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FARKLI IRK SIĞIRLARIN SERUMLARINDA BAZI ESER ELEMENT ve ELEKTROLİT DÜZEYLERİ*

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Özet: Bu çalışmada Atatürk Üniversitesi Araştırma ve Uygulama Çiftliğinde soğuk iklim ve yüksek rakımda (2000 m) yetiştirilen 20 adet Holstein (10 adet dişi ve 10 adet erkek) ve 20 adet Brown Swiss(10 adet dişi ve 10 adet erkek) olmak üzere 40 adet hayvan kullanılmıştır. Ortalama yaşları 11-12 aylık olarak seçilen hayvanlar yaz mevsiminde merada beslenmiştir. Kan serumlarında çinko (Zn) ve bakır (Cu) düzeyleri atomic absorption spectrophotometere (AAS) ile, magnezyum (Mg), kalsiyum (Ca), fosfor (Pi), demir (Fe), sodyum (Na) ve potasyum düzeyleri ise ticari kit kullanılarak otoanalizörde analiz edilmiştir. Yapılan istatistiki analizlerde incelenen elementlerin serum düzeylerinin birbirine yakın olduğu ve ırklar arasındaki farkın önemsiz olduğu bulunmuştur.

Anahtar sözcükler: Holstein ve Brown Swiss sığır, serum iz element ve elektrolit düzeyleri.

Serum Levels of Some Trace Elements and Electrolytes in Different Cattle Breed*

Summary: In this study, a total of 40 cattle [20 Holstein cattle (10 males and 10 famales) and 20 Brown Swiss Cattle (10 males and 10 famales)] were taken. The animals were grown in the pasture of the Agricultural College Farm of Atatürk University at on altitute of 2000 m above sea level and at cold climatic conditions. The animal were grazed in the pasture in the summer. All the animals had an average age of 11-12 months. Serum zinc (Zn) and copper (Cu) levels were analyzed by atomic absorption spectrophtometer and serum magnesium (Mg), calcium (Ca), phosphorus (Pi), iron (Fe), sodium (Na) and potassium (K) levels were measured on an autoanalyzer by using commercial kits. In the statistical evaluation, the serum levels of the elements measured were sililar in two groups and the differences were not statistically significant.There were no significant differences between the males and females. There were also no significant differences among in breeds regarding levels of minerals.

Keywords: Holstein, Brown Swiss Cattle, serum trace elements and electrolytes levels.

INTRODUCTION

Cattle require different levels of minerals, depending on age, size, sex, physiological state, and level of performance. The maximum level of each mineral that can be safely tolerated by cattle is also included for reference purposes. Cattle require a number of dietary mineral elements for normal bodily maintenance, growth, and reproduction. Minerals, and particularly trace minerals, are required in very small amounts. The addition of only a tiny amount may have dramatic effects on animal performance and health. Minerals that are required in relatively large amounts are called major or macro elements. Those needed in small amounts are classified as micro, minor, or trace minerals. These terms, however, have no relationship to the metabolic importance of a mineral in the diet. A trace mineral can be as essential to the health and performance of an animal as a major mineral. The major minerals include Ca, P, Mg, K, Na and Cl Among those needed in trace amounts are Fe, Zn and Cu[1-3].

Ca exists in blood serum in both organic and inorganic forms.Ca is used in the formation and maintenance of bones and teeth. It also functions in transmission of nerve impulses and contraction of muscle tissue. A dynamic system involving Ca, P and vit-D exists to maintain a relatively stable concentration of Ca in the blood. Ca and P are stored in bone and mobilized into the circulatory system when dietary intake of the two minerals is adequate. Blood Ca level is not a good indicator of a dietary Ca deficiency because blood Ca is reflective of both Ca intake and Ca mobilization from bone. Because of its importance in bone structure, deficiency of Ca in young animals leads to skeletal deformities. In older animals, fragile bones can result from extended periods of dietary Ca deficiency and requirements change depending on animal age and production status[4,5].

P exists in blood serum both in organic forms, as a constituent of lipids, and in inorganic forms. P works in conjunction with Ca in the formation of bone. In addition,

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P is a component of phospholipids, which are important in lipid transport and metabolism and in cell-membrane structure and cell growth. It is a component of ATP, creatine phosphate, RNA and DNA. P is required for protein synthesis and in energy metabolism. P and Ca are constituents of several enzyme systems. P, Ca, K, Mg, Na, and Cl function in regulating fluid balance by maintaining osmotic pressure and the acid-base balance of the entire system[4,5].

Mg is an activator of many metabolic enzymes. These enzymes control reactions that range from the breakdown of glucose for energy to the replication of DNA, which is necessary for cell division. The most common problem associated with Mg deficiency is a condition known as grass tetany. Observed most frequently in the early spring, grass tetany results from the consumption of lush forage, which has low levels of Mg[1,6].

Na and Cl are electrolytes and function in maintaining volume, pH and osmotic pressure in the body cells. Na is involved in muscle and nerve function. Cl is essential for hydrochloric acid production in gastric juice and for carbon dioxide transport[5].

K is ubiquitous in the body of mammals because it is required in large amounts by most organ systems for normal functions. Thus, a deficiency of K results in nonspecific symptoms such as poor appetite, followed by thinness, reduced performance, and stiffness, especially in the joints of the front legs. High levels of K interfere with Mg utilization. This has the effect of exacerbating the already-low Mg content of the lush forage and increasing the risk of grass tetany[1].

Cu functions as an essential component of a number of enzymes and is required for normal red blood cell formation, normal bone and elastin formation in the aorta and cardiovascular system, normal myelination of the brain cells and spinal cord, and normal pigmentation of hair. Cu is important for the functions of the immune system[5]. Cu is important in the incorporation of disulphide bonds into the protein molecules which form a major part of the keratin matrix. Such bonds determine the physical properties of keratin[2,3,7].

Fe is a component of hemoglobin in red blood cells, myoglobin in muscles, and other proteins involved in transport of oxygen to tissues or utilization of oxygen. Fe is also a constituent of several enzymes associated with the mechanisms of electron transport, a component of several metalloenzymes and important to the immune system's functions (5).

Zn is a constituent of many enzymes and many metalloenzyme systems, and effective in activation of a large number of other enzymes. Zn is required for normal protein synthesis and metabolism, a component of insulin, Zn functions in carbohydrate metabolism and important for normal development and functioning of the immune system[2,3,5]. Zn is known to be of importance in keratin synthesis and claw horn formation and it plays an important role in making the claw horn more resistance to stress[7].

MATERIALS and METHODS

A total of forty young cattle (twenty males and twenty females) divided into four groups of 10 each. Cattle, which 11-12 mounts of age, fed in the pasture conditions and showed no clinical signs of disease in Agricultural College Farm of Ataturk University where the altitude is high and harsh climate condition is cold were used for this study. Blood was taken from the jugular vein and serum was collected. Zn and Cu levels were analyzed by AAS in blood serum. Mg, Ca, Pi, Fe, Na and K in serum were measured on autoanalyzer by using commercial kits. Statistical analysis were performed by the statistical package SPSS, version 6.0. Multiple comparison of the other data was done by using the Duncan test after one-way analysis of variance (ANOVA). In these tests, $p< 0.05$ was considered as statistically significant.

RESULTS and DISCUSSION

Nutritional deficiencies, metabolic disorders and diseases, can be detected by analysis and monitoring of blood and other fluids. This, however, requires the establishment of normal reference values. Evaluation and interpretation of the results obtained depend on the reference values for each animal species, in different regions and under environmental conditions. Since the animals used in this study showed no clinical signs or pathological symptoms, they were considered healthy and the data obtained can serve as reference values for future use of these animals in veterinary medicine and animal production[8-10].

The results of serum trace elements and electrolytes profiles in Holstein and Brown Swiss cattle have been presented in Table 1. In the present study, non significant differences were observed in blood serum minerals concentrations between cattle. There were no significant differences between female and male cattle concerning

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Table 2. Levels of trace elements and electrolytes in the serum of cattles.
Tablo 2. Sığır serumlarında iz element ve elektrolit düzeyleri.

	Holstein Cattle				Brown Swiss Cattle				SEM	P
	Male (n=10)		Female (n=10)		Male (n=10)		Female (n=10)			
	X	Mi-Ma	X	Mi-Ma	X	Mi-Ma	X	Mi-Ma		
Zn (μg/dl)	109	102-117	110	103-118	112	105-118	111	102-118	5	NS
Cu (μg/dl)	109	124-139	132	124-139	132	127-137	132	124-139	5	NS
Mg (mEq/L)	109	1.8-2.5	2.1	1.7-2.4	2.2	1.8-2.6	2.1	1.7-2.6	0.3	NS
Ca (mg/dl)	109	10-11	11	10-11	10	10-11	11	10-12	0.4	NS
Pi (mg/dl)	109	4.5-7.7	6.1	4.5-7.3	5.1	4.5-7.0	5.9	4.5-7.7	1.0	NS
Fe (mg/dl)	109	137-183	159	130-185	159	120-186	161	120-186	20	NS
Na (mEq/L)	109	133-145	138	133-143	137	133-142	137	133-145	4	NS
K (mEq/L)	109	3.9-4.8	4.3	3.9-4.8	4.4	3.9-4.9	4.4	3.9-4.9	0.4	NS
Cl (mEq/L)	109	87-103	99	87-107	92	85-101	97	88-105	5	NS

X: Arithmetic Mean; Mi: Minimal; Ma: Maximal; SEM: Standart Error of Mean

with minerals levels. These values are close to each other in two breed. There is no difference from each other. Some significant differences were also obtained in the blood activities of various enzymes in comparison to cattle in other countries. Van Aken et al.[11] also reported non significant differences in Zn^{2+} concentration in young and adult cattle. Asif et al[12] reported that no significant differences were seen in levels of minerals of different cattle. Erkal[13] reported that serum avarage Cu 103.32-187.25 μg/dl and Zn 56.84-161. μg/dl different cattle at 0-2 years of age This reseacher reported also that no significant differences were seen between in levels of serum minerals of Holstein and Jersey cattle and between sexes. Cimtay and Olcucu[3] reported that significant differences were seen in level of serum Cu in the between Brown Swiss and Holstein cattle. These results could be attributed to different genetic, climatic, nutritional and environmental conditions. Bilal et al.[14] determined that serum Mg level is 1.07 ± 0.1 in the Holstein cattle at 12-18 mounts of age. Asi[15] reported that serum Mg level is 2.7 mEq/L in the normal cattle. Bilal et al.[14] reported that serum Na and K levels are 141.5 ± 1.7 and 4.45 ± 0,1 mEq/L in the Holstein cattle at 12-18 mounts of age, respectively. Cimtay and Sahin[16] reported that serum Na and K levels are 144.85 ± 1.13 and 4.36 ± 0.09 mEq/L in the normal cattle, respectively. These results confirm previous literature[9,17-20].

It has been thought that this study will fullfill an important gap, because of unexisting of the normal levels of minerals belonging to the Holstein and Brown Swiss cattle races. It is known that the excess and insufficiency of trace elements and electrolytes cause some disorder and decrease in production. So in order to search the effects of these subtances, the normal values should be known. With this study determining the normal levels of trace elements and electrolytes which have great importance on the growing of the animals in and around Erzurum region that have a wide potential of stockbreeding, and finding that there aren't any great differences between Holstein and Brown Swiss cattle, led to thought that this study will be useful in the diagnosis of lots of diseases and can light the way to the furthercoming studies.

REFERENCES

1 **Fontenot JP:** Factors influencing magnesium absorption and metabolism in ruminants. *J Anim Sci*, 67, 3445-3455, 1989.

2 **Graham TW, Thurmond MC, Mohr FC, Holmberg CA, Anderson ML, and Keen CL:** Relationships between maternal and fetal liver copper, iron, mangenese, and zinc concentrations and fetal development in California Holstein dairy cows. *J Vet Diag Invest*, 6: 77, 1994

3 **Cimtay I and Olcucu A:** Investigetion on blood plasma and hair copper levels in clinically healthy cattle in Elazıg and it's vicinity. *Turk J Vet Anim Sci*, 24: 267-273, 2000.

4 **Vicanova J, Boelsma E, Mommaas A, Kempenaar J, Forslind B, Pallön J, Egelrud T, Koerten H and Ponec M:** Normalization of epidermal calcium distribution profile in reconstructed human epidermis is related to improvement of terminal differentiation and stratum corneum barrier formation. *J Invest Dermatol*, 111:97-106, 1998

5 **National Research Council:** Nutrient requirements of beef cattle, 7th rev. ed. National Academy Press, Washington, DC.,1996.

6 **Ergun A:** Zinc metabolism and deficiency in domestic animals. *Ankara Univ Vet Fac Journal*, 30,(2) 303-316, 1983.

7 **Banting A:** A few notes an the probable rote of zinc in abnormal foot conditions in ruminants.Report an the second symposium an bovine digital disease, Veterinary Institute, Skara, Sweden. 162, 1978.

8 **Otto F, Ibanez A, Caballare R And Bogin E:** Blood profile of Paraguayan cattle in relation to nutrition metabolic state, management and race *Isr J Vet Med*, 47:91-99, 1992.

9 **Kaneko JJ, Harvey JVA and Bruss M L:** Clinical biochemistry of domestic animals. Acedemic Press, New York, 1997
10 **Bogin E, Seligman NG, Holzer Z, Avidar Y and Baram H:** Blood profile of a healthy beef herd grazing seasonal Mediterranean range. *Zentralbl Veterinar Med A*, 35(4):270-6, 1988
11 **Van Aken D, J DE-Bont, LV, Holm, Ranawana SSE:** A study on mineral status of cattle in dairy farm in Sri Lanka. *Indian Vet J*, 63:371-374,1991.
12 **Asif MM, Rahman ZU, Arif M, Haq IU and Javed I:** Trace Element and Electrolyte Concentrations in Different Physiological States of Sahiwal Cattle *Journal of Islamic Academy of Sciences*, 9 (4) 63-67, 1996
13 **Erkal N:** Determination of blood serum copper and zinc levels in cattle in the vicinity of Samsun. *Turk J Vet Anim Sci*, 8 (2): 101-115, 1984.
14 **Bilal T, Uysal A, Bilal T And Tan H:** Studies on some blood parameters in fattening cattle wheter feeding with wet bet pulp or not *İU Vet Fac Journal*, 21(1):272-281, 1995.
15 **Ası T:** Investigetion on the serum Cu, Ca, Mg and anorganic P values in normal and diseased animals in Elazıg region. *Turk J Vet Anim Sci*, 7: 219-231, 1983.
16 **Cimtay I and Sahin T:** Effects of age on some biochemical parameters in blood plasma of cattle. *YYU Vet Fac Journal*, 11 (1):74-78, 2000.
17 **Altıntas A and Fidancı UR:** Normal biochemical levels of blood in domestic animals and human *AU Vet Fac Journal*, 40, 2:173-186, 1993
18 **Yılmaz K, Can R and Gul Y:** Comparative research between clinical findings and some blood parameters of fattening cattle. *Turk J Vet Anim Sci*, 9 (1):1-9, 1985.
19 **Kamplı B, Martintic T, Alegro A, Cartinelli MM, and Susnjic M:** Profiles of selected blood biochemical parameters in dairy cows and their influence on milk production and reprodutive efficiency. II. Activiti of transaminase (AST and ALT) and calcium and inorganic phosphorus levels in blood. *Vet Arhiv*, 61(4):1987-2006, 1991
20 **Bienzle D, Jacobs RM, Lumsdenb JH:** Relationship of serum total calcium to serum albumin dogs, cats, horses and cattle. *Can Vet J*, 34 (6),360-364, 1993.

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