Analysis of heavy metals in Feces of Blue bull (*Boselaphus tragocamelus*) in Bikaner division of western Rajasthan, India

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ABSTRACT *The present study was focused on analysis of 312 samples of feces Blue bull (Boselaphus tragocamelus) collected from 26 different sites in each season for analysis of 9 major heavy metals (Zn, Pb, Cu, Cd, Fe, Ni, Cr, Mn, Co). The study showed that the heavy metal contamination with respect to sampling sites was found in order of Hanumangarh>Bikaner>Ganganagar. Concentrations of different heavy metals were determined using Atomic absorption spectrophotometer. The contamination of the heavy metal in feces was found the Fe was higher than that of permissible limit of different international standard. The sources of iron showed in study area mainly due to anthropogenic activities, use of synthetic fertilizers, pesticides, waste water irrigation, solid waste disposal and sludge.*

Keywords:*Feces, Heavy metals, Atomic absorption spectrophotometer.*

INTRODUCTION

Environment pollution is a major problem and become a life threatening challenge for the entire world and, however, no doubt that excessive levels of pollution are causing a lot of damage to human, animal, plants and trees as well as the environment to a great extent. Rapid industrialization, deforestation, over-exploitation of natural resources and increasing human population are the major reasons that caused serious environmental threats in many industrial regions worldwide. Pollution of the environment by toxic organic and inorganic substances has become a serious concern because of their negative impact on all ecosystem components (Khalilova and Mammadov, 2016). Heavy metals are typical pollutants in urban environments. These elements are of particular concern due to their persistence in the environment and their toxicity to humans (Moore and Attar, 2011). Heavy metals are bio-accumulated and bio-transferred both by natural and anthropogenic sources. The contamination by heavy metals in plants and water is one of the major issues to be faced throughout the world and requires attention because heavy metals above their normal ranges are extremely threatened to both plant and animal life. Industrialization as atmospheric deposition, waste disposal, waste incineration, urban effluents, traffic emissions, fertilizer application and long-term application of wastewater in agricultural lands (Roozbahani *et al*., 2015). The Indira Gandhi Nahar Project (IGNP) is one of the major sources of water for drinking as well as irrigation since 1950 in area (Sri Ganganagar, Hanumangarh, Bikaner and Jaiselmer) that can be irrigated (1,500,000) at the Thar Desert since the 1950. The availability of water in the region has concern with human health and is causing water-borne diseases in the region. Even Central Pollution Control Board (CPCB) has highlighted gravity of the issue in its report published in November 2012 assessment report on Status of water quality: Canals originating from Punjab. So there is strong need to assess the water quality entities and damage to human as well as whole ecosystem (Midha, 2017). The human population is growing very rapidly and to meet its requirements of food, the production of food grains has been increased simultaneously by introducing different techniques, i.e., the use of hybrid seeds, advanced seed sowing, irrigation technologies, and the use of inorganic fertilizers and pesticides in agricultural fields (Bhadouria *et al*., 2012). Some studies have been observed metal concentrations in wild mammals living in highly contaminated area near smelters, chlor-alkali plant (Beyer *et al*,. 1985, Dustman *et al*., 1972 and Wren, 1985). It is important to note that the level of heavy metals in such herbivores can be studied by analyzing their blood and feces sample (Roggeman, *et al*., 2013). The method of killing or sacrificing animal is not ethically sound. It is a purely invasive method which is increasing biological poverty on the earth. So there is an urgent need to develop a non-invasive method for method for monitoring heavy metal exposure. Feces are the most evident and most easily recognizable sign (Liebenberg, 2000). A study was carried out in wild herbivores housed in various protected areas of Rajasthan, India clearly suggests that herbivore feces can be used as a bio-indicator of heavy metals exposure (Sileo and Beyer, 1985). In the present investigation the feces of Blue bull (*Boselaphus tragocamelus*) was used for assessing the contamination of some heavy metals.

STUDY AREA

The present investigation was carried out for heavy metal contamination in feces of Blue bull (*Boselaphus tragocamelus*). The fecal material of Blue bull (*Boselaphus tragocamelus*) was collected from 26 selected

locations in Bikaner, Ganganagar and Hanumangarh districts (Fig.1). These districts are lies in Bikaner division. The Bikaner division is getting water for irrigation and drinking by the Ganga Canal and Indira Gandhi Canal. Due to availability of canal water for irrigation, the region is continuously being explored for extensive agricultural activities since last few decades. The barren sand dunes have converted into agricultural fields. The micro-climatic conditions of the region are changed. The use of synthetic fertilizers and pesticides has reached to its peak (Charan and Singh, 2018). Climate of the study area ranges arid in the east to extremely arid in the west and is characterized by large extremes of temperature, erratic rainfall and high evaporation. The mean rainfall of the region is 250 mm varying from 300 mm. Bikaner division is situated in western part of the Thar Desert, where temperature reaches 49.50^{0}C high and minimum -1^{0}C to -2^0 C. The vegetation of the region is thorny and scanty.

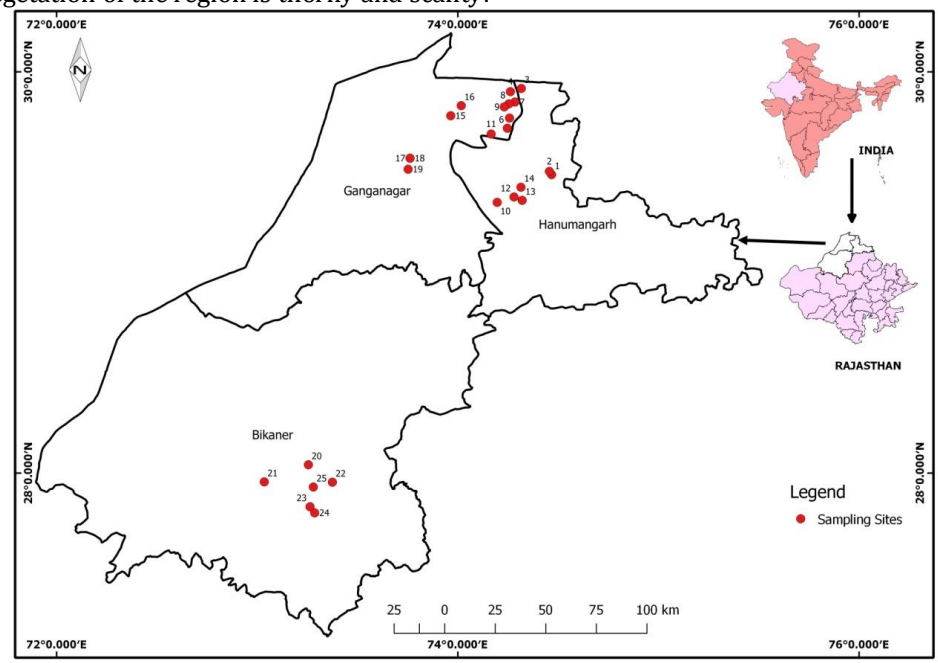

Fig. 1 Location of Sampling in Bikaner division

MATERIALS AND METHODS:

Wild animals are preferred to move in their territory which is demarcated by urination and defecation. Samples of fresh feces of free ranging Blue bull (*Boselaphus tragocamelus*) were collected from its respective natural habitats in the study area. To ascertain the source of contamination, water and vegetation samples of the study area were also collected. Feces samples were stored in the zip lock plastic bags.

Sample extraction:

Analysis of samples 0.5 gm of dry feces was weighed and taken in the Borosil glass tube. Concentrated nitric acid and perchloric acid were added to each sample in ratio (4:1). Sample was kept in water bath for 5 to 6 hours or until it was digested completely and became clear. When the sample was clear, 3 to 4 drops of H_2O_2 (30%) were added to neutralize and to dissolve the fat. After cooling, each sample was diluted up to 10 ml with denionzed water and transferred to sterilized Borosil glass vial and stored at room temperature prior to analysis (Gupta, 2013). Concentrations of different heavy metals were determined using Atomic absorption spectrophotometer. The targeted heavy metals have been analyzed using atomic absorption spectrometer ECL-AAS-4141 (Charan *et al.*, 2015).

RESULTS AND DISCUSSION:

A total 312 samples of feces, of Blue bull (*Boselaphus tragocamelus*) were collected from 26 different sites in each season for analysis of 9 major heavy metals. The study was carried out for two years (2016-17 to 2017-18). The selection of heavy metals (Zn, Pb, Cu, Cd, Fe, Ni, Cr, Mn, Co) was based on the level of their exposure in the study area (Charan *et al*., 2015). It is well known fact that the entire region is irrigated with IGNP system, which accelerates extensive agriculture activities in the region. The consumption and demand of pesticides and synthetic fertilizers has grown up during last few years. Due to availability of green fodder

throughout the year, the herbivores are attracted to the region. It has been reported that the population of Blue bull (*Boselaphus tragocamelus*) has increased in past few decades (Wildlife animal census, 2016). The green fodder produced in the region may be contaminated with some heavy metals due to over-use of agro chemical. Earlier studies are also supporting the facts of heavy metal contamination in canal water (Midha, 2017), vegetable, crop and soil (Singh *et al*., 2015). The consumption of such contaminated water and fodder by herbivores may leads to accumulation of such metals in the food chain. The comparison of heavy metals in the grasses and fodder with the results of same metals in fecal materials of herbivores may give an indirect evidence of accumulation of heavy metals in the herbivores.

The results of the present investigation revealed that the highest levels of different heavy metals found in feces of Blue bull (*Boselaphus tragocamelus*) collected from Hanumangarh district were in order of Fe>Mn>Zn>Pb>Cu>Cr>Ni>Co>Cd (Table-1) while in Ganganagar district it was in order of Fe>Mn>Zn>Pb>Cr>Cu>Ni>Co>Cd (Table-2). Similarly in Bikaner district it was found in order of Fe>Zn>Mn>Pb>Cr>Ni>Cu>Co>Cd (Table-3).

Table-1: Blue bull (*Boselaphus tragocamelus*) feces (Hanumangarh)

S. No.	Heavy Metals (µg/ml)	Summer		Rainy		Winter	
		2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
1	Zn	0.863	1.038	1.038	1.238	1.138	1.338
2	Pb	0.388	0.400	0.513	0.638	0.613	0.750
3	Cu	0.319	0.379	0.378	0.413	0.456	0.514
4	Cd	0.023	0.036	0.040	0.035	0.034	0.039
5	Fe	14.034	14.711	16.098	16.919	16.274	16.920
6	Ni	0.130	0.169	0.201	0.254	0.215	0.263
7	Cr	0.075	0.463	0.313	0.475	0.300	0.488
8	Mn	1.766	1.885	2.013	2.150	2.113	2.238
9	Co	0.110	0.145	0.143	0.159	0.149	0.171

Table-2: Blue bull (*Boselaphus tragocamelus*)feces (Sri Ganganagar)

S. No.	Heavy Metals (µg/ml)	Summer		Rainy		Winter	
		2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
1	Zn	0.313	0.513	0.463	0.538	1.138	1.263
2	Pb	0.138	0.188	0.138	0.263	0.613	0.600
3	Cu	0.134	0.193	0.164	0.184	0.456	0.533
4	Cd	0.006	0.016	0.006	0.007	0.034	0.045
5	Fe	6.463	6.595	6.621	6.631	16.274	16.651
6	Ni	0.059	0.085	0.081	0.096	0.215	0.240
7	Cr	0.138	0.250	0.150	0.288	0.300	0.550
8	Mn	0.400	0.443	0.453	0.500	2.113	2.148
9	Co	0.019	0.040	0.039	0.054	0.149	0.168

Table-3: Blue bull (*Boselaphus tragocamelus*)feces (Biknaer)

S. No.	Heavy Metals (µg/ml)	Summer		Rainy		Winter	
		2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
1	Zn	0.750	0.525	0.763	0.588	0.925	0.850
2	Pb	0.225	0.175	0.263	0.300	0.375	0.363
3	Cu	0.064	0.068	0.071	0.055	0.076	0.063
4	Cd	0.013	0.036	0.016	0.016	0.016	0.017

5	Fe	7.723	8.178	7.973	7.995	8.139	8.275
6	Ni	0.123	0.156	0.146	0.166	0.185	0.231
7	Cr	0.186	0.186	0.171	0.171	0.171	0.171
8	Mn	0.614	0.605	0.651	0.688	0.691	0.694
9	Co	0.045	0.048	0.048	0.051	0.069	0.068

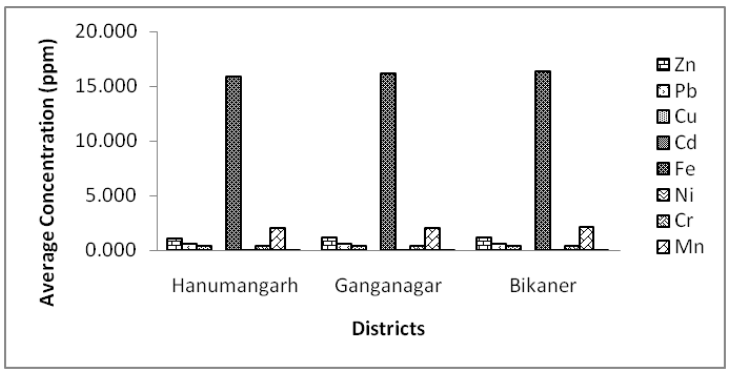

Fig.-2 District wise comparison of different heavy metal in feces of Blue bull (*Boselaphus tragocamelus*)

The results show that iron (Fe) was the most abundant heavy metal at all sampling sites (Fig. 2). The soils of agricultural field are naturally having Fe in significant amount. Therefore the uptake of iron (Fe) by plants has resulted in its increased concentration in the fodder of herbivores. The results are in linearity with earlier study carried out in Pakshi, which is an important commercial and residential vegetables growing areas of Bangladesh (Tasrina, 2015). They reported that the concentration of Fe in all soil and vegetable sample tested was higher than that of permissible limit of different international standard. The sources of iron showed in study area mainly due to burning of fossil fuel and anthropogenic activities such as waste water irrigation, solid waste disposal and sludge applications therefore as the plants in these areas usually uptake more amount of heavy metals, thereby these plants will certainly affect the human and other animals when these plants will intake by them (Tasrina, 2015). It is interesting to notice that the district wise trend of heavy metals in feces of Blue bull (*Boselaphus tragocamelus*) was in order of Hanumangarh>Bikaner>Ganganagar (Fig.3) , however in winters it was higher for Ganganagar as compared to Bikaner.

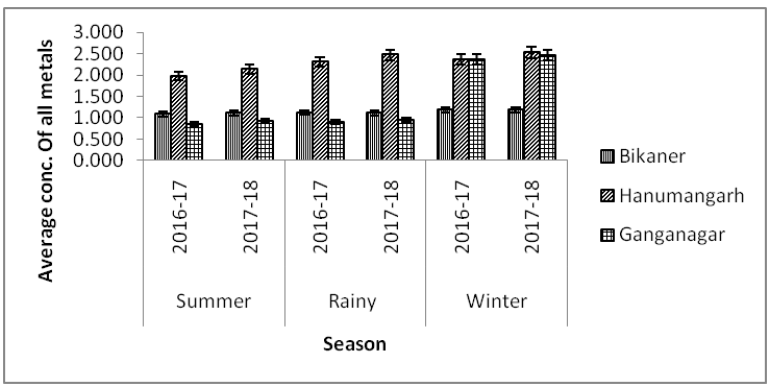

Fig. 3: Seasonal Variation in total Heavy metals in feces of Blue bull (*Boselaphus tragocamelus*) of selected district.

CONCLUSION:

Herd of Blue Bull(*Boselaphus trgocamelus)* Feces of Blue Bull(*Boselaphus tragocamelus)*

Heavy metals are chemically very stable and they are pervasive in nature. Therefore, they can be present in all the living as well as non-living components of any ecosystem. The contamination of food chains by these heavy metals is not an exception. But due to unsustainable use of agrochemicals, increased environmental pollution etc. the level of heavy metals are increased in food chains. Therefore, efforts should be made

immediately to reduce the unsustainable anthropogenic activities with special reference to heavy metals, so that the water, vegetable, food grain and other edible ingredients can be protected from the risk of contamination by heavy metals.

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