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INDUCED EFFECTS OF LEAD, CHROMIUM AND CADMIUM ON *GALLUS DOMESTICUS*

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ABSTRACT

The objective of this study was to investigate the induced effects of three selected heavy metals lead, chromium, and cadmium on poultry bird *Gallus domesticus* which are widely consumed in Karachi. Lead caused decrease in level of blood parameters whereas chromium and cadmium increased level of blood parameters. Red Blood Corpuscles (RBCs) decreased due to cadmium and lead whereas White Blood Corpuscles (WBCs) decreased with exposure to lead and chromium. Lead also decreased the life span of RBCs. After administration of high dose (20µg /body weight) of lead Hemoglobin (Hb) was 13.42 g/dL, R.B.C 3.33 (x10E12/L), Mean Corpuscular Volume (M.C.V) 160.30 (fL), Mean Corpuscular Hemoglobin (M.C.H) 40.74 (pg), Mean corpuscular hemoglobin concentration (M.C.H.C) 29.18 g/dl and W.B.C 189 (x10E9/L), respectively whereas for low dose (10 µg /body weight) Hb was 12.52 g/dL, R.B.C 3.18 (x10E12/L), M.C.V 155.72 (fL), M.C.H 39.44pg, M.C.H.C 27.99 g/dl and W.B.C 207.50 (x10E9/L), respectively. At high dose of cadmium (20 µg /body weight) concentration of Hb was 14.87g/dL, R.B.C 3.19 (x10E12/L), M.C.V 129.69 (fL), M.C.H 48.38 (pg), M.C.H.C 37.56 g/dl, W.B.C 135.24 (x10E9/L) whereas at low dose (10 µg/body weight) concentration of Hb was 14.21g/dL, R.B.C 3.11 (x10E12/L), M.C.V 127.51 (fL), M.C.H 47.54 (pg), M.C.H.C 36.70 g/dl and W.B.C 145.75 (x10E9/L), respectively. At high dose of chromium (20 µg /body weight) Hb as 9.35g/dL, R.B.C 2.03 (x10E12/L), M.C.V 142.40 (fL), M.C.H 37.20 (pg), M.C.H.C 23.95 g/dl and W.B.C 235.02 (x10E9/L) whereas at low dose (10 µg/body weight) Hb as 10.40 g/dL, R.B.C 2.37 (x10E12/L), M.C.V 148.02 (fL), M.C.H 39.42 (pg), M.C.H.C 25.60 g/dl and W.B.C 207.31 (x10E9/L), respectively. In histo-pathological study, induction of a high dose of heavy metals (Pb, Cr and Cd) showed abnormalities of cells size and function, damage to cells and tissue of liver, kidney, intestine and brain.

Keywords: Toxic effects, heavy metals, lead, chromium, cadmium, poultry bird.

INTRODUCTION

Quality of food and its safety is a most important community concern all over the world. The risks associated with consumption of food stuffs contaminated by pesticides, heavy metals and/or toxins have stimulated research in this field (D'Mello, 2003). Heavy metals are found naturally in an ecosystem with varying concentrations but a large amount of heavy metalsare introduced into the ecosystem due to anthropogenic activities. The occurrence of heavy metals in the environment is of great ecological importance due to their toxicity at certain level, translocation through food chains and which are considered as persistent (Abdul-Jameel *et al*., 2012). Hence contamination with heavy metals is a serious threat to humans because of their toxicity, bioaccumulation and biomagnifications in the food chain (Demirezen Uruç, 2006). Karachi is the industrial city and economic hub of Pakistan and about 70% of the total industry of the country is sited there. The chief industry consist of textile, chemicals, pharmaceuticals, biocides, electronic goods, food, beverages, vegetable oils, fishing, plastics, paints, dyes, cement, asbestos, glass, ceramics, oil refinery, tanneries, soap and detergents, tobacco, ship building and breaking, iron and steel, metal finishing, auto assembling and manufacture, thermal power generation, paper and printing and also forge and foundry. The sub-lethal effects of lead nitrate on hematological profile of *Clarias batrachus* studied and various hematological changes noticed. In exposed fishes RBC counts, hemoglobin percentage and serum protein levels were decreased significantly in comparison to control groups (Mastan *et al*., 2009). Strong amount of lead damages the RBC and cell membranes (Shaheen and Akhtar, 2012). Chromium shrinks the blood cells and the change in shape affects the binding of oxygen to RBC (Mazon *et al*., 2002). Chromium induced in animals showed affects on intestine tissues (Sharma and Satyanrans, 2011). Cadmium chloride at teratogenic dose induced significant alterations in the detoxification enzymes of the liver and the kidney which lead to hepatica injuries, lung damage, kidney disinfection, and

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hypertension (Reddy and Yellamma, 1996). The effects of cadmium on hematologic values of Broiler chicken showed that the values of RBC, Hb, PCV, MCHC and MCH were significantly lower and their anemia was hypo-chromic and normocytic (Caiying *et al*., 2005). The effects of heavy metal $CdCl_2$ on survival and hematology parameters of Rock pigeon *Columbia livia* showed that the treatment with 150µg of $CdCl_2$ reduces the survival time and increases the value of hematological parameters hemoglobin content, RBC, WBC, MCHC and MCH whereas PCV and MCV decreased. The low dose (50 µg) produced nominal effects on these parameters except WBC and MCH (Gabol *et al*., 2003).

Heavy metals act as environmental stressors and may alter serum biochemical parameters in fresh water fish *Oreochromis niloticus* from prolonged exposure to heavy metals such as Ag, Cd, Cr, Cu, and Zn (Öner *et al*., 2008). Trough anthropogenic activities a large amount of heavy metals are introduced into the ecosystem of the Karachi which has now great environmental importance due to their toxicity at certain intensity. The objective of this study was to investigate the induced effects of three heavy metals lead, chromium, and cadmium on poultry bird *Gallus domesticus*.

MATERIALS AND METHODS

The experiment was carried on *Gallus domesticus* (chicks) which were bought from the local market of Karachi. Birds were kept in room tempture for 5 to 7 days before experimental work, and then were divided into three groups:
(a) Lab Control
(b) Low dose (10 µg/body weight) and
(c) High dose (20 µg/body weight).

Metals used

Chromium, cadmium, and lead were used in the form of salts, chromium sulphate ($CrSO_4$), cadmium chloride ($CdCl_2$), and lead nitrate ($PbNO_3$). These were used as a low dose (10 µg /body weight) and high dose (20 µg/body weight).

The hematological parameters were measued in the following units:
Hemoglobin: g/dL
R.B.C: Red Blood Corpuscles : x10E12/L
M.C.V: Mean corpuscular volume: fL
M.C.H: Mean corpuscular hemoglobin: pg
M.C.H.C: Mean corpuscular hemoglobin concentration: g/dl
W.B.C : White Blood Corpuscles: x10E9/L

Dacie and Lewis (1977) methods were applied for estimation of following parameters:
Erythrocytes count (R.B.C.)
Leukocytes count (W.B.C.)
Mean corpuscular volume (M.C.V.)
Mean corpuscular haemoglobin concentration (M.C.H.C)
Mean corpuscular haemoglobin (M.C.H).

RESULTS AND DISCUSSION

Hematological parameters were carried out from March to December of 2013. Pathological changes and toxic effects were also observed in this study. Comparison of various hematological parameters such as Hb, RBC, WBC, MVC, MCH and MCHC after treatment with high and low dose of heavy metal lead, chromium and cadmium is shown in tables 1, 2, 3. The mean variance value of blood parameters for lead ranged between 0.10 - 1790 (Table 1) whereas mean variance value for chromium ranged between 0.03 - 123.23 (Table 2), similarly mean variance

Table 1. Toxic effects of lead on blood parameters of *Gallus domesticus*.

Blood Parameters	Doses	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean	Var.	S.D
Hb g/dL	Control	12.8	13.1	12.4	11.7	13.7	12.1	10.8	11.1	12.1	9.6	11.94	1.44	1.20
	Low	12.9	13.9	12.9	12.8	14.1	13.1	11.1	11.7	12.6	10.1	12.52	1.52	1.23
	High	13.8	14.7	13.8	13.9	15.8	13.9	11.8	11.9	13.8	10.8	13.42	2.22	1.49
RBC (10E12/L)	Control	3.2	3.4	3.0	2.9	3.4	3.3	2.9	3.0	2.8	2.4	3.03	0.10	0.31
	Low	3.1	3.6	3.1	3.6	3.5	3.4	3.1	3.1	2.9	2.4	3.18	0.14	0.37
	High	3.9	3.8	3.4	3.2	3.6	3.6	3.2	3.1	3.0	2.5	3.33	0.18	0.42
WBC (x10E9/L)	Control	248	250	220	208	261	323	199	201	200	180	229.00	1790	42.31
	Low	241	239	209	180	241	209	191	195	200	170	207.50	654.28	25.58
	High	220	210	191	150	208	181	184	190	188	168	198.00	424.44	20.60
MCV (fL)	Control	161	168	165	152	170	164	141	142	138	135	153.60	183.82	13.56
	Low	160	170	169	158	172	167	143	143	140	135.2	155.72	198.65	14.09
	High	168	175	178	164	177	171	145	143	146	136	160.30	258.23	16.07
MCH (pg)	Control	46	47	42	39	42	40	37	37	35	24	38.90	42.32	6.51
	Low	44	47.8	43	40	43	42	38.1	35.5	36	25	39.44	40.06	6.33
	High	46.5	48.1	45	42	45	44	39.0	35	37	25.8	40.74	45.45	6.74
MCHC (g/dl)	Control	28	31	29	25	28	26	25	25	27	27	27.10	3.88	1.97
	Low	27	32	30	27	29	28	26.2	25.7	27.8	27.2	27.99	3.58	1.89
	High	28.1	33	32	28.1	31	30	27	25.8	29	27.8	29.18	5.22	2.28

Table 2. Toxic effects of Chromium on blood parameters of *Gallus domesticus*.

Blood Parameters	Doses	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean	Var.	S.D
Hb g/dL	Control	11.2	12.1	11.8	9.1	11.8	9.8	11.9	11.1	9.8	12.1	11.7	1.22	1.11
	Low	10.2	11.1	11.1	8.8	11.1	9.1	11.1	10.7	9.1	11.7	10.40	1.08	1.04
	High	8.2	9.4	10	8	9.8	8.4	10.2	9.9	8	11.6	9.35	1.40	1.18
RBC (10E12/L)	Control	2.5	3.2	1.3	2.4	2.8	2	2.9	2.4	1.8	3	2.34	0.35	0.59
	Low	2.1	2.8	2.8	2.2	2.7	1.8	2.7	2.2	1.6	2.8	2.37	0.20	0.45
	High	1.1	2.2	2.4	1.9	2.6	1.5	2.5	2	1.4	2.7	2.03	0.30	0.55
WBC (x10E9/L)	Control	220.4	228	180	170	197	144	210	208	148	240	194.54	1090.56	33.20
	Low	300.1	255	205	188	208	158	231	214	152	162	207.31	2156.96	46.44
	High	360.2	262	244	200	210	162	247	226	162	277	235.02	3442.45	58.67
MCV (fL)	Control	160.1	170.3	155	144	150	137	148	141	132	162	149.94	144.12	12
	Low	162.1	168	152	139	148	135	146	139	130	161.1	148.02	160.60	12.67
	High	142	160	148	134	144	134	144	136	128	154	142.40	96.71	9.83
MCH (pg)	Control	44.2	47.1	40	40	43.10	37	39	40	32	48	41.04	22.76	4.77
	Low	48.1	44	39.1	38	42	34	35	38.1	29.1	46.8	39.42	35.19	5.39
	High	44.1	40	38	36	40	32	33	37	26.8	45.1	37.20	31.18	5.58
MCHC (g/dl)	Control	28.7	30.1	30.8	27	26.1	22	28	25	20	30	26.77	12.80	3.58
	Low	30.1	28	29.2	26.1	25.2	20.1	26.1	24	18.4	28.8	25.60	14.95	3.87
	High	24.1	26.1	29	24.9	24.2	19.7	24.8	23.7	16.9	26.1	23.95	11.95	3.4

Table 3. Toxic effects of Cadmium on blood parameters of *Gallus domesticus*.

Blood Parameters	Doses	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Mean	Var.	S.D
Hb g/dL	Control	12.3	17.2	16.8	14.1	11.7	10.7	18.1	15.1	11.8	14.1	14.19	6.63	2.57
	Low	12.4	17.0	16.79	14.1	11.72	10.72	18.12	15.2	11.81	14.2	14.21	6.46	2.54
	High	13.4	18.1	17.8	14.7	11.99	10.2	18.77	16.8	12.1	14.80	14.87	8.66	2.94
RBC (10E12/L)	Control	3.35	3.13	3.04	3.30	2.80	2.77	3.03	3.31	2.90	3.03	3.07	0.04	0.21
	Low	3.37	3.13	3.04	3.30	3.01	2.94	3.03	3.31	2.90	3.03	3.11	0.03	0.16
	High	3.47	3.34	3.08	3.32	3.21	3.0	3.22	3.32	2.95	3.03	3.19	0.03	0.17
WBC (x10E9/L)	Control	111.28	143.9	129	111.3	102.1	122.2	95.0	350	150	200	151.48	5782.7	76.04
	Low	109.44	138.9	119.9	110.0	99.98	119	85.10	330	146.	199	145.75	5175.5	71.94
	High	99.94	127.9	115.4	108.9	97	100	84.2	300	139	180	135.24	4095.7	64
MCV (fL)	Control	114.22	136.6	131.5	118.2	114.2	112.2	137.8	138.8	129.11	137.8	127.05	123.73	11.12
	Low	117.21	136.9	131.4	118.2	114.2	112.2	137.9	138.9	129.17	138.9	127.51	119.76	10.94
	High	121.22	137	132.1	120.1	115.8	114.3	138.4	149.1	129.81	139.1	129.69	132.74	11.52
MCH (pg)	Control	36.77	54.88	52.81	37.77	36.77	35.71	57.8	59.81	50.28	51.81	47.45	92.46	9.62
	Low	37.78	53.81	52.99	37.99	36.79	35.88	57.9	59.99	50.31	51.99	47.54	88.53	9.41
	High	39.11	54.8	58	38.01	37	36	58.22	59.88	50.81	52	48.38	95.34	9.76
MCHC (g/dl)	Control	32.19	40.18	39	33.21	32.21	31.2	40.2	41.18	37.08	39.17	36.56	15.40	3.92
	Low	32.28	39.1	40.01	33.24	32.28	31.28	40.2	42.0	37.31	39.28	36.7	16.07	4.01
	High	34.22	41.2	41.08	34.81	33.81	32	41.22	41.0	37.2	39.1	37.56	13.01	3.61

value of blood parameters for cadmium ranged between 0.20 - 2156.96 (Table 3).

Deposition of heavy metals in chickens is due to feeding and drinking of contaminated feed and water as well as through exposure to different manufacturing processes of factories and industries; this in addition to the air pollution with some heavy metals that may be found around the poultry raising areas. Accumulation of heavy metals within the body may take place by contaminated food and water. Effects of environmental pollution on food items has been a matter of great concern. It was observed that in ecosystem heavy metals found naturally with variations in concentrations but major source of heavy metals which are introduced into the ecosystem are due to anthropogenic activities such as combustion of fossil fuels, mining industries, domestic sewage, and wastedisposal, use of pesticide, insecticides and herbicides etc. The occurrences of heavy metals in the environment is considered persistent and is of great concern to health of humans (Friberg *et al*., 1979).

A recent study Khan *et al*. (2012) reported that all chickens samples collected from Karachi, Hyderabad and Thatta city were contaminated with Cadmium (Cd), Nickel (Ni), Copper (Cu) and Lead (Pb). Whereas Copper contamination was found to be the highest level as compared to other metals tested.

During the present study it was found that metal ($CdCl_2$, $PbNO_3$, and $CrSO_4$) concentrations in blood of *Gallus domesticus* caused enormous variation in blood parameters (Hb, RBC, WBC, MCV, MCH and MCHC level) at primarily stage of our work. However, from the research of ten months it is observed that the levels of blood parameters decreased with lead where as chromium

and cadmium treated samples showed increased in blood parameters. RBC counts decreased with cadmium where as WBC count decreased with chromium.

Katavolos *et al*. (2007) reported that lead causes hemolysis in swan birds, which can lead to anemia. It was also observed that lead caused osmotic changes in blood hence osmotic fragility is the reason for hemolysis (Legget, 1993). Lead damages the RBC and cell membranes (Ashan *et al*., 2006). In the present study the treatment of high dose of lead nitrate showed that RBCs counts decreased from 3.9 to 2.5 (x10E12/L) during March to December 2012, where as variation were observed June and August. The numbers of WBC were decreased from 220 to 168 (x10E9/L) but number WBC count was increased during 5^{th}, 7^{th} and 8^{th} months. After complete period WBCs count greater than before. MCV level was decreased from 168 to136 (fL) but level was increased during 2^{nd}, 3^{rd}, 5^{th} and in 9^{th} whereas MCH level was decreased from 46.50 to25.80 (pg) but during 2^{nd}, 5^{th} and 9^{th} month, level was increased. MCHC level was decreased from 28.10 to 27.80 g/dl but during 2^{nd}, 5^{th} and 9^{th} months showed increase in level.

Cadmium produces toxic effects and can also cause kidney dysfunction, hypertension, hepatic injury and lung damage (John and Jeanne, 1994). It is reported that cadmium affects the cells of kidney in mammals (Johri *et al*., 2010). The size of brain cells as well as neuron and neurotranmetrs are also effected by cadmium (Gerspacher, 2009). Effects of cadmium on the hematologic value of poultry birds have been reported. The blood film showed hypo-chromic and normocytic and the blood parameters RBC, Hb, PCV, MCHC and MCH were higher when cadmium was introduced in poultry birds (Caiying *et al*., 2005). It is reported that after applying the high dose of cadmium on Rock pigeon the level of blood parameters increased (Gabol *et al*., 2003). In the resent study treatment of high dose of cadmium chloride showed that RBCs counts were decreased from 3.47 to 3.03 (x10E12/L) after first month to last month i.e. March to December. The numbers of WBC sincreased from 99.94 to 180 (x10E9/L) but during 3^{rd}, 4^{th} , 5^{th} and 7^{th} months showed decline in WBCs count. MCV levels increased from 121.22 to139.10 (fL) but level decreased during 3^{rd}, 4^{th}, 5^{th} and 6^{th} and in 9^{th} month. MCH levels increased from 39.11 to 52 (pg) but during 4^{th}, 5^{th} and 9^{th} months level was decreased. MCHC level was increase from 34.22 to 39.10 g/dl but during 3^{rd} to $6^{th,}$ 8^{th} and 9^{th} months showed decline in level.

Cui *et al*. (2005) reported that high of chromium in chick increased the blood parameters Hb, RBC, PCV. Another study, Dartsch *et al*. (1998) found that high dose of chromium affects liver epithelial cells and damages the kidney cells. Chromium sulfate CrSO4 causes great fluctuation in blood parameters. RBCs counts were increase from 1.10 to 2.70 (x10E12/L) during month of March to December, but level was decreased during 4^{th}, 6^{th} and 9^{th} months. The numbers of WBC decreased from 360.20 to 277 (x10E9/L) but during 5^{th}, 7^{th} and 8^{th} and 10^{th} months showed increase in WBCs count. MCV level was increased from 142 to154 (fL), but level was decreased during 3^{rd}, 4^{th}, 6^{th}, 8^{th} and in 9^{th} months. MCH level was increase from 44.10 to 45.10 (pg) but during month of 2^{nd}, 3^{rd}, 4^{th}, 6^{th} and 9^{th} months level was decreased. MCHC level was increase from 24.10 to 26.10 g/dl whereas during 4^{th}, 5^{th}, 6^{th},8^{th} and 9^{th} months observed decrease in level.

The high and low doses of chromium and cadmium showed increase in the level of Hb where as lead showed decline in Hb level. The high doses of Pb, Cd and Cr showed mean concentration value of Hb as13.42, 14.87 and 9.35 g/dL, respectively. Hb level decreased with lead from 13.80 to10.80 g/dL whereas chromium and cadmium showed increase level of Hb from 8.20to11.60 g/dL and 13.40 to 14.80 g/dL, respectively.

High doses of lead caused highest rates of hemolysis. The highest concentration showed maximum hemolysis as well as it destroyed the red blood cells and caused anemia. Legget (1993) obtained similar results, while Foulkes (2011) and Evoy (2012) reported that lead damages the tissue of intestine and also affects the gut function. A recent study, Khaki and Khaki (2010) reported that lead damages the kidney cells and shrinks the collection tubules in rats. It was reported that lead damages the liver cells (Petersipos and Blazovics, 2003).

Two other studies Goldstein (1990) and Brochin *et al*. (2008) reported that lead affects the brain cells and also affects the neurotransmitter and brain function affected due to toxic heavy metals lead.

High dose of lead showed that hepatic cells, blood vessels and smooth muscle are damaged. Some area show high number of cells death in the liver after applying strong doses. Figure 1 showed that induced strong dose of lead damaged the kidney cells known as nephropathy. Figure 2 shows that high dose of lead damages intestinal lining and outer covering epithelium tissues.

Figure 3 shows that lead damages brain cells. Some black spots showed that these areas cells were damage where s some sides' myelin coasts also lost. Another study Johri *et al*. (2010) also reported that cadmium affects the cell of kidney in mammals. Some studies already reported that cadmium affects the brain cell neuron size decayed and function of brain and neurotranmetrs was also influence due to cadmium (Gerspacher, 2009).

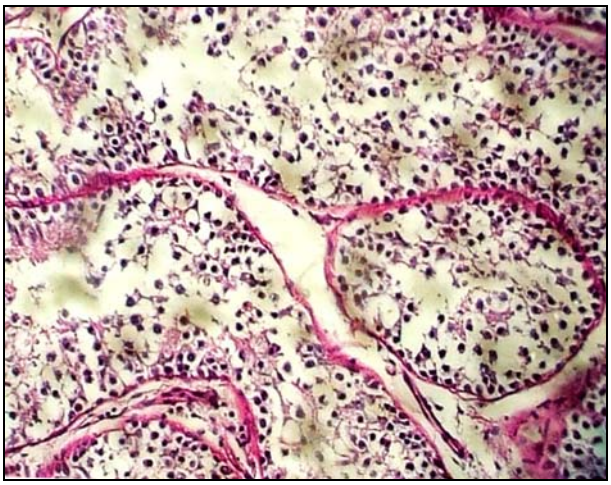

Fig. 1. Kidney induced dose of Lead.

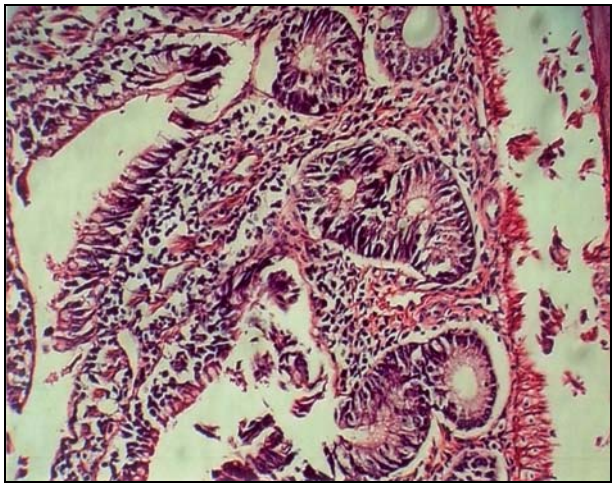

Fig. 2. Intestine induced dose of Lead.

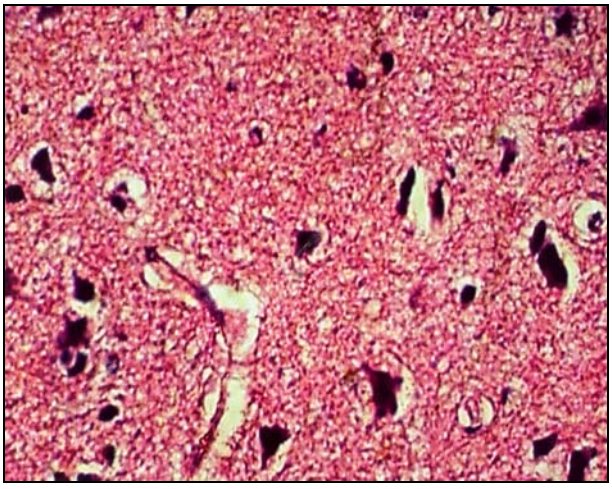

Fig. 3. Brain induced dose of Lead.

Figure 4 cadmium has detritus effects on cell functions. Figure 5 showes normal size of liver cells in control experiment. It is clear from figures 6 and 7 that the size of liver cell Melanomarcophes in small size but the induced effect of cadmium (20mg) the cell size increased. Figure 8 showes that the intestinal lymphoid tissues are major haemopoietic tissues. Kidney consists of lymphoid tissues and many nephropores with intestinal lymphoid tissues.

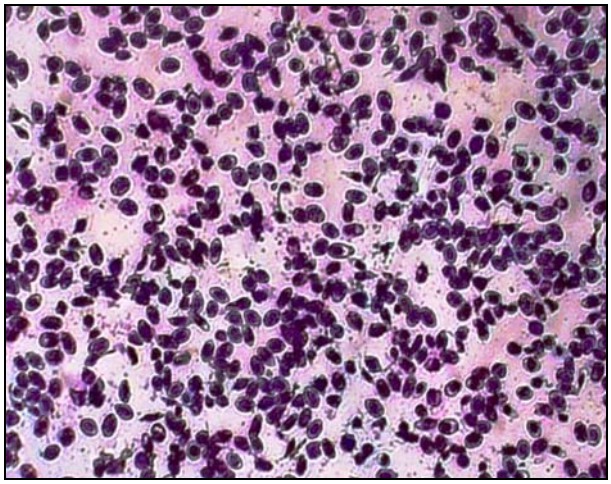

Fig. 4. Blood of *Gallus domesticus* (control).

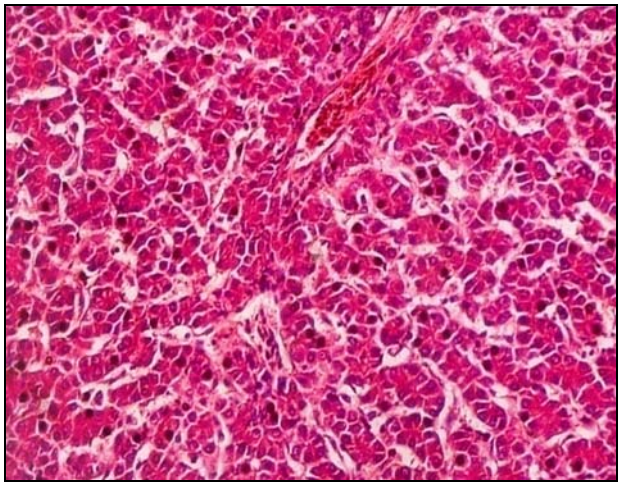

Fig. 5. Liver of *Gallus domesticus* (control).

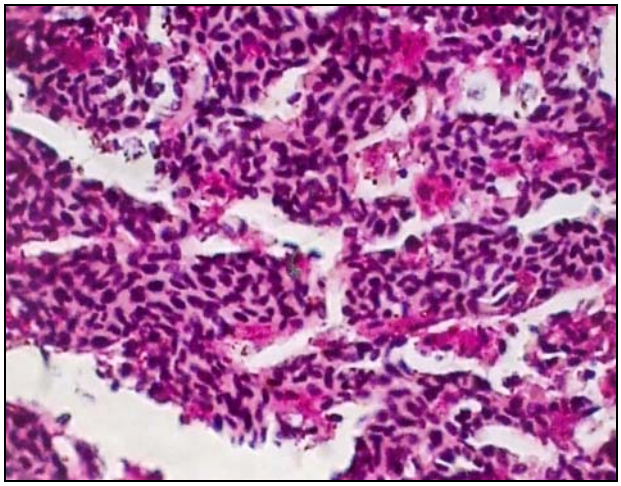

Fig. 6. Liver induced dose of Cadmium (h x e).

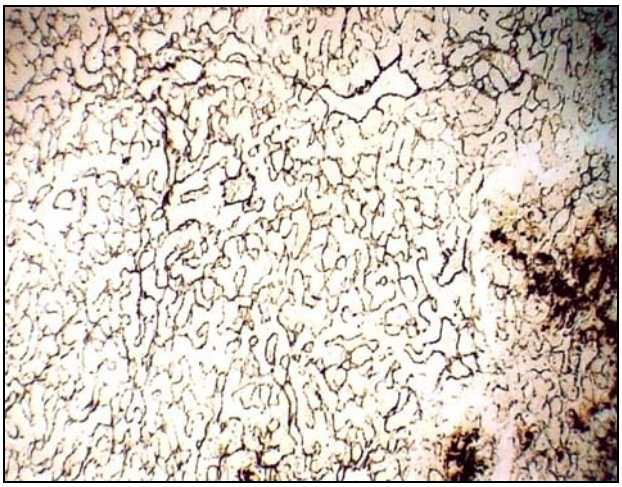

Fig. 7. Liver induced dose of Cadmium (silver).

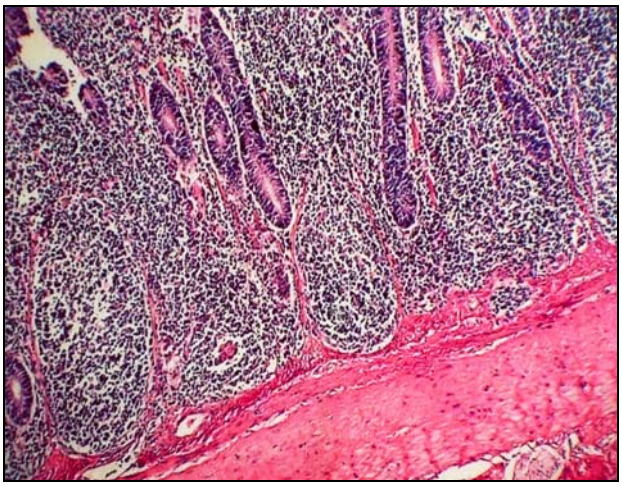

Fig. 8. Intestine induced dose of Cadmium.

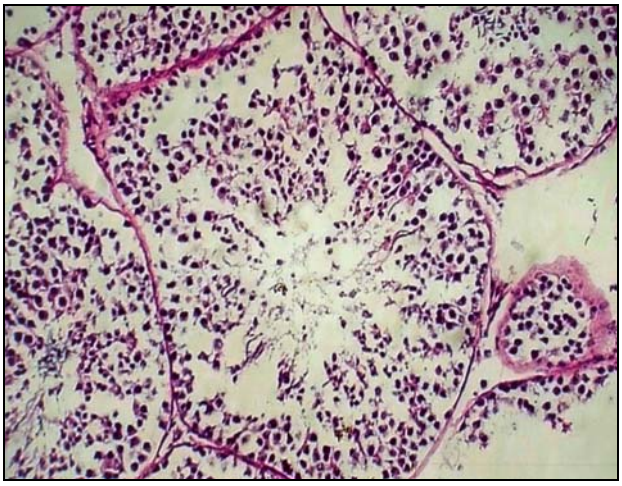

Fig. 9. Kidney induced dose of Cadmium.

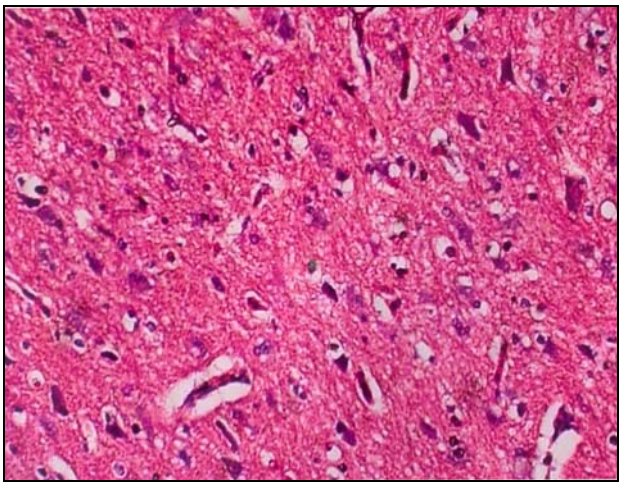

Fig. 10. Brain of *Gallus domesticus* (control).

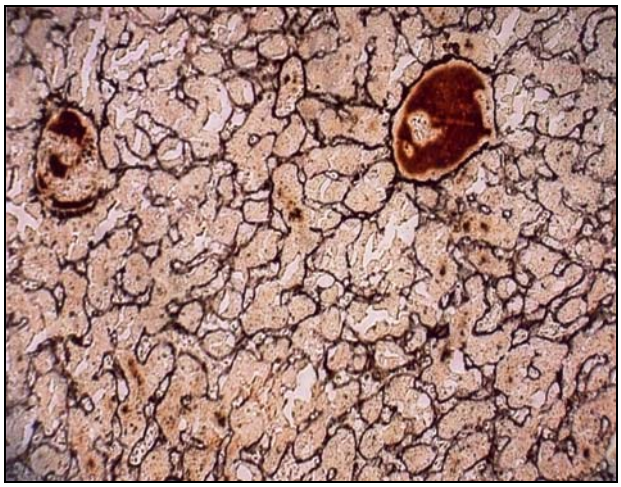

Fig. 11. Liver induced dose of Chromium (silver).

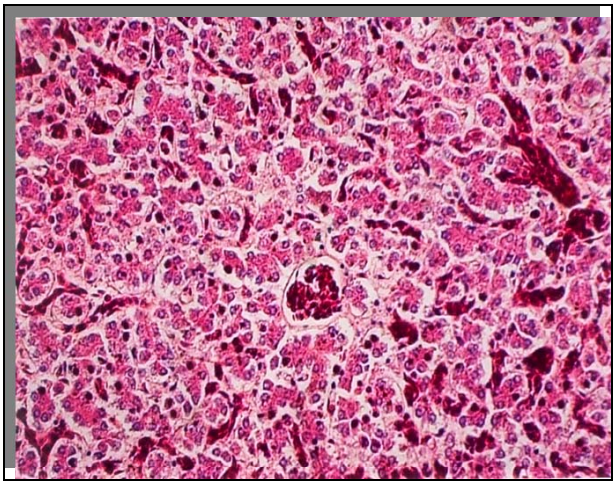

Fig. 12. Liver induced dose of Chromium (h x e).

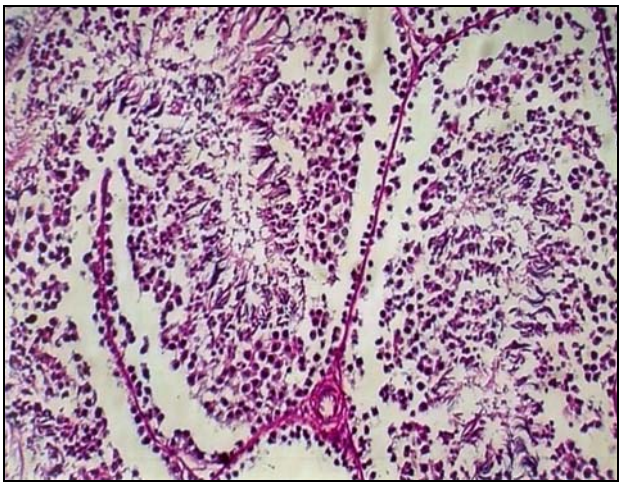

Fig.13. Kidney induced dose of Chromium.

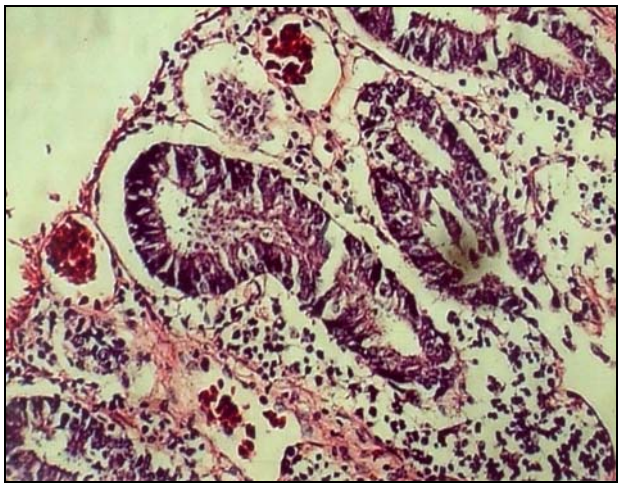

Fig. 14. Intestine induced dose of Chromium.

Figure 9 showes that the lethal concentration of $CdCl_2$ caused deteriorative changes in haemopoietic tissues and degeneration of kidney. The present study showes that large number of macrophages in liver and kidney were capable of taking up the debris in haemopoietic tissues. Figure 10 shows high dose of cadmium enlarges the size of brain cells. High doses of chromium affected cells size and the liver epithelial cells (Dartsch *et al*., 1998). It is also observed that chromium caused hepatic cells damage and necrosis. Sharma and Satyanrans (2011) reported that the intestine tissue of animal was damaged and effect due to high amount of chromium which was induced in animals.

Figures 11 and 12 compared the control cells size was normal but strong dose chromium affected on cells size increased and the liver epithelial cells affected due to which hepatic cells damage and necrosisoccurred. In figure 13 kidney epithelium cells increased and some nephrons were damaged. At higher concentration the cell volume increased figure 14 showes that high dose of chromium affected the cellular levels of intestinal tissue.

CONCLUSION

The level of blood parameters decreased with lead where as chromium and cadmium showed increased level of blood parameters. RBC level decreased with cadmium and lead whereas WBC level was decreased with lead and chromium. The present study showed that large number of macrophages in liver and kidney were capable of taking up the debris in haemopoietic tissues. It was noted that cadmium has detritus effects on cell functions and cause abnormality in cell size. It caused degenerative changes in haemopoietictissues as well as swelling in renal tubules, cellular hypertrophy and kidney cells was damaged and enlarged. It also affects on the size of neuron of brain and cause abnormality in neurotranmetrs. It was observed that high dose of cadmium enlarges size of brain cells where as high dose of chromium affected the liver epithelial cells and hepatic cells and caused damages of hepatica cells and necrosis. Kidney epithelium cells increased and some nephrons were damaged and at higher concentration the cell volume increased cellular levels of intestinal tissue was affected. It was also observed that high doses of lead cause highest rates of hemolysis, decrease haemoglobin synthesis and reduced the life span of RBC as well as changes in brain cells and loss of myelin coat of brain. It was also found that lead can damage the tissue of intestine, kidney cells, liver cells and also affect the gut function.

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