

Heavy metal residues in plasma of broiler birds and goats from automobile industry rich area of northern Gujarat

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ABSTRACT

The present work was carried out to study plasma profile of five heavy metals viz., lead (Pb), chromium (Cr), cadmium (Cd), zinc (Zn) and cobalt (Co) from broiler (poultry) birds and goats reared in vicinity of automobile industry rich area of Palanpur, Banaskantha district of Gujarat. Plasma samples of fourteen birds and nine goats were analysed by atomic absorption spectrometry (AAS) for estimation of heavy metals. The mean $\pm$ S.E. value of lead, chromium, zinc and cobalt in broiler birds' plasma were found to be 4.389 ± 0.676 , 0.149 ± 0.067 , 0.963 ± 0.103 and 1.332 ± 0.135 ppm, respectively. In goat plasma, the mean $\pm$ S.E. value of lead, chromium, zinc and cobalt were found to be 3.321 ± 0.690 , 0.018 ± 0.017 , 1.343 ± 0.171 and 1.462 ± 0.171 ppm, respectively. Cadmium was not found in any goat or broiler bird's sample.

Key words : Heavy metals, blood plasma, broiler birds, goat

Heavy metals are persistent environmental contaminants that can cause serious health hazards to man and animals. Anthropogenic activities (mostly industrial growth) and geological background are two main origins for the wide release of the heavy metals in the environment (Baize and Sterckeman, 2001). Heavy metals can readily transfer through food chains and cause adverse effects on human health (Rahimi, 2013). Palanpur is the headquarter city of Banaskantha district of Gujarat State, having automobile and ancillary industries like manufacturing and recycling of automobile batteries, recycling of engine oils and rubber tyres. Additionally, this city is located on linking of state and national highways, so, exposure to vehicular emissions is common. There is trend of goat and poultry rearing in the area for the purpose of trading chevon and chicken meat; respectively. Thus, there is need to assess the

selected heavy metal levels in poultry and goats to safeguard the local public health. Also, knowledge of heavy metal concentration in livestock reared in polluted environment is essential to assess their deleterious effects on animal health and humans (Lopez-Alonso *et al.*, 2000; Miranda *et al.*, 2005). Plasma heavy metal level reflects the potential of metals for biotransfer and bioaccumulation in meat beyond legal limits and help to determine the potential risks from the toxic effects of heavy metals. Moreover, concentration of heavy metals in blood samples could be considered as bio-indicators of heavy metal pollution in an environment (Somasundaram *et al.*, 2005). Thus, the present study was undertaken to acquire the plasma heavy metal profile of broiler birds and goats reared in Palanpur area of Banaskantha district of Gujarat state having above mentioned predispositions.

MATERIALS AND METHODS

Blood samples from nine goats and fourteen broiler birds (poultry) from slaughter houses located in

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Palanpur, Banaskantha district, North Gujarat, were collected. Analysis of metals included lead (Pb), chromium (Cr), cadmium (Cd), zinc (Zn) and cobalt (Co). The metals were selected based on their toxic potential of exposure to domestic animals and birds, and on the nature of industries located in the vicinity of area under investigation. About 2 ml of blood was collected from jugular vein of goats whereas about 1 ml of blood was collected from wing vein from poultry in a clean, sterile heparinized tube, prior to slaughter. All the blood samples were centrifuged (4000 RPM for 10 minutes) and plasma was separated and stored in deep freeze (-20°C) until analysed by atomic absorption spectrometry (AAS; Model AAS-4141, ECIL, New Delhi). Sample digestion was performed by method as described by Kolmer *et al.* (1951) with some modifications. For sample processing, 0.2 ml of plasma was digested with 1.8 ml of triple acid mixture (Nitric acid: sulfuric acid: perchloric acid; 1:2:1). The digestion procedure was continued until the solution became clear. Then sample was transferred into volumetric flask and diluted to 10 ml with deionizer water. Lead, copper, cadmium, chromium and zinc were excited using oxygen

acetylene flame. The absorbance of elements was compared with absorption values of standards.

RESULTS AND DISCUSSION

The levels of heavy metals in plasma of broiler birds and goats are presented in Tables 1 and 2, respectively. Present investigation revealed that mean level of Pb, Cr, Zn and Co in broilers plasma were 4.389, 0.149, 0.963 and 1.332 ppm, respectively, where as these values in goat plasma were 3.321, 0.018, 1.343 and 1.462 ppm, respectively. High blood lead levels were noticed in both broilers and goats with the range of 1.522 to 7.997 ppm and 0.102 to 6.361 ppm, respectively. In goats, blood lead levels less than 0.20 ppm are considered normal and levels more than that may be indicative of lead intoxication (Smith and Sherman, 2009), but in the present report all the goats were apparently healthy and exhibit no clinical signs. Nigam *et al.* (2014) reported much higher values of blood lead level in the range of 7.35 ppm to 14.91 ppm in buffaloes without any apparent toxic symptoms which is in close agreement to our findings.

Table 1 Levels of heavy metals (ppm) in plasma of broilers

Sample No.	Lead (Pb)	Chromium (Cr)	Cadmium (Cd)	Zinc (Zn)	Cobalt (Co)
1	3.680	0.684	0.000	0.170	0.037
2	2.995	0.000	0.000	1.247	1.560
3	2.626	0.684	0.000	0.264	1.367
4	1.522	0.000	0.000	0.947	1.633
5	6.729	0.387	0.000	1.009	1.657
6	6.571	0.212	0.000	1.004	1.464
7	7.512	0.000	0.000	0.926	1.343
8	7.997	0.000	0.000	1.029	1.560
9	7.307	0.000	0.000	0.910	1.488
10	1.789	0.000	0.000	0.893	1.876
11	1.953	0.000	0.000	0.976	1.234
12	6.543	0.122	0.000	1.672	1.87
13	2.456	0.000	0.000	0.978	0.987
14	1.765	0.000	0.000	1.453	0.578
Mean ± SE	4.389 ± 0.676	0.149 ± 0.068	0.000 ± 0.000	0.963 ± 0.104	1.332 ± 0.135

Table 2 Levels of heavy metals (ppm) in plasma of goats.

Sample No.	Lead (Pb)	Chromium (Cr)	Cadmium (Cd)	Zinc (Zn)	Cobalt (Co)
1	5.624	0.000	0.000	0.926	1.343
2	6.361	0.000	0.000	1.029	1.560
3	0.102	0.000	0.000	0.910	1.488
4	4.234	0.000	0.000	1.629	1.273
5	2.323	0.000	0.000	1.982	1.856
6	2.822	0.000	0.000	0.899	2.007
7	1.892	0.161	0.000	1.728	1.899
8	1.652	0.000	0.000	2.112	1.456
9	4.876	0.000	0.000	0.872	0.275
Mean±SE	3.321 ± 0.690	0.018 ± 0.017	0.000 ± 0.000	1.343 ± 0.171	1.462 ± 0.171

In present study, cadmium was not detectable in any goat or broiler birds' sample. Lead along with cadmium is most abundant heavy metal in the industrial polluted environment and they have no detectable beneficial roles in the body. Increased level of blood lead concentration also affects bioaccumulation of other heavy metals including cadmium (Patra *et al.*, 2006). In this study too, there are high blood lead levels found with no detectable cadmium in broilers as well as goat. However, Oluokun *et al.* (2007) reported lower blood lead level (0.511 ± 0.126 ppm) and detectable blood cadmium level (0.024 ± 0.004 ppm) from goats raised in environment polluted with cement kiln dust. Mean level of zinc and cobalt in goat plasma were observed to be 1.343 ± 0.17 and 1.462 ± 0.171 ppm, respectively in the present study whereas Swarup *et al.* (2006) found blood Zn and Co values as 2.709 ± 0.163 and 0.102 ± 0.012 , respectively in goats from lead polluted smelter area. These dissimilarities may be attributable to the difference in nature of pollutants. Chromium was detected only in five broilers and one goat plasma sample indicating that variation in the pattern of bioaccumulation of chromium in broilers where as goats were more tolerable to the bio-transfer of chromium.

CONCLUSION

In heavy metal analysis from 14 broiler bird's plasma and 9 goat plasma, lead, zinc and cobalt were detectable in all samples whereas chromium was detected in five broilers and one goat plasma samples.

Cadmium was not found in any of plasma sample from either species. Blood lead levels were high in both broiler birds and goats. On the basis of this preliminary model study, it is necessary to study periodically the level of heavy metals in the edible tissues of meat animals from the same area rich in automobile industry. Further expansion of study over large area involving more number of samples would clarify the heavy metal profile, its relation with health status and quality of livestock origin foods.

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