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INDUCED TOXIC EFFECTS OF HEAVY METAL (CHROMIUM) ON *PASSER DOMESTICUS* (LINNAEUS, 1758)

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ABSTRACT

Toxic heavy metals are global problem. Toxic metals can bioaccumulate in the body and in the food chain. The different main sources of metals pollution present in nature. To access heavy metal bioaccumulation in *Passer domesticus* (house sparrow); fifty four birds were exposed Chromium for one month in three different cages. The heavy metal used was Chromium in compound form as Chromium Sulphate. Two different doses (0.005g and 0.01g) produced lethal effects at different intervals. The high dose caused high physiological disorder and mortality rate as compared to the low dose. In case of low dose (0.005g) 5 to 10 percent shedding of feathers, 15 to 20 percent mortality rate was observed while in case of strong dose (0.01g) 15 to 20 percent shedding of feathers and 30 to 40 percent mortality rate was observed.
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KEYWORDS: Heavy metal, Birds, House sparrow.

INTRODUCTION

The heavy metals throw serious impacts on environment. Chromium and lead are in particularly toxic and cause serious problems when got enter the food. The use of metal like lead present in shot it's in the environment and results in considerable avian mortality, (Licata *et al.*, 2010). Many significant number of bird mortality was reported in Western Australian due to high level of lead and chromium were found in the bone, kidney and liver of dead birds (Heyworth and Mullan, 2009). A very specific pollution problem cause by the use of lead shot resulting in considerable avian mortality. The levels of Lead, Cadmium, Copper, Manganese, Zinc and chromium were found higher amount in liver and lung samples of common buzzard (*Buteo buteo*). (Licata *et al*., 2010).Benito *et al*. (1999) concluded that diet is one of the most wetland birds heavy metals are found in the area around Donana. Similarly, Samour and Naldo (2002) reported that heavy metals toxicity found in falcons which are present in captivity birds in Saudi Arabia. Lead deposited in muscle tissue of birds is generally considered to pose minimal health risks.

The main sources of Chromium pollution are the plastic wastes, septic wastes and sewages. According to the Barnhart (1997) 40 percent of Chromium pollution is caused by tanning of leather. Chromium is a naturally found in animals, rocks, volcanic dust ,plants and soil. It is usually occurs in two forms; chromium (III) and chromium (VI). The natural and essential one is the Chromium (III), whereas chromium (VI) is generally by-product of industrial activities and considered to be more mobile and toxic (Paiva *et al.*, 2009). The mobilization, subsequent uptake and the toxicity of the Chromium depend on the metal speciation, which determines the impact of it on the physiology of birds (Shanker *et al*., 2005).

The present finding showed that Chromium effects birds' growth, body weight (Yagminas *et al.*, 1990).

MATERIALS AND METHODS

The study was carried during September to October, 2010 in Area of District Kohat Khyber Pukhtoonkhwa and the birds samples were purchased in the local market of District Karak and brought to the Department of Zoology KUST.

Source of collection: The experiment was carried on selected birds *Passer domesticus* (house sparrow).The birds *Passer domesticus* were obtained from the local market of Karak. They were transferred to cages for preservation and later on transferred to the laboratory of Department of Zoology, Kohat University of Science and Technology Kohat for further experimental process. We obtained total 54 birds and put these into three separate cages as each cage contained 18 birds. They were kept under control condition for five days.

Dosage: Fifty four birds were kept in three separate cages, each of which contained 18 birds.

Cage 1st: where all birds were served as controlled. They were provided equal amount of tap water.

Cage 2nd: where all birds were treated with low dose of Chromium (0.005g) of chromium sulphate.

Cage 3rd: where all birds were treated with high dose of Chromium (0.01g per) of chromium sulphate.

Environment: All birds were kept in normal and same environment where there was no interruption of human beings. To save birds from environmental effects all the three cages were covered by a white and clean cloth sheet having pores for trespassing of fresh air. The cages were cleaned and brushed daily.

Examining bird's external features after treatment: After giving the specific amount of metal solution we observed the external features and behavioral changes of birds daily. Similarly Bird's fecal materials were collected and analyzed before and after treatment with metal solution and compare the faeces of the treated birds with normal and controlled birds.

RESULTS AND DISCUSSION

Results of the experiments are presented in Tables 1-5 with Fig. 1(A, B), Fig. 2(A, B) and Fig. 3(A, B) respectively. The exposure to high dose of (0.01g) of chromium sulphate induced significant increase as compared to low dose concentration (0.005g) in the *Passer domesticus* shedding of feathers, mortality rate, behavioral changes and also changes in their faeces color.

The low dose (0.005g) caused 33.33 percent mortality and 50 percent shedding of feathers while high dose (0.01g) caused 55.55 percent mortality and 72.22 percent shedding of feathers in *passer domesticus* population (Tables 1 & 3) during first night observation .During second night observation the low dose caused 46.66 percent mortality and 50 percent shedding of feathers while the weak dose caused 87.5 percent mortality and 87.5 percent shedding of feathers (Tables 2 and 4).During experiments there were *Passer domesticus* some behavioral changes e.g., the control M birds were calm and quite but the treated birds were very aggressive.

A B

Fig. 1. Pattern and wear of wings of *Passer domesticus* before treatment (A) and after treatment (B).

Chromium is a toxicant that causes severe changes in many body organs including liver. The heavy metals interferes the body physiology and its toxic many organs like brain ,liver, different tissues and egg yolks following different sources of nutritional chromium supplementation (Taib *et al.,* 2004).

The Chromium pollution in the environment is due to the different kinds of wastes like plastic, septic and mainly by sewages. According to the Barnhart (1997) 40 percent of Chromium pollution is caused by tanning of leather. In Nature chromium occur in rocks, animals, plants, soil, and in volcanic dust and gases. It is usually occurs in two forms; natural and essential, one is the Chromium (III), whereas chromium (VI) considered as carcinogen because it is the by-product of industrial activities (Paiva *et al.,* 2009). The impact of toxicity, succeeding uptake, and mobilization of the Chromium on the birds physiology determines by the metal speciation (Shanker *et al*., 2005).

When Chromium exposed *Passer domes*ticus the growth rate was also decreased with comparison the control group which was find in above results. The body weight reduction was accompanied with depressive food utilization. This may involve a down-regulation of nutrient intake because Chromium alters the hypothalamic appetite center. Other investigators also observed the same (Yagminas *et al.,* 1990).

The findings showed that the mortality increases as the dose increased and it also alters the physiological conditions in house sparrows. Similarly the toxicity is totally affected by the route and foam of ingestion as well as dealings between necessary elements and toxic. The amount of metal is totally depends on the time of interval, age and breed. (Massanyi *et al.,* 2000).

A B

Fig. 2. Pattern and wear of head of *Passer domesticus* before treatment (A) and after treatment (B).

A B

Fig. 3. Pattern and wear of tail of *Passer domesticus* before treatment (A) and after treatment (B).

Table 1. Mortality of *Passer domesticus* during first 15 days treatment.

Observation	Cage # 1M (Total 18 birds control)	Cage # 2M (18 birds receiving low dose)	Cage # 3M (18 birds receiving high dose)
Day 1st – 7th	0	0	0
Day 8th	0	0	1
Day 9th	0	0	2
Day 10th	0	1	1
Day 11th	0	1	1
Day 12th	0	2	2
Day 13th	0	1	2
Day 14th	0	0	1
Day 15th	0	1	0
Total	0	6	10
Mortality in (%)	0 M	33.33 M	55.55 M

Table 2. Mortality of *Passer domesticus* during second 15 days treatment.

Observation	Cage # 1M (Total 18 birds control)	Cage # 2M (18 birds)	Cage # 3M (18 birds)
Day 1st-8th	0	0	0
Day 9th	1	0	0
Day 10 th	0	0	2
Day 11 th	0	1	1
Day 12 th	0	1	1
Day 13 th	0	2	1
Day 14 th	0	1	0
Day 15 th	1	0	1
Day 16 th	1	7	7
Mortality %	5.55M	41.66M	87.5M

Table 3. Total number of *Passer domesticus* show in a shedding of feathers during first 15 days treatment.

Observation	Cage # 1M (total 18 birds controlled)	Cage # 2M (18 birds)	Cage # 3M (18 birds)
Day 1st - 6th	0	0	1
Day 7th	0	0	1
Day 8th	0	1	2
Day 9th	0	1	1
Day 10th	0	2	2
Day 11th	0	1	1
Day 12th	0	2	1
Day 13th	0	0	2
Day 14th	0	1	1
Day 15th	0	1	1
Total	0	9	13
Feather shedding (%)	0 M	50 M	72.22 M

Table 4. Total number of *Passer domesticus* showed shedding of feathers during second 15 days treatment.

Observation	Cage #1M (Total 18 birds control)	Cage #2 M (12 birds receiving low dose)	Cage #3M (8 birds receiving high dose)
Day 1st – 7th	0	0	0
Day 8th	0	0	1
Day 9th	0	0	1
Day 10th	0	1	1
Day 11th	0	1	0
Day 12th	0	1	1
Day 13th	0	2	1
Day 14th	0	0	2
Day 15th	0	1	0
Total	0	6	7
Feather shedding (%)	0 M	50 M	87.5 M

Table 5. Total no of *Passer domesticus* showed Mortality and shedding of feathers during whole 30 days treatment.

Observation	Mortality (1st night) (%)	Mortality (2nd fortnight) (%)	Shedding of feathers (first fortnight) (%)	Shedding of feathers (second fortnight) (%)
Control	0.00	5.55	0.00	0.00
Low Cr dose	33.33	41.66	50 .00	50.00
High Cr dose	55.55	87.5	72.22	87.50

The present studies showed that sub toxic chronic Chromium exposure resulted mortality in birds. The liver of mammals was also effect on chromium. Result showed no histological alterations in the liver of monkeys on 9 months uptake of Chromium while some investigators observed that hepatic effects of Chromium exposure comprised abnormal serum enzyme levels and mild hepatitis (Colle *et al.,* 1980). On the other hand, Jarrar (1999) observed effects on liver, severe renal histological and histochemical alterations, in albino rats *(Rattus norvegicus*) exposed to Chromium sulphate in drinking water. Induced Chromium intoxication was observed in the nuclei of hepatocytes which showed considerable alterations. It is may be due to increased cellular activity and nuclear interruption related to the mechanism of Chromium detoxification. Some of the physiological alterations observed in the present study have also been detected in previous studies (Nehru and Kaushal 1993; Abd El-aal *et al.,* 1989). In addition, Abd El-aal *et al*. (1989) observed increased mitotic division and hepatocytes ratio in nuclear when rats were induced chromium.

Our data be worthy of meticulous attention especially because they were recorded in a region (Karak) with a very low risk of pollutant contamination, because of less industries at this region. For efficient biomonitoring of environmental contamination. Cadmium, Copper, Lead,, and Zinc to extend the scope of monitoring to other heavy metals such as Aluminum and mercury etc. For the safety of food, we will propose to extend our finding concerning the Chromium concentrations in different birds species, poultry and food producing animals from the same areas to clarify the absence of different toxicological risks in this region (Licata *et al.*, 2010).

In general, species that are top on the food chain accumulate most of the effect. Birds present in the top on the food chain consume largest mass of fish ultimately have highest contaminants than smaller ones. In addition to, levels in birds should reflect the levels in the fish that they eat. Skimmers (Long winged seabird) eat only fish (Gochfeld and Burger, 1994), or they consume larger fish while the terns (Sea bird having much smaller size) consumes small sizeds fish (Burger and Gochfeld, 1990, 1991). Gulls (Long winged web footed sea bird) are omnivores, eating on fish, variety of invertebrates and also sort food from the garbage (Burger, 1988). Thus the chromium contamination relatively based on trophic levels like lead, probably it is higher in species that eat invertebrates (because they accumulate in invertebrates), seem great rate in herring gulls and skimmers. Herring gull prefers mostly invertebrates in food beside fish (Burger, 1988, while skimmers eat only fish. That skimmer eats only fish makes their increased local exposure due to either availabe sources

CONCLUSION

The above results showed that chromium causes very dangerous effects in birds and also the mortality percentage was very high in birds.

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