results were inconsistent with the result of **(*22*).** On the other hand, this study did not observe any decrease in Haemoglobin rate in comparison to the results obtained by **(*22*).** Our results found a slight decrease in the mean of RBCs considered as anaemia in deficient lambs. Anaemia can be due to peroxidative damage to the red blood cells, which is induced by changes in the cell membrane of erythrocytes as a result of selenium deficiency **(*22, 23*)**. Selenium deficiency was observed in lamb that did not exceed two months of age and in mountainous areas.

Conclusion

Selenium deficiency was observed in lamb that did not exceed two months of age and in mountainous areas. Therefore, it is suggested to use selenium supplements in the diet of animals at the recommended level.

References:

1. B. Hosnedlova, M. Kepinska, S. Skalickova, C. Fernandez, B. Ruttkay-Nedecky, T. D. Malevu, J. Sochor. A summary of new findings on the biological effects of selenium in selected animal species—a critical review. *International journal of molecular sciences* **18**, 2209 (2017).
2. M. P. Rayman, Selenium and human health. *The Lancet* **379** 1256 ،.(2012)
3. Z. I. Khan, K. Ahmad, M. Danish, M. A. Mirza, F. Mirzaei, Selenium profile in blood plasma of grazing sheep: A case study in specific ranch in Punjab, Pakistan. (2012).
4. A. Ademi, E Govasmark, A Bernhoft, H Bytyqi, M Djikic, M Manojlović, Z Loncaric. Status of selenium in sheep and dairy cow blood in Western Balkan countries. *Acta Agriculturae Scandinavica, Section A—Animal Science* **65**, 9 (2015).
5. N. Suttle, Mineral nutrition of livestock. Wallingford. *Oxfordshire, UK: CABI Publishing*, (2010).
6. J. Ramırez-Bribiesca, J. Tórtora, M. Huerta, A. Aguirre, L. Hernández, Diagnosis of selenium status in grazing dairy goats on the Mexican plateau. *Small Ruminant Research* **41**, 81 (2001).
7. H. Mayland, L. James, K. Panter, J. Sonderegger, Selenium in seleniferous environments. *Selenium in Agriculture and the Environment* **23**, 15 (1989).
8. M. M. López Alonso, M. Inés, M. Castañón, J. H. Bermúdez, C. C. Rodríguez, I. A. de la Peña, and B.C. José Luis . Seasonal variation of glutathione peroxidase, CK and AST in sheep in a low-selenium region. (1997).
9. Z. Khan, M. Ashraf, A. Hussain, H. Koyro, B. Huchzermeyer, Seasonal variation in selenium status of different classes of grazing goats in a semi-arid region of Pakistan. *DTW. Deutsche Tierarztliche Wochenschrift* **112**, 460 (2005).

10. J. Hall, D. Bailey, K. Thonstad, R. Van Saun, Effect of parenteral selenium administration to sheep on prevalence and recovery from footrot. *Journal of veterinary internal medicine* **23**, 352 (2009).
11. O. Muth, J. Oldfield, L. Remmert, J. Schubert, Effects of selenium and vitamin E on white muscle disease. *Science* **128**, 1090 (1958)
12. J. Fernadez, H. Kahr, Clinical methods for atomic absorption spechoscopy. *Clinical Chemistry Newest* **3**, 124 (1971).
13. J. Maas, D. G. Francis, R. P. John, T. C, James, E. S. Littlefield, C. C Gay, L.D. Koller. The correlation between serum selenium and blood selenium in cattle. *Journal of veterinary diagnostic investigation* **4**, 48 (1992)
14. T. McComb, K. Bischoff, B. Thompson, M. C Smith, H. O. Mohammed, J. Ebel, J. Hillebrandt. An investigation of blood selenium concentrations of goats in New York State. *Journal of veterinary diagnostic investigation* **22**, 696 (2010).
15. M. Karimi-Poor, S.-N. Tabatabaie, F. Zamani, A. Pirestani, Y. Bahrami, Investigation of selenium concentration of sheep's diet, blood and milk in different regions from a central state of Iran. *Annals of Biological Research* **2**, 51 (2011).
16. A. Chalabis-Mazurek, G. Walkuska, Environmental conditions causing selenium deficiency in sheep. *Journal of Elementology* ،19 .(2014)
17. C. Ammerman, H. L. Chapman, G.W. Bouwman, J. P. Fontenot, C. P. Bagley, A. L. Moxon. Effect of supplemental selenium for beef cows on the performance and tissue selenium concentrations of cows and suckling calves. *Journal of animal Science* **51**, 1381 (1980).
18. D. Campbell, J. Maas, D. Weber, O. Hedstrom, B. Norman, Safety and efficacy of two sustained-release intrareticular selenium supplements and the associated placental and colostral transfer of selenium in beef cattle. *American journal of veterinary research* **51**, 813 (1990)
19. E. Govasmark, A. Steen, T. Strøm, S. Hansen, B. R. Singh, A. Bernhoft. Status of selenium and vitamin E on Norwegian organic sheep and dairy cattle farms. *Acta Agriculturae Scandinavica, Section A-Animal Science* **55**, 40 (2005).
20. M. Gierus, F. Schwarz, M. Kirchgessner, Selenium supplementation and selenium status of dairy cows fed diets based on grass, grass

silage or maize silage. *Journal of Animal Physiology and Animal Nutrition* **86**, 74 (2002).

21. L. Rozenska, A. Hejtmankova, D. Kolihova, D. Miholova, Selenium and iodine content in sheep milk from farms in central and east Bohemia. *Scientia Agriculturae Bohemica* **42**, 153 (2011).

.22 M. Ghanem, M. Anwar, Y. Abd El-Raof, H. El-Attar, Clinical, hematological and biochemical changes in lambs suffered from nutritional muscular dystrophy. *Benha Vet. Med. J* **30**, 61 (2016).

23. E .Ada-Al Dhari, W. Y. Kassim, Effect of Supplementation Selenium and Vitamin E on Blood and Stress Parameters of Awassi Lambs. *Diyala Agricultural Sciences Journal (DASJ)* **13**, (2021).

معدل انتشار نقص السيلينيوم في الحملان في منطقة الجبل الأخضر

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المستخلص العربي

السيلينيوم هو عنصر ضئيل مدمج في البروتينات المحتوية على السيلينيوم والمطلوبة لعدة وظائف بيولوجية. بحثت هذه الدراسة في معدل انتشار نقص السيلينيوم في مصل 100 حملان من كلا الجنسين (76 ذكراً و 24 أنثى)، وتراوحت أعمارهم من 1 إلى 4 أشهر. وبالنظر إلى منطقة الدراسة، تم جمع عينات من منطقتين في منطقة الجبل الأخضر والتي شملت المناطق الجبلية والجنوبية. تم تحليل العينات باستخدام مطياف الامتصاص الذري (AAS). أظهرت النتائج أن 12٪ من الحملان لديها مستوى منخفض من السيلينيوم، و 33٪ لديها مستوى هامشي، و 55٪ لديها مستوى مناسب. وكان معدل الانتشار في الفئة العمرية (1-2) شهراً أعلى بكثير (56%) منه في الفئة العمرية (3-4 أشهر). كان نقص السيلينيوم أكثر انتشاراً في 69٪ من العينات التي تم جمعها من المناطق الجبلية. لم تختلف مستويات السيلينيوم بين الجنسين اختلافاً كبيراً، على الرغم من أن مستوى انتشار الإناث أعلى (54٪) من الذكور. لم يكن هناك فرق ذو دلالة إحصائية في تأثير السيلينيوم على صورة الدم.

الكلمات المفتاحية: السلينيوم، الحملان، الجبل الأخضر .