

Concentrations of some elements in blood serum of Angora goats

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Summary

The aim of the study was to determine serum essential trace, macro and industrial element levels of Angora goats according to breed and age differences. Clinically healthy (ages 2-3 and 4-5) female Angora goats of two different breeds (Eskisehir and Lalahan) were used as material at the Lalahan Livestock Research Institute. Serum aluminum (Al), arsenic (As), boron (B), barium (Ba), cobalt (Co), chromium (Cr), copper (Cu), gallium (Ga), indium (In), lead (Pb), lithium (Li), nickel (Ni), selenium (Se), silver (Ag), sulfur (S), strontium (Sr), vanadium (V) and zinc (Zn) were measured with an ICP-OES plasma optical atomic emission spectrometer. There were no statistically significant differences found in the different breeds and age groups.

Keywords: Angora goat, blood serum

Ankara goat, well known as „Angora goat”, is an important gene resource of Turkey. Angora goat was raised only in Turkey till 1839, afterwards other countries have been started to breed, as well. Nowadays, especially USA, South Africa and partly Argentina and Lesotho raise this goat breed. Mohair of Angora goats is an important raw material for textile industry in the world. Mohair is strong, bright, flexible, moisture absorbent, highly insulate and resistant to harmful sunshine and to heat and can be easily dyed (13).

In Turkey, two different Angora goat breeds are raised as Lalahan and Eskisehir Angora goat breeds in Lalahan Livestock Research Institute. Although Lalahan Angora goat breed is originally goat breed of Turkey, Eskisehir Angora goat breed was obtained from American male Angora goats and Turkish female Angora goats.

In the periodic table, 109 elements are listed (5) and 27 are considered essential for normal growth healthy of mammals. Of these, 16 are generally accepted trace elements and occur at concentrations of less than 1% in the body. Arsenic (As), boron (B), cobalt (Co), chromium (Cr), copper (Cu), lead (Pb), lithium (Li), nickel (Ni), selenium (Se), vanadium (V) and zinc (Zn) are identified as essential trace elements. Trace elements deficiency may cause disorders in mammals (8, 10, 11). Sulfur (S), a macro element, exists many areas such as hair, horn, cornea and some enzymes in the body (8). Silver (Ag, it is used in jewellery, mirrors, electrical industry and veterinary medicine), aluminum (Al, it is used in vehicle, aircraft, construc-

tion industry and used to make cans), barium (Ba, it is used in drilling fluids for oil and gas exploration, paints and glass), gallium (Ga, it is used in light – emitting diodes and microwave equipment), indium (In, it is used in transistors), and strontium (Sr, it is used in special glass for television) are used in the industry (5, 9). When mammals exposure to high level of some essentials and industrial elements, toxicosis, teratogenicity and mutagenicity may occur (9).

In the present study, serum As, Co, Cr, Cu, Pb, Ni, Se, S, V and Zn levels were measured as essential trace and macro elements, and serum Ag, Al, B, Ba, Ga, In, Li and Sr levels were measured as industrial elements.

The aim of this study was to determine blood serum elements levels of Angora goats according to breed and age differences and compare to other studies associated with element levels of goats.

Material and methods

Clinically healthy female Angora goats (2-5 ages, 18-20 kg, n = 61), of two different breeds (Eskisehir, n = 37 and Lalahan, n = 24), were used as material in Lalahan Livestock Research Institute. Grazing was provided for the goat in the sampling months. Blood samples were collected from each goat in the morning (July, 10:00 AM) by puncture of vena jugularis. Blood serum samples were separated by centrifugation (1619 × g, 15 minutes), and stored -80°C until analysis. Serum aluminum (Al), arsenic (As), boron (B), barium (Ba), cobalt (Co), chromium (Cr), copper (Cu), gallium (Ga), indium (In), lead (Pb), lithium

Tab. 1. Blood serum element levels of Angora goats according to breed differences (mean \pm SE)*

Parameters mg/l	Eskisehir (n = 37)	Lalahan (n = 24)	Total (n = 61)
Ag	0.0050 \pm 0.0011	0.0035 \pm 0.0009	0.0044 \pm 0.0008
Al	3.0269 \pm 0.6401	2.8114 \pm 0.55789	2.9421 \pm 0.44301
As	0.1941 \pm 0.0445	0.1392 \pm 0.0430	0.1725 \pm 0.0318
B	1.4100 \pm 0.0703	1.3620 \pm 0.9490	1.3910 \pm 0.0563
Ba	0.2412 \pm 0.0498	0.1945 \pm 0.0212	0.2229 \pm 0.0313
Co	0.0257 \pm 0.0053	0.0203 \pm 0.0054	0.0236 \pm 0.0038
Cr	0.8362 \pm 0.1039	0.9375 \pm 0.1612	0.8761 \pm 0.0888
Cu	1.3939 \pm 0.0886	1.1231 \pm 0.1131	1.2873 \pm 0.0713
Ga	0.4618 \pm 0.0824	0.3498 \pm 0.0731	0.4178 \pm 0.0577
In	0.5310 \pm 0.0706	0.6142 \pm 0.0900	0.5637 \pm 0.0554
Li	0.4263 \pm 0.0063	0.4517 \pm 0.0089	0.4363 \pm 0.0054
Ni	0.2505 \pm 0.0330	0.2519 \pm 0.0627	0.2511 \pm 0.0314
Pb	0.0574 \pm 0.0146	0.0854 \pm 0.0193	0.0684 \pm 0.0117
S	1064.8 \pm 31.4319	1033.5 \pm 45.958	1052.5 \pm 26.1152
Se	0.3740 \pm 0.0553	0.2998 \pm 0.0700	0.3291 \pm 0.0436
Sr	0.1358 \pm 0.0091	0.1423 \pm 0.0125	0.1383 \pm 0.0074
V	0.0330 \pm 0.0057	0.0383 \pm 0.0082	0.0351 \pm 0.0047
Zn	3.5899 \pm 0.3383	3.8280 \pm 0.3856	3.6836 \pm 0.2536

Explanation: * – there are no statistically differences

Tab. 2. Serum element levels of Angora goats according to age differences (mean \pm SE)*

Parameters mg/l	Eskisehir		Lalahan	
	2-3 years (n = 21)	4-5 years (n = 16)	2-3 years (n = 13)	4-5 years (n = 11)
Ag	0.0046 \pm 0.0017	0.0055 \pm 0.0014	0.0042 \pm 0.0014	0.0028 \pm 0.0012
Al	2.4759 \pm 0.3251	3.7500 \pm 1.4240	2.5491 \pm 0.4795	3.1215 \pm 1.1039
As	0.1866 \pm 0.0534	0.2038 \pm 0.0774	0.1646 \pm 0.0693	0.1091 \pm 0.0481
B	1.3692 \pm 0.0918	1.4635 \pm 0.1110	1.4162 \pm 0.1156	1.2979 \pm 0.1597
Ba	0.2868 \pm 0.0842	0.1816 \pm 0.0302	0.2007 \pm 0.0262	0.1873 \pm 0.0358
Co	0.0191 \pm 0.0057	0.0343 \pm 0.0095	0.0222 \pm 0.0084	0.0181 \pm 0.0066
Cr	0.7843 \pm 0.1461	0.9043 \pm 0.1486	1.2423 \pm 0.2602	0.5773 \pm 0.1020
Cu	1.3961 \pm 0.1341	1.3910 \pm 0.1290	1.2012 \pm 0.1756	1.0309 \pm 0.1374
Ga	0.3725 \pm 0.1137	0.5791 \pm 0.1160	0.3799 \pm 0.1074	0.3141 \pm 0.1013
In	0.5015 \pm 0.0845	0.5697 \pm 0.1239	0.7389 \pm 0.1340	0.4668 \pm 0.1059
Li	0.4281 \pm 0.0071	0.4240 \pm 0.0115	0.4496 \pm 0.0117	0.4543 \pm 0.0143
Ni	0.2706 \pm 0.0397	0.2241 \pm 0.0565	0.2800 \pm 0.0115	0.2188 \pm 0.0139
Pb	0.0682 \pm 0.0209	0.0433 \pm 0.0197	0.0775 \pm 0.0247	0.0948 \pm 0.0315
S	1067.9 \pm 33.063	1060.6 \pm 58.734	1078.1 \pm 46.927	980.95 \pm 83.462
Se	0.3775 \pm 0.0770	0.3694 \pm 0.0811	0.3537 \pm 0.0991	0.1489 \pm 0.0918
Sr	0.1416 \pm 0.0111	0.1281 \pm 0.0155	0.1586 \pm 0.0194	0.1230 \pm 0.0134
V	0.0347 \pm 0.0083	0.0307 \pm 0.0075	0.0332 \pm 0.0116	0.0442 \pm 0.0119
Zn	3.7018 \pm 0.4658	3.4430 \pm 0.5029	3.7224 \pm 0.3111	3.9228 \pm 0.7784

Explanation: as in tab. 1.

(Li), nickel (Ni), selenium (Se), silver (Ag), sulfur (S), strontium (Sr), vanadium (V) and zinc (Zn) were measured with ICP-OES plasma optical atomic emission spectrometer (ICP-OES, Inductively coupled plasma optical emission spectrometer, VARIAN simultaneous AXIEL VISTA).

All the values are expressed as means \pm SE. The results were analyzed by Tukey multiple range test (SPSS for windows, release 10.0). In all cases, probability of error of less than 0.05 chosen as the criterion of statistical significance.

Results and Discussion

There was no statistically significance ($p > 0.05$) determined in age of years (2-3 and 4-5 years old) and breed (Eskisehir and Lalahan) groups (tab. 1 and 2).

Elements are very important in the life of mammals. Although concentrations of macro elements in biological tissues present in gram per kilogram, trace elements present in milligram per kilogram amounts or less (12). Trace elements play important role in many essential metabolic functions and their importance in biochemistry science has grown. Recent researches have renewed interest in trace elements such as Cu, Cr, Se and Zn. The deficiency of Cr, Fe, Se and Zn especially is important in mammals. Trace element status affects growth and reproduction (Se, Zn), immune functions (Fe, Se, Zn), lean body mass (Cr), bone density (Cr, Cu, Zn), cognitive functions (Se, Zn), insulin sensitivity (Cr) and oxidative stress (Cu, Fe, Se, Zn) (17). High levels of some elements, especially

industrial elements, cause toxicosis, teratogenicity and mutagenity, and on the other hand deficiency of elements also may cause serious disorders in mammals. Trace element deficiencies lead to impaired growth, immune function disorders, increased oxidative stress, decreased cognitive functions, aggravate glucose intolerance and loss of bone density (9, 17). Some serum element levels such as Cu, Pb, Se and Zn are affected from geographical area. In addition to this, food process, dietary interactions, drug interactions, genetic disorders and diseases affect blood serum elements levels, as well (10, 11).

Many studies were conducted on the level of Cu, Zn and Se in goats. In the present study, serum total Cu, Zn and Se levels were determined 1.29, 3.68 and 0.33 mg/l, respectively. Serum Cu levels are in agreement with other authors' reports (8, 22, 23). On the contrary to this, serum Cu level was found higher than Sami goats (6), female Kacang goats (1), Nubian goats (3, 21) and Omani goats (14), and lower than Murciano – Granadia goats (18), Marwari goats (20) and Nubian goats (2). Serum Zn level was found higher than Sami goats (6), Marwari goats (20), Angora goats (4, 15, 16),

Nubian goats (2), Murciano – Granadia goats (18), Dwarf goats (24, 25) and Nubian goats (3) and lower than cited by Youde (26) in goats. Serum Se level was determined higher than Sami goats (6), Boer goats (23), Philippine goats (19) and Kacang goats (1). In addition to these, serum Pb level was determined lower than notified by Kaneko et al. (7) and Karagul et al. (8). Serum Co level was found higher than Kacang goats (1) and similar cited by Youde (26).

These contradict results may be mainly dependent on differences of geographical area, diet consumption, sampling season and analytical methods. In the present study, serum element levels were determined with ICP-OES plasma optical atomic emission spectrometer, but in the other studies, element levels were measured with atomic absorption spectrophotometer, fluorometer or other devices (2, 6, 14, 18, 19, 21, 26).

It may be concluded that some serum essential trace macro and industrial elements are firstly determined in Angora goats. To our knowledge, there was no published any data about other elements measured in this study.

As a consequence, there was no found any difference in the breeds and age of years groups.

References

1. *Abdul-Latief T., Johana C. L.*: Feeding cocoa leaf to Kacang goat. Sustainable animal production and the environment proceeding of the 7th AAAP animal science congress. Bali, Indonesia 3 1994, 11-16 July, p. 195-196.
2. *Ahmed M. M. M., Hamed T. F. M., Barri M. E. S.*: Variation of zinc and copper concentrations in the plasma of Nubian goats according to physiological state. *Small Rum. Res.* 2001, 39, 189-193.
3. *Amin A. E., Adam S. E. I.*: Determination of the toxicity of molasses in Nubian goats. *Vet. Hum. Toxicol.* 1993, 35, 213-216.
4. *Cevik M. Z., Altintas A.*: Correlation between serum retinol and zinc concentrations and effect of seasons on these parameters in Angora goats. *Turk J. Vet. Anim. Sci.* 1999, 23, 705-709.
5. *Emsley J.*: The Elements. Third Edition, Clarendon Press, Oxford, New York 1998.
6. *Erdogan S., Ergun Y., Erdogan Z., Kontas T.*: Some mineral substance levels in serum of sheep and goat grazing in Hatay region. *Turk J. Vet. Anim. Sci.* 2002, 26, 177-182.
7. *Kaneko J. J.*: Clinical Biochemistry of Domestic Animals. Kaneko J. J. (Ed.), Fourth Edition, Academic Press, California 1989.
8. *Karagul H., Altintas A., Fidanci U. R., Sel T.*: Clinical Biochemistry. Medisan, Ankara 2000.
9. *Kaya S., Akar F.*: Toxicology in Veterinary Profession. Kaya S., Pirincci I., Bilgili A. (Eds), Second Edition, Medisan, Ankara 2002.
10. *Keen C. L., Graham T. W.*: Clinical Biochemistry of Domestic Animals. Kaneko J. J. (Ed.), Fourth Edition, Academic Press, California 1989.
11. *McDowell L. R.*: Minerals in Animal and Human Nutrition. Academic Press, California 1992.
12. *Milne D. B.*: Clinical Chemistry. Burtis C. A., Ashwood E. R. (Eds), Second Edition, Saunders W. B. Company, Philadelphia, Pennsylvania 1994.
13. *Mizrak G.*: The abstract of completed research projects about Angora goats published in Lalahan Livestock Institute (1953-1997). Ankara 1997.
14. *Osman N. I. E. D., Johnson E. H., Al-Busaidi R. M., Suttle N. F.*: The effects of breed, neonatal age and pregnancy on the plasma copper status of goats in Oman. *Vet. Res. Com.* 2003, 27, 219-229.
15. *Puchala R., Pierzynowski S. G., Sahlu T., Hart S. P.*: Effects of mimosine administered to aperfused area of skin in Angora goats. *Br. J. Nutr.* 1996, 75, 69-79.
16. *Puchala R., Sahlu T., Davis J. J.*: Effect of zinc – methionine on performance of Angora goats. *Small Anim. Res.* 1999, 33, 1-8.
17. *Roussel A. M.*: New aspects on trace element metabolism disturbance in man and pet animals. *Revue Med. Vet.* 2000, 151, 637-642.
18. *Salama A. A. K., Cajat G., Albanell E., Such X., Casals R., Plaixats P.*: Effect of dietary supplements of zinc-methionine on milk production, udder health and zinc metabolism in dairy goats. *J. Dairy Res.* 2003, 70, 9-17.
19. *Serra A. B., Serra S. D., Nakamura K., Orden E. A., Cruz L. C., Fujihara T.*: Effect of selenium in soluble glass bolus on selenium content of milk and blood of goats. *Biol. Trace Elem. Res.* 1996, 55, 207-212.
20. *Shinde A. K., Karim S. A., Patnayak B. C.*: Seasonal changes in circulating mineral contents of sheep and goats on different types of pasture. *Indian J. Small Rum.* 1996, 2, 23-27.
21. *Solaiman S. G., Maloney M. A., Qureshi M. A., Davis G., Andrea G. D.*: Effects of high copper supplements on performance, health, plasma copper and enzymes in goats. *Small Rum. Res.* 2001, 41, 127-129.
22. *van Niekerk F. E., Cloete S. W. P., Heine E. W. P.*: Concentrations of blood minerals and metabolites, as well as production characteristics of Angora goats in the Southern Cape. *S. Afr. J. Anim. Sci.* 1990, 20, 2, 90-93.
23. *van Niekerk F. E., Cloete S. W. P., Barnard S. A., Heine E. W. P.*: Plasma copper, zinc and blood selenium concentrations of sheep, goats and cattle. *S. Afr. J. Anim. Sci.* 1990, 20, 144-147.
24. *van Miert A. S. J. P. A. M., van Duin C. T. M., Schotman A. J. H., Franssen F. F.*: Clinical, haematological and blood biochemical changes in goats after experimental infection with tick-borne fever. *Vet. Parasitol.* 1984, 16, 225-233.
25. *van Miert A. S. J. P. A. M., van Duin C. T. M., Wensing T. H.*: Fever and changes in plasma zinc and iron concentrations in the goat. The effect of interferon inducers and recombinant IFN- α_{2a} . *J. Comp. Path.* 1990, 103, 289-300.
26. *Youde H.*: An experimental study on the treatment and prevention of Shimao zheng (Fleece – eating) in sheep and goats in the Haizi area of Akesai county in China. *Vet. Res. Com.* 2002, 26, 39-48.

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