Research Journal of Biological Sciences 9 (1): 6-12, 2014
ISSN: 1815-8846

A Survey of the Coal Mining Effects on the Blood and Blood Factors of the Livestock Around the Zirab-Iran

Changiz Mohammadizadeh
Department of Geology, Islamic Azad University, Sari Branch, Sari, Iran

Abstract: Zirab region of Mazandarn Province, located at Central-Northern Alborz mountain range of Iran includes numerous coal mines of vital importance for the regional economy. In the meantime, considerable precipitation, surface waters and relatively high level of the wells heightens the risk potential in the region. Rich underground and surface waters besides vast pastures and fertile agricultural lands have caused the people of the region to suitably welcome cultivation and breeding. Hence, considering the strategic importance of the mining in the region, an investigation was accomplished about the relationship between the livestock health from the one hand and coal extraction from the other. About 45 randomly taken blood samples 25 and 20 samples from Zirab and Alasht districts, respectively were gathered from among the flocks of the region without considering the age, gender, race, etc. The samples then were analyzed and assessed for cadmium-arsenic content and other toxic elements of the blood factors (CBC). Studies indicated that despite non-observation of the exploitation principles and discharge of the sewages into the environment, no unfavorable effect is seen among the livestock. The important result has been obtained from comparing the mentioned earlier said elements in 17 samples of agricultural soil, 26 samples of surface waters, 11 samples of the well waters and 9 samples of the mining wastes.

Key words: Zirab, coal mine, medical geology, pollution, blood, blood factor

INTRODUCTION

Absorption of metal, non-metal, alkali, etc., materials into the body more than the authorized values can incur considerable problems for the living creatures (Spierenburg *et al*., 1988). A group of elements are useful for the health, while a minute trace of others may be harmful to us (Selinus *et al*., 2005). Human activities, whether industrial, mining or agricultural activities cause transference of the metals from their accumulation place to other locations where they can cause some sort of problems for the human being and other creatures (Kluge-Berge *et al*., 1992). Such, problems are aggravated in places where factors like extensive mining is performed without observing environmental regulations (specifically in mineral concentrating industries and concentrate production factories in which accessibility to heavy elements and their absorption into the nutrition cycle is facilitated (Tahvonen and Kumpulainen, 1994).

Toxic elements in soils and stones are results of natural geochemical reactions or human activities, normally affecting the human health (Farley, 1998). In fact, such elements enter into the animate body through food and beverage (FAO/WHO, 2002). Investigating the blood, hair, nail and the skin can play a major role in studying the environmental effects on the animate creatures (ATSDR, 1999).

Although, in many remote regions the people just use local foods but modern industrial societies often demand varied foods, produced in different geographical regions (FAO/WHO, 2002). But contrary to the food industries, the potable water is affected more by the local environmental factors, among which the geochemical factors play the major role in polluting the potable water (Massaro, 1997).

MATERIALS AND METHODS

The following methods were chosen after accurate consideration of the methods currently in use in Iran and abroad. The blood samples must be taken by the syringe from the livestock neck vein (Ballantyne *et al*., 1995). The blood samples are then transferred into the EDTA anti-coagulation smeared vials (AOAC, 1995). The obtained samples were sent to a reliable laboratory using containers capable of maintaining below zero temperature conditions (-4°C) and were analyzed in <48 h.

Sampling was done using 2 vials for each animal, a vial of 5 mL vol. for CBC experiments and the other with 15 mL vol. for measuring heavy elements both requiring to be sent immediately to the pathology and heavy elements measurement laboratories. Preparation procedure of the blood samples using luck man method are as follows:

- Transferring 15 cc of blood samples into a 100 cc beaker
- Adding 5 cc of heigh concentrated HNO_3 and 2 cc of H_2O_2 30%
- Putting clock glass on the beaker to prevent from the sample wasting
- Transferring all the sediments and the solution into an Erlen of 125 cc vol. through using 10 cc of H_2SO_4 solution
- Adding 10 cc of H_2SO_4 and adding a number of stone glasses
- Putting the Erlen into the autoclave and putting all the equipment under the hood until the white flames of the SO_3 gas is observed
- Re-addition of 10 cc of HNO_3 to acquire clear solution and re-vaporization
- Making up to volume of the remaining solution with re-distilled water in a flask of 50 cc vol.
- Analyzing the sample to determine the cadmium, lead, zinc and arsenic content in atomic absorption system, model varian 20 plots, VGA 76 GTA 96
- Gun sampling method was used for sampling from mineral cakes and dumping (Truscott, 1962)

In this method, the samples are taken from non-weathered region of the cakes inside the dumping location. For soil sampling, the entire area was first depicted in trapezoid shape and then the soil samples were taken from 30-200 cm depth of the sampling area.

The solid samples were dried, ground and pulverized after screening and categorization (Truscott, 1962). An oven with 105°C temperature was used for drying the samples after which they were ground into 200 mesh size particles.

The running water samples were gathered from the rivers and the water resources using especial containers having been rinsed with weak acid (0.1 mol chloridric acid). Next, 2 mL of magnesium sulfate, sodium iodide and sulfuric acid were added as per each 20 mL of sample waters (Farre *et al*., 1986). The containers then were sent to the laboratory under -4°C standard conditions (Hassani, 2001).

RESULTS AND DISCUSSION

External, possibly toxicant substances found in foods are not limited to micro-organisms and other biological factors and the poisons spattered from them; rather various types of chemicals and drugs, somehow polluting the food can also incur poisoning (EPA, 2003).

The waters contain soluble materials, often including inorganic salts ions. The most important ions include Ca, Mg, NaCl, sulfate and bicarbonate. Often, too much salt in the water can cause harmful osmotic effects, resulting in undesirable bodily conditions, sickness or even death of the livestock.

Table 1: Geochemical compound of different layers of Zirab mine coals

Layer No.	1	2	3	4	5	6
Layer depth	100.00	160.00	200.00	300.00	380.00	430.00
SiO_2	54.21	52.97	50.86	50.98	56.57	47.34
Al_2O_3	29.35	28.99	28.00	25.64	24.30	25.37
Fe_2O_3	3.14	2.34	7.92	4.74	5.18	11.10
TiO_2	1.29	1.35	1.29	1.21	1.27	1.05
CaO	1.15	1.75	1.14	2.53	2.23	1.92
MgO	2.32	3.39	2.31	5.49	4.94	3.73
Na_2O+K_2O	5.00	4.93	4.82	4.68	4.98	4.13
SO_3	0.03	0.57	0.22	2.24	0.46	1.93

Table 2: Geochemical compound of the coal ashes of layer no. 1 of Zirab mine

Elements	Concenration (%)	Elements	Concenration (ppm)	Elements	Concenration (ppm)
SiO_2	54.21	V	1200	Rb	398
Al_2O_3	29.35	Cr	655	Sr	2100
Fe_2O_3	3.14	Sn	36	Ba	1300
TiO_2	1.29	Cu	442	Zr	1500
CaO	1.15	Zn	516	Y	317
MgO	2.32	Mn	334	Nb	293
Na_2O+K_2O	5.00	Ni	308	La	131
SO_3	0.03	Pb	211	Ce	308
P_2O_5	2.35	Sc	201	U	27
Au (ppm)	146.00	Co	187	Th	98
Ag (ppm)	9.00	Sb	9	Ta	83
Hg (ppm)	94.00	Ge	26	Ga	145

Zirab and Kiaasar mines locate in coaly zone region of the central Alborz mountain range. The coal containing rocks in the 2 min usually contain shale, sandstone, lime sandstone and Argillite. The age of these rock units changes from upper Triassic to lower Jurassic. The slop of the coal containing layers in Karmozd mine location is northward, constituting part of a syncline. The Zirab mine coals are mostly categorized in fat gaseous coal and coke shoe group from the commercial categorization point of view. The coals are of clarodurite to clarovitrinite type from petrology classification viewpoint and are classified in dry steam coal to anthracite coals group from the coaling degree point of view. The mean value of ash content in them is about 11.5-11.8%. However, there are other coal horizons with inherent ash of 2-4% in this mine. Reports estimate that the sulfur mean content of the coals amounts to about 0.5-0.6%. Coal extraction is done underground. The absolute resource of Zirab mine is approximately 34 million ton from which about 600,000 ton is extracted annually. The mine produces about 200,000 ton of processed coal per year according to the year 2008 estimation. The geochemical compoundof the Zirab mine coals is as shown in Table 1. Also, Table 2 shows the ash compound of the coals.

Investigations accomplished on the regional waters indicated that nearly all of the samples taken are free from chemical contamination by arsenic, cadmium and lead. Figure 1-3 show the results.

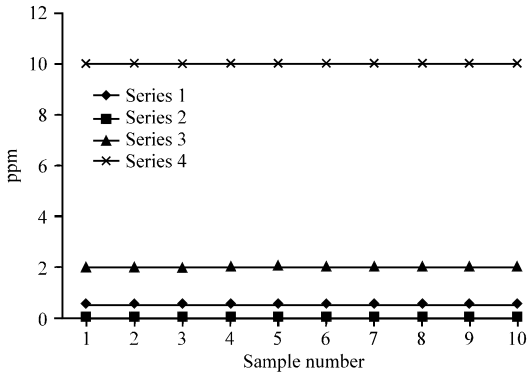

Fig. 1: Series 1: The arsenic content of the regional waters which is immeasurable in all samples due to the slight amount which is <0.5 ppm; Series 2: The expected arsenic content in the potable waters according to the WHO standard; Series 3: The arsenic content of the regional running waters; Series 4: The expected max. Arsenic content in the factory sewages for discharge into the running waters

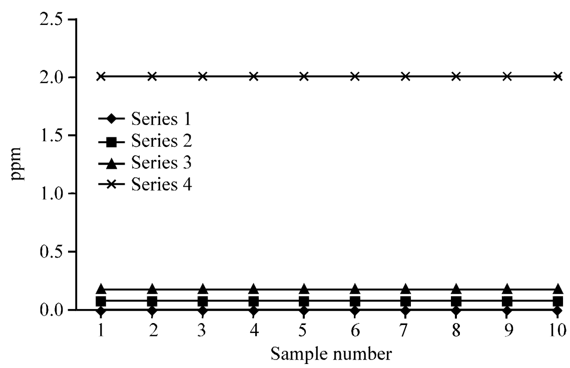

Fig. 2: Series 1: The cadmium content of the regional waters which is immeasurable in all samples due to the slight amount which is <0.02 ppm; Series 2: The expected cadmium content in the potable waters according to the WHO standard; Series 3: The cadmium content of the regional running waters; Series 4: The expected max. Cadmium content in the factory sewages for discharge into the running waters

Also, research indicates the fact that nearly all of the samples taken from the region are free from chemical contamination by arsenic, cadmium and lead elements. This has been concluded from comparison between the element content existing in the regional soils, the suitable amount of element in soil and the element content permissible for the human being health. The results have been shown in Fig. 4-6.

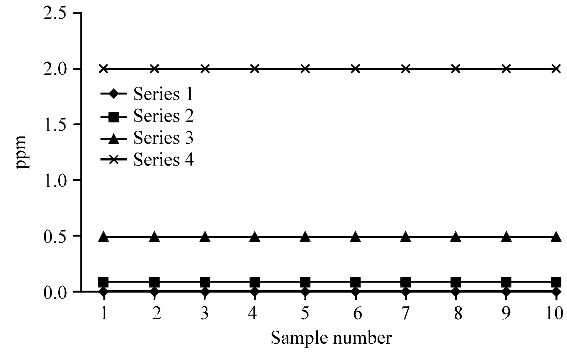

Fig. 3: Series 1: The lead content of the regional waters which is immeasurable in all samples due to the slight amount which is <0.1 ppm; Series 2: The expected lead content in the potable waters according to the WHO standard; Series 3: The lead content of the regional running waters; Series 4: The expected max. Lead content in the factory sewages for discharge into the running waters

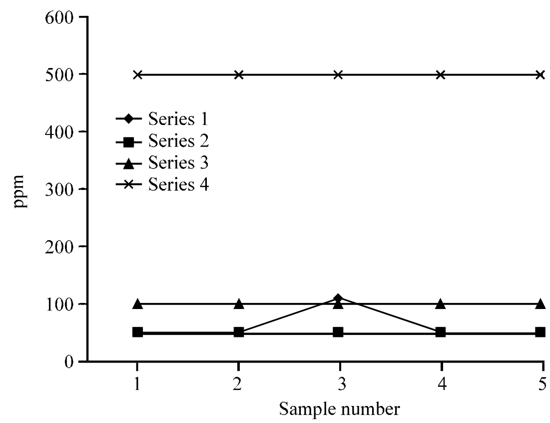

Fig. 4: Series 1: The arsenic content of the regional soil; Series 2: The suitable amount of arsenic in soil based on FAO standards; Series 3: The permissible amount of the element for the human health and the environment based on the FAO standards; Series 4: The limit necessary for the soil improvement

Experiments carried out on the major plants of the region show that nearly all of the samples taken are free from contamination by arsenic, cadmium and lead elements, so no especial pollution effect can be recognized on the region plants. The results obtained are shown in Fig. 7-11.

Experiments performed on the blood and blood factors of the region livestock showed that nearly all of the samples taken are free from chemical contamination by

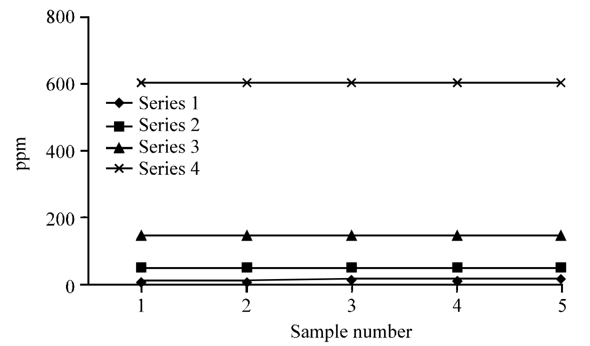

Fig. 5: Series 1: The lead content of the regional soil; Series 2: The suitable amount of lead in soil based on FAO standards; Series 3: The permissible amount of the element for the human health and the environment based on the FAO standards; Series 4: The limit necessary for the soil improvement

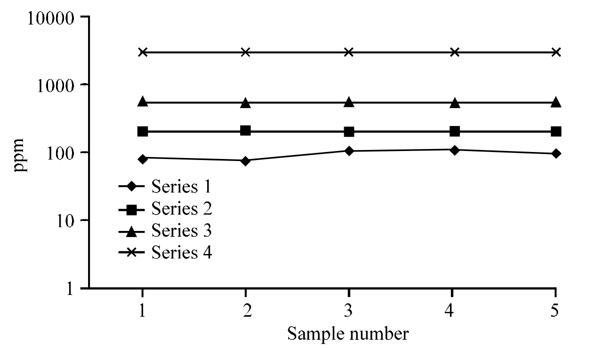

Fig. 6: Series 1: The cadmium content of the regional soil; Series 2: The suitable amount of cadmium in soil based on FAO standards; Series 3: The permissible amount of the element for the human health and the environment based on the FAO standards; Series 4: The limit necessary for the soil improvement

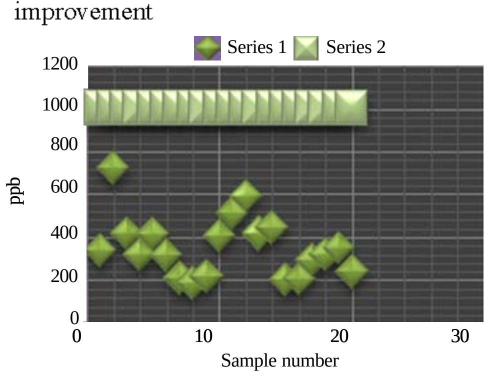

Fig. 7: The arsenic content of the forage consumed by the region livestock; Series 1: The arsenic content of the livestock forage; Series 2: Amount permissible by the standards

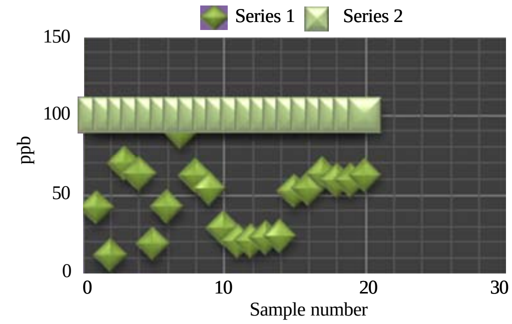

Fig. 8: The cadmium content of the forage consumed by the region livestock; Series 1: The cadmium content of the livestock forage; Series 2: Amount permissible by the standards

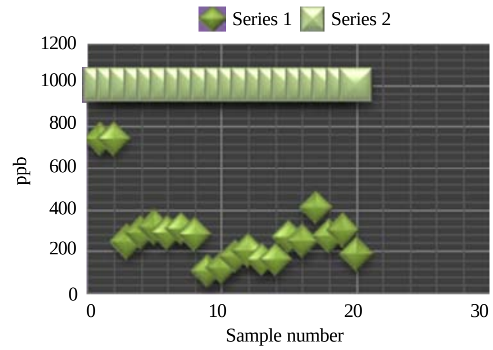

Fig. 9: The lead content of the forage consumed by the region livestock; Series 1: The lead content of the livestock forage; Series 2: Amount permissible by the standards

Fig. 10: View of deposition of the extracted coals beside the water resources

Fig. 11: A view of the coal extraction and concentration installations in Alasht region

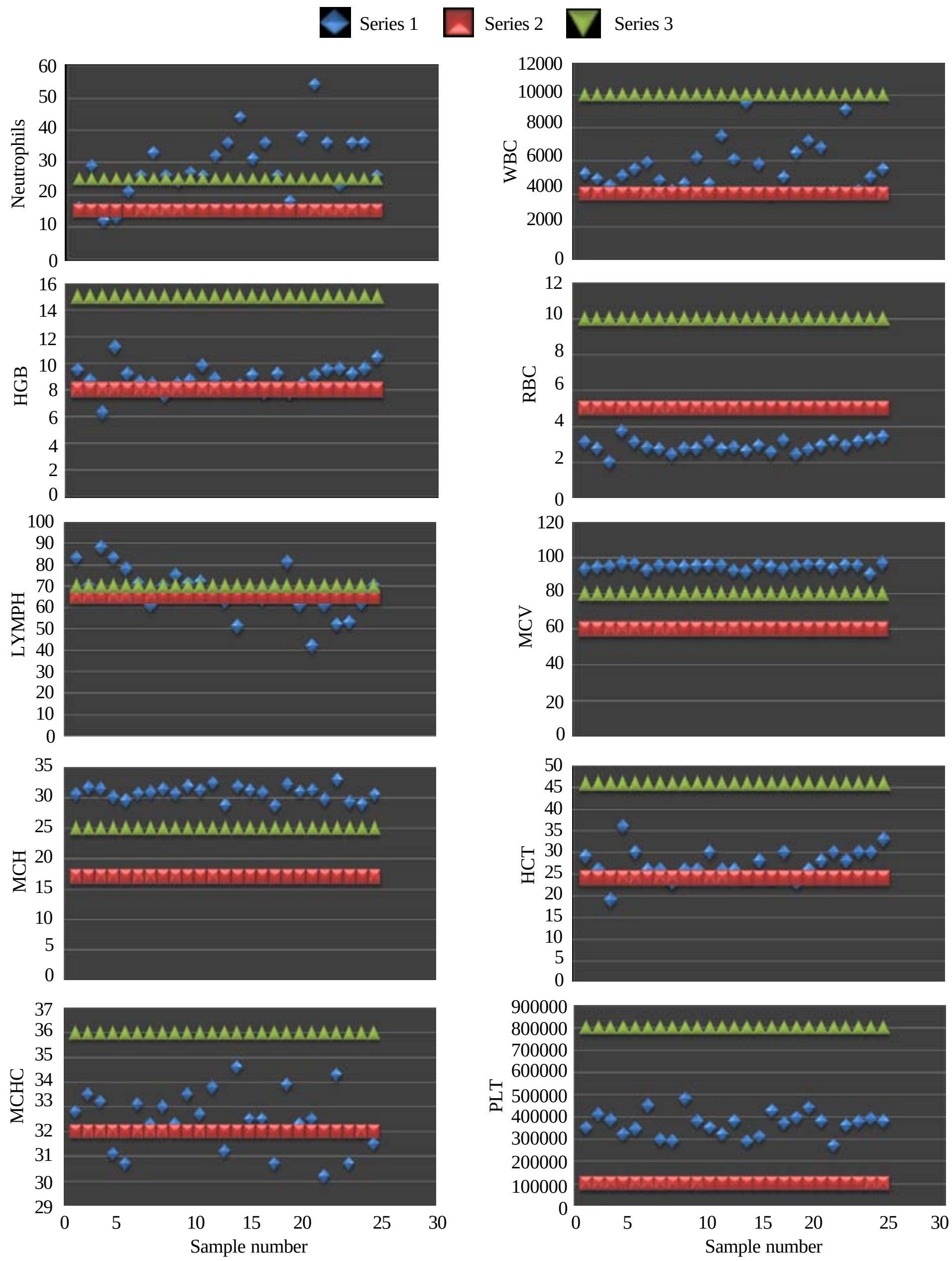

Fig. 12: Series 1: The measured value in the blood of the Zirab region livestock; Series 2: Min. expected value; Series 3: Max. expected value

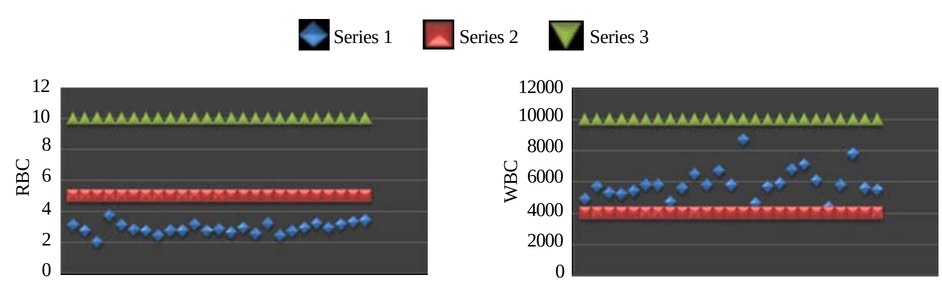

Fig. 13: Continue

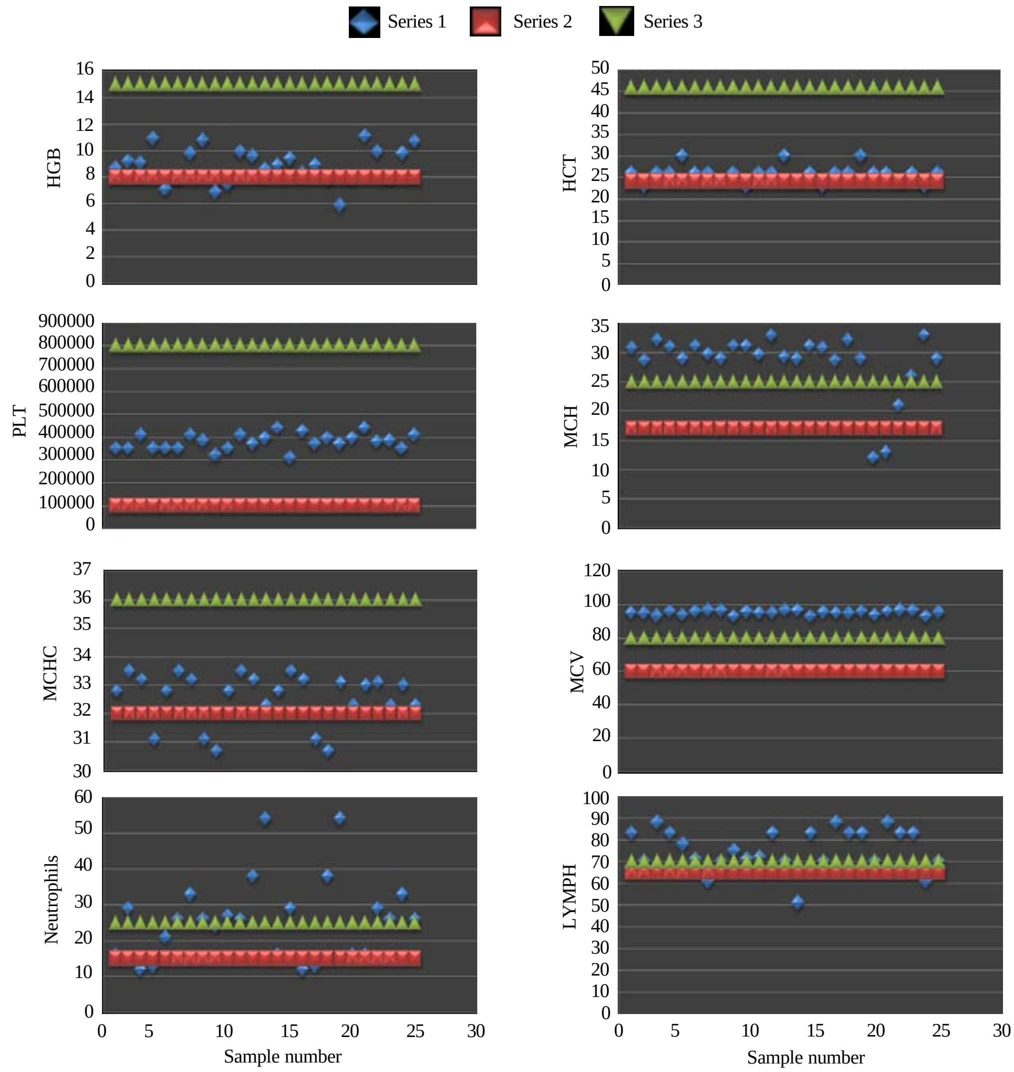

Fig. 13: Series 1: The measured value in the blood of the Kiaasar region livestock; Series 2: Min. expected value; Series 3: Max. expected value

arsenic and cadmium. Also no significant relationship was observed between the environmental conditions and the livestock blood factor changes. Also, the obtained data indicates that all the acquired samples are pathologically within the desirable range. The results are shown in Fig. 12.

Kiaasar region results also resemble the Zirab region results. The following samples are estimations of the data acquired from the motioned region livestock, represented in Fig. 13.

CONCLUSION

Investigations show that the blood and the blood factors of the region livestock are in normal conditions and the mineral pollutants have no considerable effect on their blood factors. As the animates blood factors reflect their health condition, the absence of abnormality then admits that the region livestock have not been affected by the chemical pollutants, the reason of which is not known making it an interesting subject of research.

REFERENCES

AOAC, 1995. Association of Official Analytical Chemists. Official Methods of Analysis. 16th Edn., AOAC, Arlington, Virginia, USA.

ATSDR, 1999. Toxicological Profile for Mercury, Agency for Toxic Substances and Disease Registry. U.S. Department of Health and Human Services, Public Health Service, Atlanta, GA.

Ballantyne, B., T.C. Marrs and P. Turner, 1995. General and Applied Toxicology. Abridged Edn., MacMillan Press, Basingstoke.

EPA, 2003. Ground water and drinking water contaminants and MCLs. U.S. Environmental Protection Agency.

FAO/WHO, 2002. Codex alimentary commission. CX/FAC 04/36/16.

Farley, D., 1998. Dangers of lead still linger. FDA Consumer, 32: 16-21.

Farre, R., M.J. Lagarda and R. Montoro, 1986. Atomic absorption spectrophotometric determination of chromium in foods. J. Assoc. Off Anal. Chem., 69: 876-879.

Hassani Pak, A., 2001. The principle of geochemical exploration. Tehran University, pp: 239.

Kluge-Berge, S., E. Skjerve, T. Sivertsen and A. Godal, 1992. Lead, cadmium, mercury and arsenic in Norwegian cattle and pigs. Proceedings of the 3rd World Congress on Food Borne Infections and Intoxications, Volume 16, June 16-19, 1992, Berlin, pp: 745-748.

Massaro, E.J. 1997. Handbook of Human Toxicology. Vol. 236, CRC Press, Boca Raton, New York, ISBN: 9781439805756, pp: 429-433.

Selinus, O., B. Alloway, J. Centerro, R. Riukelman, R. Fuge, V. Lindh and P. Smedley, 2005. Essentials of Medical Geology. Elsevier Academic Press, USA., ISBN: 0126363412, Pages: 812.

Spierenburg, T.J., G.J. de Graaf, A.J. Baars, D.H.J. Brus, M.J.M. Tielen and B.J. Arts, 1988. Cadmium, zinc, lead and copper in livers and kidneys of cattle in the neighbourhood of zinc refineries. Environ. Monit. Assess., 11: 107-114.

Tahvonen, R. and J. Kumpulainen, 1994. Lead and cadmium contents in pork, beef and chicken and in pig and cow liver in Finland during 1991. Food Addit. Contam., 11: 415-426.

Truscott, S.J., 1962. Mine Economics. Mining Publications Ltd., USA.