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Effects of lead on feathers of grey francolin *Francolinus pondicerianus*

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SUMMARY

This research was conducted in the vicinity of Karachi to observe the lead concentration in feathers of grey francolin. The analysis of metal concentration was done using the atomic assimilation spectrophotometry with air acetylene. The amount of lead concentration in primary feathers of grey francolin at Steel town was observed to be 7.25 ±0.04 ppm d/w while the lowest level was observed from Safora Goth as; 1.02±0.03 ppm d/w. In secondary feathers, the highest level concentration was observed in Malir as; 3.40±0.14 ppm d/w, while the lowest value was observed in Layari town as; 1.02±0.17 ppm d/w. Same time the highest amount of lead concentration of tail feathers was observed from the Steel town (6.45±0.34 ppm d/w), the lowest concentration rate was documented in Layari town (1.21±0.05 ppm d/w). The present study concluded that feathers of grey francolin contain high concentration of lead, which may be a sign of lead contamination; and shows the possibility of using the feathers as biological agents for environmental lead in birds.

Keywords: Lead, Grey Francolin, Feather, Environment, Bird

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INTRODUCTION

The grey francolin (*Francolinus pondicerianus interpositus*) are resident bird of Pakistan, they are widely distributed in dry, and grassland areas. The species are widely spread from the Indian Peninsula, Bangladesh, Sri Lanka to Pakistan (Ali *and* Ripley, 1983; Roberts, 1991; Fuller *et al.,* 2000). The members of these species are recognized worldwide as the close friends of farmers because they protect cultivated crops from the injurious pest and are also good game birds (IUCN, 2007). Lead (Pb) has long been recognized as an ecological and human health hazard because exposure to this cumulative metabolic poison has negative consequences for all organisms (DeMichele, 1984; Scheuhammer and Norris, 1995; Hernberg, 2000; Goddard *et al.,* 2008; Watson *et al.,* 2009; CDC, 2013; Chen, 2013). Although "Pb" occurs naturally as a trace element of geological materials, human activities have greatly increased the distribution and abundance of "Pb" in the environment because it is used widely in

the production of batteries, pigments and dyes, caulks, and metal alloys, as well as in aviation fuel for small piston engine aircraft due to its physical properties (e.g., high density, low melting point, malleability, corrosion resistance), as well as its low cost compared with alternative metals (Rattner *et al.*, 2008; Carr *et al.,* 2011; Goddard *et al.,* 2008; Thomas 2013). Beginning in Roman times, ~95% of "Pb" in the environment resulted from human activities, including mining, smelting, coal combustion, battery processing, waste incineration, and fuel additives (Goddard *et al.,* 2008).

Lead is one of the most toxic metals known and its negative effects range from slight biochemical or physiological disorders to serious pathological conditions, in which some organs and systems can be damaged or have their functions altered, according to the degree of exposure. Death from "plumbism" or "saturnism" is at present an unusual phenomenon in humans, although not so in domestic and free-living animals for which "plumbism" remains one of the major causes of death. This is especially significant in the case of birds, with several million deaths from lead poisoning estimated annually (in the USA alone, 1.5/3 million waterfowl) (USFWS, 1990; Francisco *et al.,* 2003). That's the alert about the bio-monitoring in science on the basis of the quantitative and qualitative measures regarding the high amount of poisonous agents like lead in the environment. For this purpose the bio-indicators including blood, serum, plasma, hair, nail can be used because in the developmental stage, the blood of feathers contains enough amount of heavy metal concentration. Current studies will provide the knowledge about the levels of lead in primary, secondary ad tail feathers of gray falcon at rural-urban area of Karachi and its adjoining areas because feathers play important role as the biological monitors for the environmental lead spotlight in birds and the environment (Beyer *et al.,* 1994). The main aim of the study is to know the lead impacts on the feathers of grey francolin.

MATERIALS AND METHOD

The samples of feather grey francolin (*Francolinus pondicerianus*) were collected from various localities of Karachi and its adjoining areas. Feathers of grey francolin were categorized into primary, secondary, and tail feathers. Every sample was placed in a plastic sealable container and transferred to the laboratory. The measurements of every feather were close to (1gm). The every feather was washed, applying digestion method, a glass tube was taken having HNO_3 and $HCLO_4$, 8:2 ratios and each sample were added, whole tubes of racks were put into water bath for about 7 to 8 hours upto samples were purify. Later the samples were transferred to beakers. Each beaker contains the (16-22 drops of 30% H_2O_2), digestion was constant from 0.5 ml to 1 ml up to obtaining of colorless liquid. Subsequently after cooling every sample was diluted in (10 ml) with de-ionized water and transferred to the plastic containers. For lead analysis double beam atomic assimilation spectrophotometer was used and statistical analysis of data was based on (Ipsen and Feigel's, 1970) method. The level of significance was set at <0.001. Arithmetic means and standard errors are shown in the Table 1.

RESULTS AND DISCUSSION

The current study was done in Karachi and its adjoining areas. The highest amount of lead concentration was observed in the primary feather of grey francolin at Steel town as 7.25 ±0.04 ppm d/w, while the lowest level was observed from Safora Goth (1.02±0.03 ppm d/w) (Table I& Fig.1). In secondary feathers, the highest level concentration was observed in Malir (3.40±0.14 ppm d/w); while the lowest value was observed in Layari town (1.02±0.17 ppm d/w) (Table 1, Figure 1).

Table1: Shows lead concentration (Mean ± S.E ppm/dw) in the feathers of grey francolin

S.NO	Sites	Observational feathers		
		PF	SF	TF
1	Steel town	7.25 ±0.04	3.32±0.24	6.45±0.34
2	Safora Goth	1.02±0.03	1.20±0.23	1.41±0.05
3	Malir	2.23±0.05	3.40±0.14	2.23±0.13
4	Lyari town	1.26±0.04	1.02±0.17	1.21±0.05

PF=Primary Feathers, SE= Secondary Feathers, TF= Tail Feathers

Tail feathers has the highest amount of lead concentration was observed in the Steel town (6.45±0.34 ppm d/w) and the lowest concentration rate was examined in Layari town (1.21±0.05 ppm d/w). Current studies clarified the various concentrations of metals in feathers at high levels due to traffic density because the high concentration of metal in feathers was examined in the samples of Steel town with high traffic density, low concentrations were observed in the areas with low density of traffic. The current observation showed that the maximum lead concentration in Steel town because the Lead is used in the production of batteries, smelting, painting and motor fuels. This road is surrounded by both diesel and petrol using vehicles and exhaust has no getaway route and particle containing matter finally settles down on the ground and the vegetation. Particle containing matter that has settled down on the soil is eventually drained to the nearest water body which may serve as a drinking water source for humans apart from inhalation of contaminated air. These high concentrations of lead suppose to be expected.

The study has confirmed that feathers of common resident birds collected from the ground can be used for common monitoring of the levels of trace elements in the environment. The study demonstrates that in all feathers higher concentration of lead was noticed in primary feathers. This may be supported by the facts like it takes more days to grow and hence more concentration of metal may build up in the feathers in the course of blood circulation and it has been confirmed by many researchers that heavy metals frequently build up in the feathers during its growth. The cause of higher level of lead in primary and tail feathers may be owing to outer deposition of metals because they are more in contact with the atmosphere. It may also be clarified that when the wing is folded, innermost primaries and may thus be protected from outer contamination. Outermost primaries may also be tidier than the innermost primaries. Birds are supreme as models for lead toxicity because they rely on visual and vocal communication, an attribute they share with human. Additionally feather is a supreme tool for sampling and testing. It can be obtained without difficulty, painlessly and can be sent to the laboratory without special handling

supplies. Moreover feathers can be used as display for both acute and chronic lead spotlight since lead is stored in the feather months after digestion and can be a sign of metabolic changes of the body over long.

CONCLUSION

Current research concluded that the concentration of lead in feathers of grey francolin birds in Karachi and its adjoining areas is at high levels. Additionally, the result concludes that the feathers can be used as a suitable tool to study lead pollution in birds and the environment.

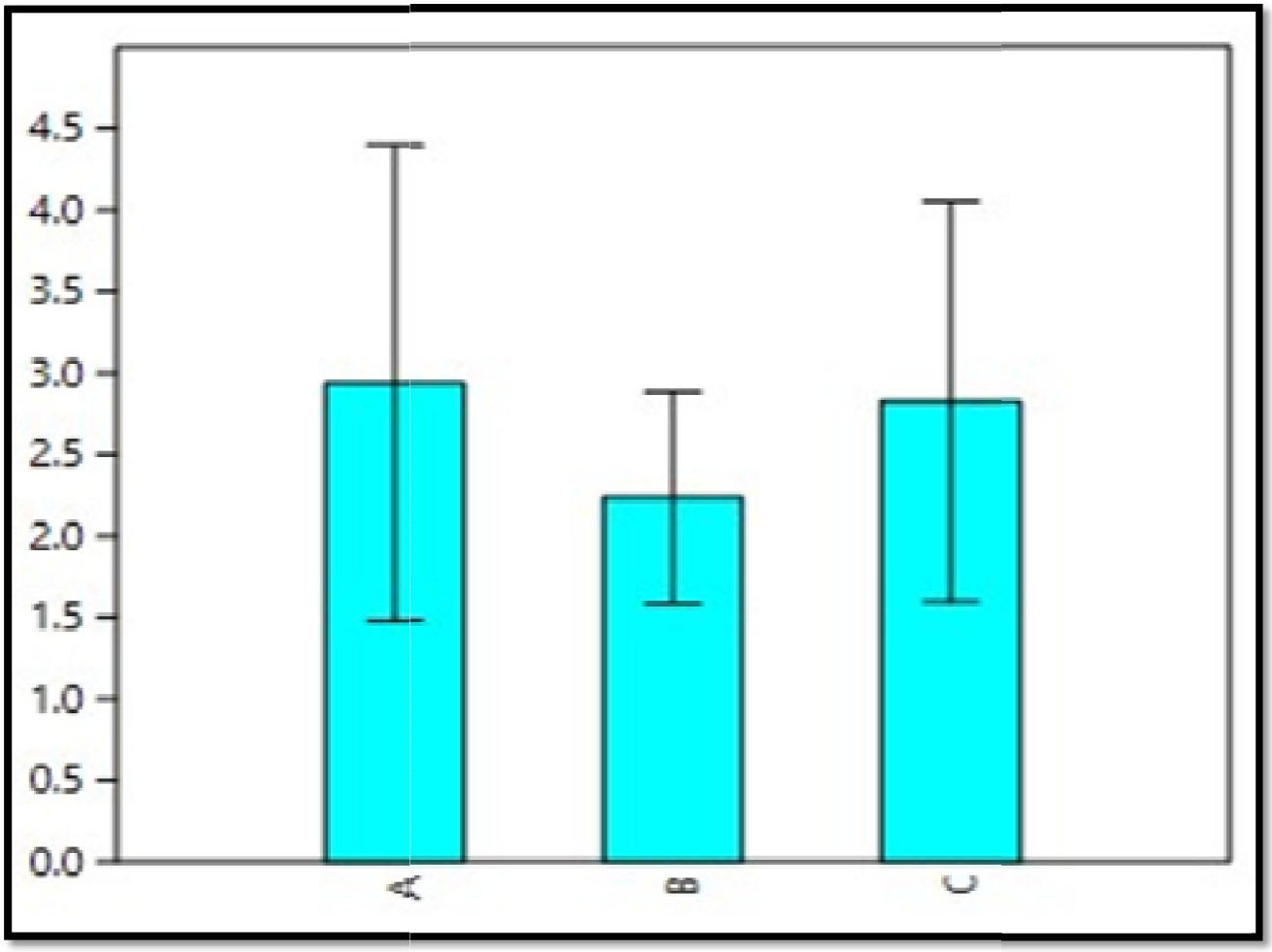

Figure 1: Shows lead concentration and variation in graphical form (Where A=Primary Feathers, B= Secondary Feathers, C= Tail Feathers)

REFERENCES

Ali, S. and S. D. Ripley. 1983. Handbook of the birds of India and Pakistan. Oxford University, Press, Delhi, India.

Beyer, W.N, E.E. Connorand and S. Gerould. 1994. Estimates of soil ingestion by wildlife. J. Wildi Manage 58: 375-382.

Bump, G and J.W. Bump.1964. A study and review of the Black Francolin and the Grey Francolin. Spec. Sci. Rep. Wildl. (81): Bur. Sport Fish. Wildl., Washington, D.C.USA.

Carr, E., M. Lee, K. Marin, C. Holder, M. Hoyer, M. Pedde, R. Cook and J. Touma .2011. Development and evaluation of an air quality modeling approach to assess near-field impacts of lead emissions from piston-engine aircraft operating on leaded aviation gasoline. Atmospheric Environment 45:5795–5804.

CDC. 2013. Blood lead levels in children aged 1–5 years—United States, 1999–2010. Centers for Disease Control. Morbidity and Mortality Weekly Report 62 (April 5):245–248.

Chen, I. 2013. Overlooked: Thousands of Americans exposed to dangerous levels of lead in their jobs. Scientific American 309(3).

DeMichele, S. J. 1984. Nutrition of lead. Comparative Biochemistry and Physiology A 78:401–408.

Francisco, N, J.D. Troya, and E.L. Aguera. 2003. Lead and lead toxicity in domestic and free living birds. Avian Pathol 32:3-13.

Fuller, A.R and P.J. Garson.2000. Pheasants. Status survey and conservation action plan 2000-2004. IUCN, Gland, Switzerland.

Goddard, C. I., N. J. Leonard, D. L. Stang, P. J. Wingate, B. A. Rattner, J. C. Franson, and S. R. Sheffield. 2008. Management concerns about known and potential impacts of lead use in shooting and in fishing activities. Fisheries 33:228–236.

Haley, V.B and T.O. Talbot 2004. Geographic analysis of blood lead levels in New York State children born 1994-1997. Environ Health Perspect 112:1577-1582.

Hernberg, S. 2000. Lead poisoning in a historical perspective. American Journal of Industrial Medicine 38:244–254.

Ipsen, J. and Feigel, P .1970. In Bancrofts Introduction to Biostatistics, 2nd Ed. Harper and Row Publisher. Inc., New York.

IUCN. 2007. IUCN red list of threatened species.<www.iucnredlist.org>. (downloaded on June, 07, 2008).

Niskar, A.S, S. Buchanan and P.A. Meyer. 2005.A federal agency's role in fulfilling the public health core functions: the childhood lead poisoning prevention program model. J Public Health Manag Pract 11:50-58.

Rajeshwari, A and S. Asha. 2013. Impact of high concentration of lead on pigeon feathers.Sacha Jour Environ Stud 3(1):11-15.

Rattner, B. A., J. C. Franson, S. R. Sheffield, C. I. Goddard, N. J. Leonard, D. Stang, and P. J. Wingate. 2008. Sources and implications of lead ammunition and fishing tackle on natural resources. Technical Review 08-01. The Wildlife Society and American Fisheries Society, Bethesda, MD, USA.

Roberts, T.J. 1991. The birds of Pakistan. Vol. I. Regional studies and non-passeriformes. Oxford Univ. Press. Karachi, Pakistan, pp. 598.

Scheuhammer, A. M. and S. L. Norris, 1995. A review of the environmental impacts of lead shotshell ammunition and lead fishing weights in Canada. Occasional Paper 88. of the Canadian Wildlife Service, Ottawa, Ontario.

Thomas, V. G. 2013. Lead-free hunting rifle ammunition: Product availability, price, effectiveness, and role in global wildlife conservation. AMBIO 42:737–745.

USFWS. 1990. Lead poisoning in waterfowl. U.S. Fish and Wildlife Service (USFWS), Washington, D.C., pp. 1-15.

Watson, R. T., M. Fuller, M. Pokras and W. G. Hunt. 2009. Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, ID, USA.

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