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A STUDY ON HEAVY METAL ACCUMULATION IN THE FEATHERS OF YOUNG HOUSE SPARROW *PASSER DOMESTICUS* RESIDING IN MUMBAI CITY, INDIA.

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ABSTRACT: The House Sparrow (*Passer domesticus*) is one of the most common birds found in the urban environment. The population of house sparrow living in nest colonies near to human habitats is now threatened by pollutants. Knowledge of toxicological residue studies in house sparrow is still in dearth. The primary goal of present study is to understand if we are providing adequate habitat for the fauna or attracting harm that may be detrimental to individuals and population overtime. Use of bird as bio monitors is one of the effective methods in quantifying the overall health of ecosystem. Aim of the present study is to determine the level of heavy metal accumulated in the down feather of house sparrow. High level of Calcium, chromium, Iron and magnesium detected in down feathers of young sparrow shows external contamination from anthropogenic sources which cannot be ruled out.

KEYWORDS: Sparrow, heavy metal, down feather.

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1. INTRODUCTION:

Pollution of the natural environment by heavy metals is a worldwide problem. Its main sources are: leather tanning, sewage water, city refuse, fertilizers, pesticides, automobiles, industrial effluents, and e wastes [1]-[3]. Dumping of waste into the soils and wetlands is a common activity that finally affects the food chain, ecosystem also its amount accumulated by birds [4]-[7]. Due to this reason soils, air, and water are heavily polluted with various heavy metals like Hg, As, Pb, Zn, Mn, Li, Cd, and Cr. Metals like mercury (Hg), cadmium (Cd), chromium (Cr), lead (Pb), nickel(Ni), cobalt (Co), and zinc (Zn) are highly toxic to fauna components of the ecosystem[8]-[11]. Heavy metals thus have a serious impact on the environment that can threaten the ecosystem's stability. Cd in both the environment and food has long persistence and high toxicity and is listed as one of the most dangerous trace element, while the toxic effect of Pb has been well established in birds for over a century and has become dangerous to natural life and public health. Analyzing pollutants in living organisms is more attractive as it provides precise information about the bioavailability, bio magnification and bio-transference of pollutants. Birds are the bio monitors of geographical, historical and global patterns of heavy metal pollution in the environment, as they occupy a wide range of trophic levels in different food chains [12-18]. The House Sparrow is a non-migratory sedentary bird living in the urban environments. Its ecological niche is characterized by the interaction with anthropogenic structures. It seems to be tolerant to urban environmental stress, and also has a high reproductive rate. Due to this characteristics features the House Sparrow is considered as one of the most suitable birds for urban bio monitoring of heavy metals [19]. The population of house sparrow living near human habitats is now threatened by pollutants. Reports are now pouring in from all over India and around the world about rapid decline in the *Passer domesticus* populations which was once found in abundance.

2. MATERIALS AND METHODS

2.1. Sample collection and preparation:

Birds can be exposed to heavy metals both externally through physical contact, and internally by consumption of contaminated food [20]-[27]. Nestling's feathers was taken as experimental model for the study. Due to the fact that the bird readily uses man-made nest-boxes, artificial nest were made in different areas of Andheri (west) regions of Mumbai city. Down feathers were collected from the each nests selected for the study. Feathers were collected from 30 nests of Andheri area, Mumbai, Maharashtra. They were placed in individual envelopes and labeled for later Identification. Metals enter feathers during the 2^{nd} –3^{rd} week, it takes for them to grow; then the blood supply atrophies, and there is no further deposition of metals .To remove loosely adhering external contaminants, feathers were washed thoroughly with acetone and then with doubly distilled water. All specimens were transferred into clean, acid-washed glass vials and oven-dried at 60 °C until constant weights were obtained.

2.2. Analytical procedure:

Specimens were digested in a mixture of super-pure nitric and per chloric acids (Merck) (2: 1, v/v). The volume of the digestion mixture was 10 times the sample's mass in g. After soaking the specimens in the acid mixture overnight at room temperature, the mixture was gradually heated to 200 °C in a sand bath over a period of 3 h. Digestion was then continued until no fumes were observed and the mixture became pale yellow. Mixtures were then diluted to 25 mL with doubly distilled water. Blanks and reference material were run with the samples. Finally, concentrations of Cu, Mg, As, Ca, Mn, Hg, Fe, Cr, Cd, Pb, and Zn were measured by inductively coupled plasma –

atomic emission spectrophotometry (ICP Optima 3000, Perkin–Elmer, USA).As no studies were conducted on feathers of sparrow present study would be a good reference.

2.3. Statistical analysis:

Statistical analysis of the data was carried out using SYSTAT for Windows software (SYSTAT for Windows Inc.26). Differences were considered significant where P was =0.05.

3. RESULTS AND DISCUSSION

The mean concentration of Cr recorded in the down feathers was, 25.173 μg/g (Table 1). Chromium concentrations observed in the present study are relatively higher compared to the levels reported by other studies in the Indian subcontinent [14]. The high levels of Cr observed in the samples exceeding the threshold of 2.8 μg/g [10] could be linked to the anthropogenic source of contamination. The concentrations of Manganese recorded in the, down feathers samples was 167.57 μg/g. (Table.1).The highest concentrations of Mn in the urban samples were detected in down feathers. The levels of Mn reported in the study are comparable to the levels reported by [14] in *Bubulcusibis* (21 μg/g), by [28] in *Ardea cinerea* (9.90±3.62 μg/g), and in *Egretta garzetta* (9.94±2.75 μg/g). Mn contamination in food chain generally occurs through anthropogenic sources such as urban waste dumps and industrial effluents [14] .The mean concentrations of Zn recorded in the down feathers samples was 112.04 μg/g (Table.1) . The values of Zn observed in the current study are lower compared to the levels reported by [28] in feathers of *Ardea cinerea* (204±57.2 μg/g) and *Egretta garzetta* (233±64.7 μg/g). The mean concentrations of Cu recorded in bird down feathers samples 1.23 μg/g. The results of the study are in consistent with previous studies by [29], [6]. Cu is one of the essential elements for various physiological functions and also as structural component of numerous metallo enzymes. Excess intake of copper can lead to harmful effects including growth irregularity, respiratory malfunctions, and carcinogenesis. The presence of copper in feathers suggests the dietary source of metals; however, external contamination from anthropogenic sources also cannot be ruled out. High level of Calcium, Iron and magnesium was also detected in down feathers of young sparrow*(Passer domesticus)*.

Table no 1. Showing metal accumulated in the feathers of young sparrow.

Metal	**Metal content in down feather µg/g**
Magnessium	2577±123.7
Manganese	24.32±9.82
Lead	ND
Zinc	22.8±2.7
Arsenic	ND
Mercury	ND
Calcium 15929	15929±84.7
Cadmium	ND
Copper	2.3±0.52
Chromium	25.73±3.81
Iron	14550.35± 138.6

ND less than 0.01ppm ± standard deviation

4. CONCLUSION

It was evident from the results that feather analysis is an effective and non-destructive strategy to study the heavy metal contamination in the food chain. Higher concentrations of Chromium, Iron, Calcium ,Copper, Magnesium and Zinc in the feather samples reveals potential anthropogenic sources of contamination from leather tanneries, metal fabrication industries, and vehicular traffic. Presence of Zn and Cr mainly indicates the anthropogenic sources (leather tanneries, metal industries, and vehicular traffic) of metals in the food chain. The high levels of Cr observed in the samples exceeding the threshold of 2.8 µg/g [10] could be linked to the anthropogenic source of contamination. Accumulation of Ca, Mg, and Mn suggests natural sources of these metals in the diet. Accumulation of Fe indicates the possibility of source from metal fabrication industries present in the rural areas. The presence of copper suggests the dietary source of metals in feathers, high calcium content may be that passerine species supplement their nestlings with calcium rich foods. The study confirms the hypothesis that analyzing metal contents in feathers provide reliable method in monitoring environmental contamination. In the present analysis certain toxic metals like mercury, cadmium, arsenic and lead has not reached the toxic level. Over all the health of the sparrows *(Passer domesticus)* of Mumbai appears to be normal.

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