HEAVY METALS POLLUTION (PB, CD) AND ITS INFLUENCE ON ANIMALS RAISED IN A NON-FERROUS ORE PROCESSING UNIT

Mitranescu, E.[1], Tăpăloagă, D.[1], Bianu, B.[2], Simion, V.[3], Butaru, D.[4] and Tudor, L.[1]

[1] University of Agronomical Sciences and Veterinary Medicine Bucharest, Faculty of Veterinary Medicine; [2] Institute of Diagnosis and Animal Health Bucharest; [3] University Spiru Haret Bucharest, Faculty of Veterinary Medicine; [4] Sanitary Veterinary Direction Dolj County

SUMMARY

In an area of a non-ferrous ore processing unit it was taken in view the lead and cadmium concentrations.

The metals were harvested from forages, organs and bone samples from animals of different species and ages (cattle, horse and goat youth and adults).

Test was made by atomic absorption spectrophotometer and results interpretation was in compliance with the provisions of the stipulated standards.

The results revealed exceeding of admitted limits in all samples (from forages, organs or bone).

The high lead and cadmium concentrations in organs and bones, correlated by clinic and forensic examinations show a chronic poisoning in this area.

Keywords: pollution, lead, cadmium, organs, forage, limits, samples

INTRODUCTION

The organizing and developing a monitoring system of the whole environment and its component represents the beginning of the national protecting activity of environment as an efficient and clear state politics.

Pollution represents the human beings actions of staining his own life area, clearing this environment being a natural law which permits the continuous activity of life.

Chemical pollution is a consequence of industry development in some areas with implication on health status of organisms and environment.

Such a zone is one surrounding the site of a non-ferrous ore processing unit, in the centre of the country.

This unit pollutes the area with a series of chemical elements and lead and cadmium, too.

Lead spreads the animal organism by the digestive way (forage, waters) or respiratory way; it is fast absorbed, blocks the access of Ca^{2+} and modifies the chemical processes which rely on it. It blocks the porphirinic chain, changes the red blood cell membrane and favors the haemolysis. Lead has a toxic action on the central nervous system, vessels and different organs.

Cadmium, an other pollutant element studied in the present paper, enters the organism by the digestive way; a part of it passes the vessels being carried by the RBCs and deposits especially in liver, kidney and spleen.

Cadmium stops the oxidative phosphorilation and favors the iron excretion, producing anemia.

MATERIALS AND METHODS

The researches had in view the establishing of heavy metal concentration (Pb, Cd) in forage (hay, maize, lucerne), organ (liver, kidney, spleen) and long bones samples, from animal raised in a non-ferrous processing unit area.

The organ samples were taken from animals of different species and age category (young cattle and goats, adult cattle and horses).

The analysis of lead and cadmium concentration was made by atomic absorption spectrophotometry.

The results interpretation was made by 97/2005 Order for organ and bone samples and 120/2005 Order for forages.

RESULTS AND DISCUSSION

In table no. 1 there are shown the average values of lead and cadmium concentration in forage samples (hay, maize, lucerne).

Table 1. The average Pb and Cd concentration in forage samples

Kind of sample	**No. of sample**	**Determined element**	
		Pb	**Cd**
Hay	10	119.6	4.15
Maize	20	0.92	0.16
Lucerne	20	161.6	6.25
Maximum admitted limits 120/2005 Order	Hay, lucerne	10	1
	Maize		

Analyzing the data in the table, it could notice an exceeded concentration of Pb by 11.96 times beside the stipulated 120/2005 Order in hay samples and by 16.16 times in lucerne samples.

Regarding cadmium concentration in forages, it was noticed a four times higher value in hay and 6.25 times in lucerne.

In maize samples, Cd and Pb concentrations are framed within the admitted limits.

The pollutants enter the plants in stomata, producing the poisoning of the chloroplasts, ribosomes and other cell compounds, reducing the main processes of life. So, these plants, eaten by animals could produce poisoning. The average lead concentrations in organ and bone samples are shown in table 2.

Table 2. The average Pb concentrations in bone and organ samples harvested from animals in a non-ferrous ore processing unit limitrophe area

Species	Type of sample				
	liver	kidney	spleen	heart	long bone
Young goats	0.77	0.24	0.59	–	5.69
Horses	18.90	18.94	25.2	11.84	101.2
Adult cattle	8.18	11.86	10.6	6.7	120.2
Calves	16.16	6.15	0.504	–	33.79
Maximum admitted limits 97/2005 Order	0.5	0.5	0.5	0.5	3.0

Following the date in the table, it could notice an exceeding of the admitted limits in most of the samples, no matter the species, age or organ.

Thus, in young goats, the exceeding was higher by 1.54 times in liver, 1.01 in spleen and 1.89 times in bones. There was not recorded any exceeding in kidney. In adult horse organ samples, the exceeding was 37.8 times higher in liver and kidney, 50.4 times in spleen, 23.86 times in heart and 33.73 times in bone samples.

In adult cattle samples, the exceeding was 16.36 times higher in liver, 23.78 times in kidney, 21.2 times in spleen, 13.4 times in heart and 40 times in bone.

In young cattle samples, lead concentration exceeded the maximum admitted limit by 32.32 times in liver samples, 12.3 times in kidney and 11.26 times in bone.

On the basis of obtained results it could notice that lead is placed into liver, kidney, spleen and after a while it accumulates in bones.

At a nephral level, lead inhibits the activity of some mithocondrial hydrogenases and destroys the piruvic acid.

Average cadmium concentrations in bone and organ samples are shown in table 3.

Table 3. The average concentrations of cadmium in organ and bone samples harvested from animals in a non-ferrous ore processing unit limitrophe area

Species	Type of sample				
	liver	kidney	spleen	heart	long bone
Young goats	0.023	0.004	0.021	–	0.011
Horses	18.49	33.88	8.73	2.47	2.18
Adult cattle	3.19	7.95	0.23	0.17	0.09
Calves	0.45	0.782	0.213	–	0.10
Maximum admitted limits 97/2005 Order	0.5	1.0	0.5	0.5	1.0

Regarding the data in the table, the concentration of cadmium recorded an exceeding beside the admitted limit stipulated by 97/2005 Order, in organ and bone samples of adult cattle and horses.

Thus, in liver samples, the exceeding was 37 times higher in horses and 6.38 times in cattle; in kidney it was 34 times higher in horses and 8 times in cattle.

In spleen and heart samples it was recorded an exceeding only in horse samples, respective 17.46 times higher in spleen and 4.94 times in heart. In bone samples it was 21.8 times higher.

The excessive cadmium increases the lead toxicity and it has negative effects on reproductive system, skeleton, neural system and haematopoesis.

There is a large cadmium and lead pollution in the non-ferrous ore processing unit area. These pollutants exist in forages and animal organisms, no matter the species and age. The highest

concentrations were carried out in the samples from adult animals and especially horses, cattle being more resistant to cadmium pollution.

Clinical and forensic examinations, correlated with the high concentration of lead and cadmium in organs and bones show a chronic poisoning with the two heavy metals in the studied area.

CONCLUSIONS

1. Lead concentration in forage samples exceeded the admitted limit by 12–16 times and cadmium concentration by 4–6 times.
2. Lead recorded an exceeding beside the maximum admitted limits in organ and bone samples of young goats by 1–2 times, of adult horses by 24–50 times, of adult cattle by 13–40 times and of young cattle by 11–32 times.
3. Cadmium recorded values exceeded the maximum admitted limit in all horse samples by 5–37 times, in a decreasing order in: liver, kidney, bone, spleen, heart.
4. In cattle, cadmium concentration recorded an exceeding beside the admitted limit by 6–8 times in liver and kidney.
5. A large pollution with lead and cadmium is noticed in the limitrophe area of the non-ferrous ore processing unit.
6. The high concentration of lead and cadmium in organ and bone samples correlated with the clinical and forensic findings show a chronic poisoning with the two heavy metals in this area.

REFERENCES

1) Avram N., Medrea N. et al. – *Poluarea cu metale grele si sanatatea animalelor*, Revista Romana de Medicina Veterinara, Vol. 6, nr. 4, p. 489, 1996
2) Bianu E. – *Intoxicatia cronica cu cadmiu la cabalinele din zona Copsa Mica*, Revista Romana de Medicina Veterinara, 2: 99–106, 2004
3) Elena Mitranescu şi col. – *Observatii privind influenta poluarii cu metale grele asupra starii de sanatate a animalelor din zona Turnu-Magurele*, Lucrari Stiintifice USAB, Seria C, Vol. XXXVII
4) Nica D., Bianu E. – *Consideratii privind nivelul zincului la cabalinele intr-o zona poluata industrial cu cadmiu, plumb si zinc*, Al IV-lea Simpozion al IDSA Bucureşti, 2001
5) Suteanu E., Rapeanu, M. D. – *Aspecte privind implicatiile poluarii chimice in patologia animala*, Lucrarile Simpozionului National de Toxicologie Veterinara, 1982