Amelioration Of The Body Weight Gain, Feed Conversion Rate And Some Biochemical Effects Of Cadmium On Sasso Chicken By Zinc

Abo El Fetouf, E.H.[1],Alam, H. H.[2]Mona,S. Abdel-Khalek[3] and Elen, E. Manqarios[4]

(Pathology[1],Poultry[2],Clinical pathology[3] and Biochemistry[4] Departments)
Animal Health Research Institute(Zagazig branches)

ABSTRACT

One hundred Sasso chicks aging 2 week old and average weight 120 gm body were evenly distributed into four equal groups.1st group was fed on a basal diet free from cadmium and zinc and kept as negative control, 2nd, 3rd and 4th groups received 50 mg / kg ration cadmium chloride, 40 mg /kg ration zinc sulphate and 50mg / kg ration cadmium chloride plus 40 mg / kg ration zinc sulphate in diet respectively for 30 successive day. After then all chicks received tape water for 75day as clearance period. Five chicks from each group were weighted individually and consumed diets were recorded where the weight gain and feed conversion rate was calculated at 1st, 25th, 50thand 75thday post supplementation chicks were these sacrificed and blood samples were collected in centrifuge tube to obtain clear serum for determination some biochemical analysis. Specimens were taken from liver ,kidneys, heart and spleen from scarified chicks and fixed in 10% formalin buffer for histopathological examination

Cadmium chloride induce significant decrease in body weight,weight gain,total protein, albumin,globulin, calcium, inorganic phosphorus, sodium,potassium, magnesium and significant elevation in feed conversion rate, AST, ALT, alkaline phosphatase, uric acid and creatinine at 1st ,25th and 50th day post administration.

Sasso chickens received zinc showed significant an increase in body weight gain, serum total protein, albumin and globulin concentrations and significant decrease in feed conversion rate at of 1st ,25th and 50th day post supplementation. Liver enzymes activities(ALT,AST and alkaline phosphates), urea, creatinine, serum calcium , phosphorus, sodium, potassium and magnesium were in significantly elevated at 1st, 25th and 50th day post administration.

Grossly, G2.Sasso chicks showed sever congestion in the internal organs specially liver and kidneys .

Microscopically hepatocytes and renal epithelium of chickens G2,showing focal area of coagulative necrosis at the 1st day of clearance period. Spleen in G2 showing thickned capsule beside sever lymphoid depletion in white pulpes mild pericarditis and focal leukocytic aggregation among the degenerated musculature.The kidney of G4 at the 1st third of clearance period of showing mild degenerative change in the epithelium.

Zinc prevent the adverse effect of cadmium on body weight,feed conversion rate, biochemical parameters and pathological lesion.

INTRODUCTION

Cadmium is a heavy metal that is widely distributed in the environment and is present in trace levels in sea water and in a broad range of animal and plant species. Relatively large quantities of cadmium are found in commercial phosphate fertilizer, thus the increases in soil and plant cadmium contents may lead to increases in dietary cadmium *(1)*. In recent years, cadmium poses a potential environmental hazard due to increases in its industrial use *(2)*. It was reported that the maximum tolerable dietary cadmium level for domestic animals is 0.5ppm.Dietary concentrations of 1ppm results in undesirable effects while 5 ppm cause adverse health effects *(3)*. Gastrointestinal absorption of cadmium is affected by the type of diet and nutritional status *(4)*. Absorption of ingested

cadmium is only about 5% and when absorbed it accumulate first in the liver and then in the kidney *(5)* where its half-life is about 20-30 years *(3)*.The high dietary levels of cadmium results in suppressed feed intake and weight gain, reduction in bone mineralization and anaemia *(6)*.It was suggested that low levels of cadmium stimulates immunity while high levels suppresses immunity *(7)* . The biochemical alteration occur prior to morphological changes in the organs and the changes in certain enzyme levels in extracellular fluids may reflect the extent of cadmium induced damage in target organs *(8)*.

Zinc is an essential nutrient for animals produced a deficiency symptoms due to lack of zinc in the diet of rats has been reported *(9)*. Zinc deficiency in animals is characterized by growth inhibition and decreased food intake and it is now recognized as a problem among sheep and cattle in some areas of the world *(10)*. Zinc is a constituent of numerous metalloenzyme, ribonuclease and DNA polymeras. Zinc activates some enzymes and plays a role in the configuration of DNA and RNA *(11)*.The biochemical functions of zinc are related to the functions of the enzymes of which it is a constituent. Zinc is required for normal protein synthesis and metabolism and is a component of insulin so it participate in carbohydrate metabolism *(12)*.

The objective of this study was to elucidate the effect of cadmium chloride and zinc sulphate alone or in combination on growth performance, egg production and some serum biochemical parameters as well as histopathological study in Sasso chickes.

MATERIALS AND METHODS

Chickens

A total of 100, Sasso chickens two week-old and weighting 120 gm were used in this study.

Ration

It was obtained from Cairo Poultry Company and used during our study

Experimental design

Sasso chickens were used in this trial and kept in wire floor batteries under hygienic measures.Chickens were evenly distributed in four groups 25 chicks each.1st group was fed a basal diet and kept as control group,2nd and 3rd groups were received 50 mg/kg cadmium chloride and 40 mg/kg ration zinc sulphate in diet respectively for 30 day,4th group received 50 mg/kg cdmium chloride plus 40mg/kg zinc sulphate added to the basal diet for 30 day. After then all chickens received tape water for 75 day as clearance period. Five chicks from each group were weighted individually and the consumed diets were recorded where the weight gain and feed conversion rate was calculated at the end of 1st,25th,50thand 75th day post supplementation these chicks were sacrificed and blood sample were collected in centrifuge tube to obtain clear serum for determination of some biochemical parameters.

Table 1. Experimental design

Group	No.	Treatment, dose and rout of medication	Time of medication	Clearance period
G1	25	Basal Diet Without Any Treatment	----------	---------
G2	25	Cdmium Chloride 50mg/Kg Ration	30 day	75 day
G3	25	Zinc sulphate 40 mg/kg ration		
G4	25	50 mg/kg cdmium chloride plus 40 mg/kg zinc sulphate were added to the ration		

Biochemical parameters

Serum were used for determination of aminotransferases(AST-ALT) *(13)* alkaline phosphatase *(14)* ,total protein *(15)*, albumin *(16)*, (globulin was calculated as difference between total protein and albumin) , serum urea (17) creatinine *(18)*serum calciuum *(19)* inorganic phosphorus *(20)* sodium and potassium *(21)* and magnisum *(22)*.

Histopathological study

Specimens were collected from liver, kidneys, heart and spleen then fixed in 10% neutral formalin and embedded in paraffin. Sections of 5 microns thickness were prepared, stained by haematoxylin and eosin and examined microscopically *(23)*.

Statistical analysis

The obtained data were tabulated and statistically analysed *(24)*.

RESULTS

Body weight, feed conversion rate and egg production

Sasso chickens supplemented with cadmium chloride displayed a significant lowering in body weight ,weight gain and significant increase in feed conversion rate at1st,25th and 50th day post treatment.Zinc sulphate (40 mg / kg ration) showed a significant increase in body weight,weight gain and significant decrease in feed conversion rate, Zinc sulphate plus cadmium chloride induce insignificant effect in body weight gain and feed conversion ratio at 1st,35th and 75th day post treatment Tables 1.

Protein profile

Results in Table 2. showed a significant decrease in serum total proteins, albumin and globulin at 1st ,25thand 50th day post application of cadmium chloride to Sasso chickens. Meanwhile, a significant increase in serum total proteins albumin and globulin at same period post application of zinc sulphate was recoded. The toxic effect induced by the use of cadmium was amiliorated by the use of zinc sulphate and induce insignificant effect in protein profile at the end of 1st,25th and 50th day post treatment.

Biochemical studies

Cadmium chloride (50mg/kg ration) yield significant increase in the liver enzyemes (AST-ALT) alkaline phosphatase,urea and creatinine at the end of 1st,25th and 50th day post supplementation to Sasso chickens when compared with unmedicated chickens, Meanwhile zinc sulphate either alone or in combination with Cadmium chloride produced insignificant effect on liver enzymes or kidney function at 1st, 25th and 50thday post treatment when compared with the unmedicated group (Table 3).

Mineral

The present work revealed that cadmium chloride at concentration of 50mg / kg ration induced significant decrease in serum calcium, phosphorus, sodium, potassium and magnisum levels. Zinc sulphate alone or in combination with cadmium chloride showed non significant increase in serum calcium, phosphorus , sodium, potassium and magnisum levels 1st ,25th and 50th day post treatment.

Histopathological results

Grossly, severe lesions were present in G2. Sasso chickens of G2. Showing sever congestion of the internal organs specially liver and kidneys, Meanwhile mild congestion in the internal organs of G4 occurred in clearance period .

Microscopically Liver of Sasso chickens G2,showing focal area of coagulative necrosis, edema and heterophilic infiltration (Figure 1) at the 1st day of clearance period . Hepatic tissue undergo leukocytic infiltration and edema (Figure 2). The renal epithelium showed coagulative necrosis and leukocytic infiltration (Figure 3). Beside heterophilic infiltration. Spleen in G2 showing thickned capsule and severe lymphoid depletion in white pulpes (Figure 4). Mild pericarditis and focal leukocytic aggregation among the degenerated musculature were showing in heart tissue of G2 (Figure 5). The kidney of G4 at the 1st third of clearance period showing mild degenerative change in the epithelium (Figure 6).

Table 1. Effect of cadmium chloride and zinc sulphate on body weight gain(B.W.G.), Feed consumption (F.C.),feed conversion rate(F.C.R.)in Sasso chicks at 1st,35th and 75th post supplementation to ration.(n=5)

Groups	Body weight									
	Inetial weight	1st days			35th day			75th day		
		B.WG Gm/layer	F.C. gm / layer	F.C. R.	B.W.G. gm /layer	F.C. gm/ layer	F.C. R.	B.WG .gm / layer	F.C. gm / layer	F.C. R.
Group1	92.01 ± 1.52	147.41 ± 2.25	312.67 ± 3.63	2.12	1498.48 ± 3.93	3120.4 ± 4.83	2.08	1768.7 ± 5.73	4031.62 ± 4.93	2.28
Group2	89.59 ± 1.29	134.24 ± 2.12**	303.49 ± 2.61*	2.26	1443.74 ± 4.72***	3051.9 ± 4.52**	2.11	1724.5 ± 5.82**	3984.86 ± 5.83**	2.31
Group3	90.49 ± 1.25	162.12 ± 2.83**	322.53 ± 2.61**	1.99	1512.63 ± 3.95***	3132.3 ± 4.71**	2.07	1795 ± 5.99**	4052.64 ± 6.52**	2.25
Group4	91.83 ± 1.52	146.61 ± 1.94	315.04 ± 4.89	2.14	1493.95 ± 4.82	3108 ± 4.73	2.08	1765.9 ± 5.79	3999.94 ± 4.92	2.26

* significant at P < 0.05 ** significant at P < 0.01 *** significant at P < 0.001

Table 2. Effect of cadmium chloride and zinc sulphate on proteinogram in Sasso chickens

Parameter	G1	G2				G3				G4			
		1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day
T.protein (gm./dl)	3.18 ± 0.16	2.16 ± 0.13***	2.43 ± 0.20**	2.61 ± 0.18*	2.90 ± 0.05	4.76 ± 0.21**	4.32 ± 0.29**	3.84 ± 0.22*	3.62 ± 0.25	3.3 ± 0.49	3.29 ± 0.42	3.17 ± 0.27	3.11 ± 0.23
Albumin (gm/dl)	1.58 ± 0.19	1.21 ± 0.10*	1.37 ± 0.23	1.43 ± 0.27	1.53 ± 0.21	2.04 ± 0.05*	2.00 ± 0.04*	1.83 ± 0.08	1.76 ± 0.12	1.63 ± 0.14	1.57 ± 0.17	1.55 ± 0.15	1.50 ± 0.12
globulin (gm/dl)	1.60 ± 0.15	0.95 ± 0.12**	1.06 ± 0.06**	1.18 ± 0.09*	1.37 ± 0.11	2.72 ± 0.19**	2.32 ± 0.12**	2.01 ± 0.11*	1.86 ± 0.15	1.70 ± 0.14	1.72 ± 0.15	1.62 ± 0.13	1.61 ± 0.11
A/G ratio	0.99 ± 0.06	1.27 ± 0.09*	1.29 ± 0.07**	1.21 ± 0.06*	1.12 ± 0.09	0.75 ± 0.15	0.86 ± 0.08	0.91 ± 0.07	0.95 ± 0.06	0.96 ± 0.14	0.91 ± 0.09	0.96 ± 0.11	0.93 ± 0.12

* significant at P < 0.05 ** significant at P < 0.01 *** significant at P < 0.001

Table 3. Effect of cadmium chloride and zinc sulphate on liver and kidney function in Sasso chickens

Parameter	G1	G2				G3				G4			
		1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day
AST (U/L)	41.7 ± 1.76	53.74 ± 2.31**	50.74 ± 2.06**	48.13 ± 2.41*	45.93 ± 1.42	42.73 ± 1.73	43.93 ± 2.94	42.27 ± 2.54	42.09 ± 1.85	44.5 ± 2.82	42.7 ± 3.83	42.01 ± 2.95	40.68 ± 3,38
ALT (U/L)	29.43 ± 1.36	39.09 ± 2.03**	35.17 ± 1.84*	33.82 ± 1.05*	31.96 ± 1.03	30.72 ± 1.50	30.53 ± 0.92	31.95 ± 1.29	30.3 ± 1.53	33.8 ± 2.53	31.95 ± 2.72	32.96 ± 3.18	28.84 ± 3.49
AIK.Ph. (U/L)	11.21 ± 0.79	14.63 ± 0.83**	14.48 ± 0.69**	13.49 ± 0.36*	12.38 ± 0.53	11.69 ± 0.95	12.05 ± 0.69	11.07 ± 0.83	11.5 ± 0.72	12.8 ± 093	12.8 ± 0.75	12.04 ± 0.82	11.64 ± 0.63
Uric acid (mg/dl)	3.68 ± 0.08	4.97 ± 0.29**	4.71 ± 0.38**	4.42 ± 0.31*	3.85 ± 0.45	3.98 ± 0.89	3.78 ± 0.74	3.64 ± 0.79	3.97 ± 0.59	4.08 ± 0.83	3.96 ± 0.78	3.75 ± 0.66	3.65 ± 0.53
Creatinine (mg/dl)	0.95 ± 0.07	1.88 ± 0.11**	1.65 ± 0.23*	1.41 ± 0.17*	1.06 ± 0.08	1.02 ± 0.12	1.05 ± 0.23	1.04 ± 0.11	1.02 ± 0.21	1.03 ± 0.09	0.99 ± 0.06	0.96 ± 0.07	0.93 ± 0.06

* significant at P < 0.05 ** significant at P < 0.01 *** significant at P < 0.001

Table 4. Effect of cadmium chloride and zinc sulphate on mineral picture in Sasso chickens

Parameter	G1	G2				G3				G4			
		1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day	1st days	25th day	50th day	75th day
Calcium mg/dl	9.31 ± 0.35	6.93 ± 1.50*	7.48 ± 0.72*	7.96 ± 0.43*	8.79 ± 0.72	9.44 ± 0.64	9.49 ± 0.73	9.42 ± 0.89	9.38 ± 0.86	10.4 ± 0.64	10.0 ± 0.82	9.83 ± 0.73	9.17 ± 0.62
Inorg.Ph mg/dl	4.91 ± 0.43	2.74 ± 0.6**	2.94 ± 0.5**	3.64 ± 0.37*	4.39 ± 0.49	4.97 ± 0.43	5.01 ± 0.48	4.98 ± 0.68	5.09 ± 0.73	5.04 ± 0.48	4.95 ± 0.59	4.90 ± 0.52	4.85 ± 0.61
Sodium (mEq/L)	143.2 ± 2.52	131 ± 3.23**	135.1 ± 2.71*	139 ± 1.62	141.7 ± 2.678	144 ± 4.94	149 ± 5.94	149 ± 4.63	151 ± 4.93	148 ± 3.94	146 ± 4.96	145 ± 3.71	144 ± 4.59
Potassium (mEq/L)	7.95 ± 0.52	4.73 ± 0.96**	5.29 ± 0.62**	6.13 ± 0.41*	7.28 ± 0.43	8.06 ± 0.86	8.53 ± 0.96	8.24 ± 0.97	8.13 ± 0.86	8.40 ± 1.07	8.34 ± 0.96	8.03 ± 0.83	7.99 ± 0. 88

* significant at $P < 0.05$ ** significant at $P < 0.01$

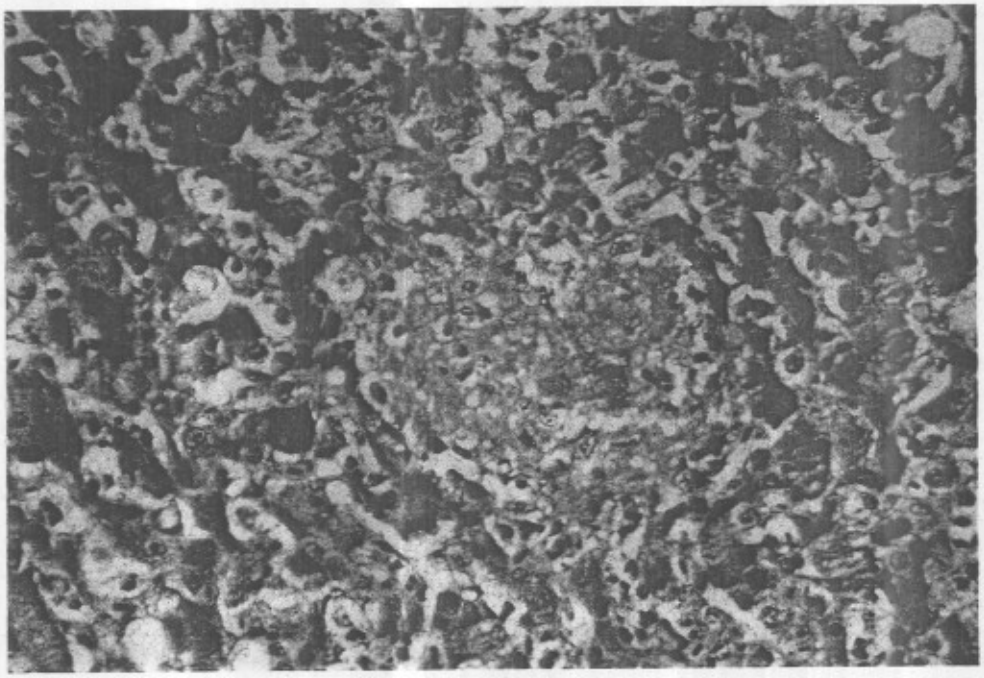

Figure 1. Section from liver of Sasso chick G2,showing central area of coagulative necrosis, edema and heterophilic infIltration . H&E,x300.

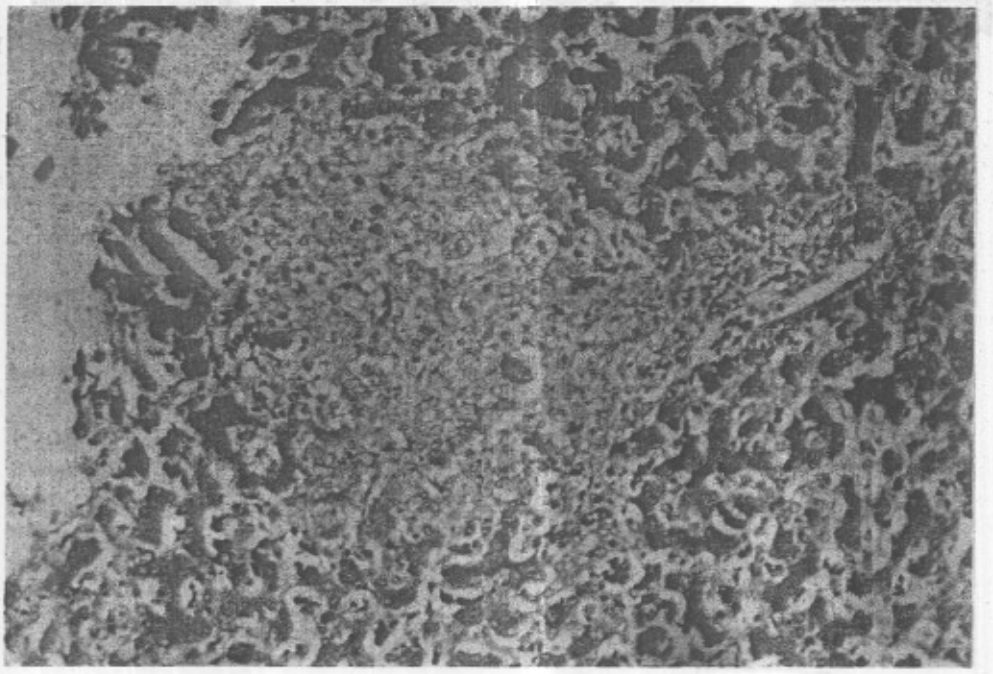

Figure 2. Section from liver of Sasso chick G2 at the 1st day of clearance period showing leukocytic infiltration and edema in the portal area .H&E.,x 300.

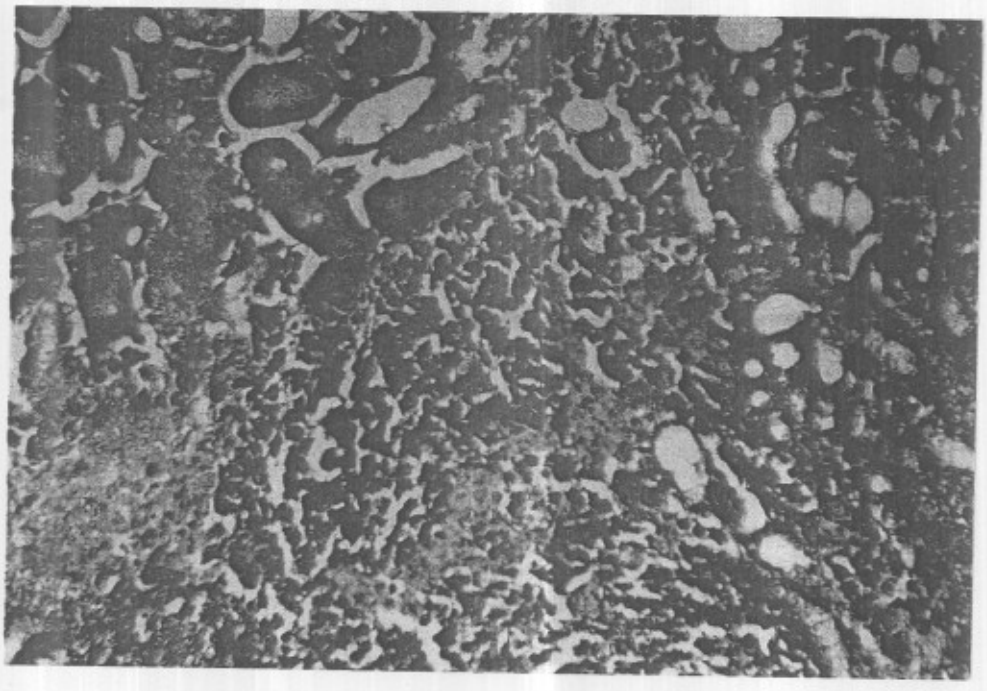

Figure 3. Section from kidney of Sasso chick G2 showing severe leukocytic infiltration, edema and coagulative necrosis.H&E.,x300.

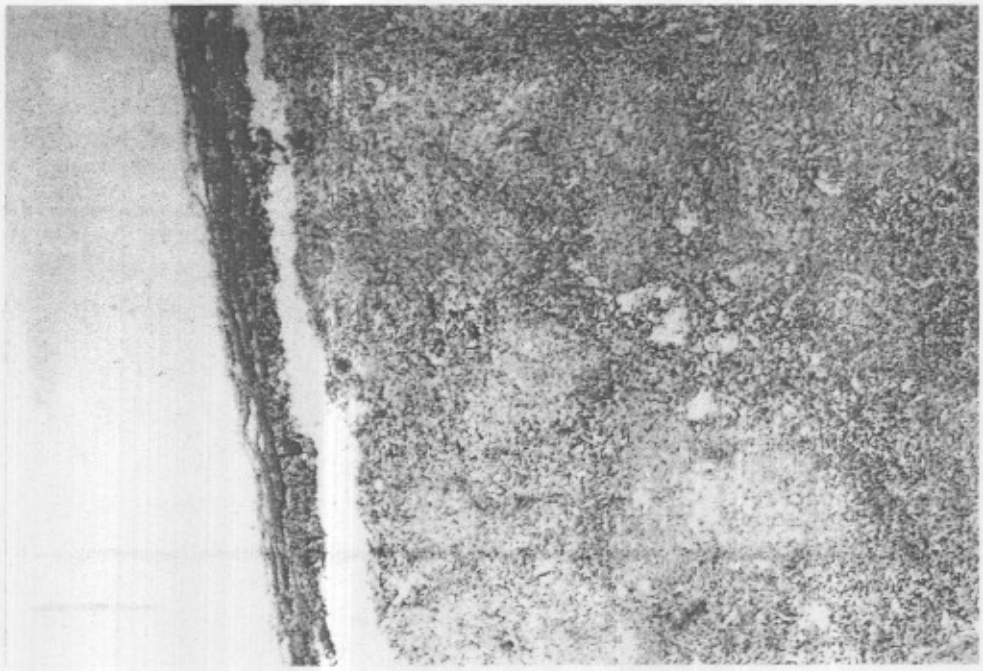

Figure 4. Section from spleen of Sasso chick G2 showing severe thickned splenic capsule and lymphoid depletion H&E.,x300.

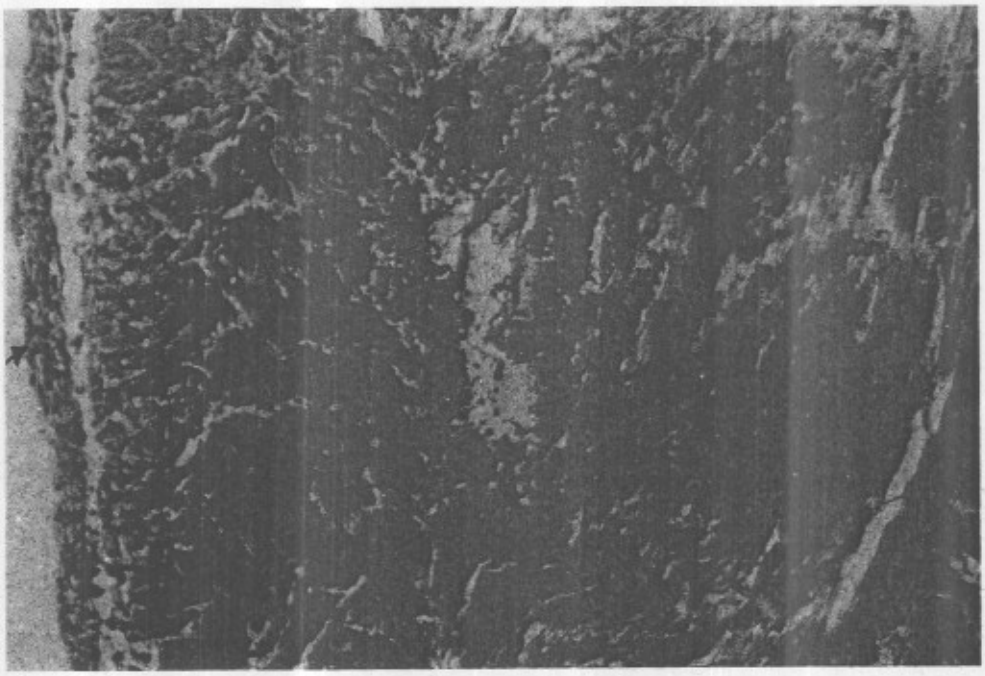

Figure 5. Section from heart of Sasso chick G2 showing focal leukocytic aggregation among the degenerated musculature with mild pericarditis.H&E.,x 300.

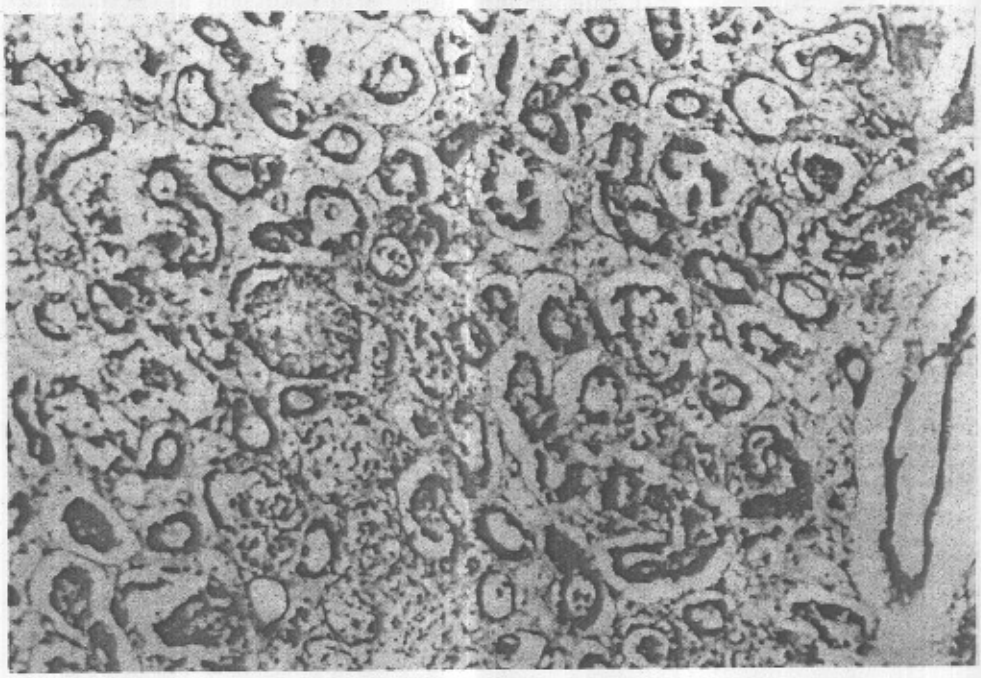

Figure 6. Section from kidney of Sasso chick of G4 at the 1st third of clearance period showing mild degenerative change in the renal epithelium. H & E., x 300.

DISCUSSION

This study was undertaken to investigate mainly the toxic effects of cadmium with paying interest to the body weight, weight gain, some liver enzyemes and kidney function.Effects that may arise as a consequence of long–term exposure to such harmful chemical. In the same time a trail was adopted by using zinc for minimizing the toxic effect of cadmium or in otherwise for protection against the toxicity of cadmium.

In the present study it has been observed that cadmium chloride (50 mg/kg ration) induce significant reduction in body weight, weight gain and increase in feed conversation rate compared with the control Sasso chicks at 1st,25th and 50th day post supplementation. Several authors observed reduction in body weight, weight gain and increase in feed converstion rate in chickens supplemented cadmium chloride *(25,26)*. Supplemented diets contain zinc sulfate significantly improved the body weight, weight gain and feed conversion rate allover the experimental period. The increase in the body weight and gain in Sasso chickens supplemented with zinc sulphate in compareson to control chicks run parallel with the study which that zinc induce significant increase in live weight gain and improve feed conversion rate of broiler chickens *(27,28)*.Chick supplementing zinc in the ration induce significant improve in body weight, weight gain and feed conversion rate *(29)*.

Concerning the laboratory studies on the protein profile changes in Sasso chicks treated with cadmium chloride (50mg/kg ration) for 30 days,(Table,2) revealed a signi-ficant reduction in total proteins, albumin, globulin values and significant increase in A/G ratio at

1st,25th and 50th day post supplementation compared with control group. The reduction in protein picture may be due to reduction of liver function as the liver is the major primary target organ for acute cadmium toxicity *(30)*. Decreased in serum albumin in our study may be due to the fact that the liver is the sole of albumin synthesis and the hypoalbuminemia is an important feature of liver damage *(31)*. Another explanation for reduction in protein profile due to cadmium intoxication comfirom the reduction of the fact that the liver is responsible for the production of great proportion of plasma protein conferm *(32)*. .This results were confirmed by histopathological finding as cadmium induce coagulative necrosis in liver cells.Cadmium induced damage in the liver of male rats *(33)*.On the other hand, the data listed in(Table,2) showed a significant increase in serum total proteins, albumin and globulin in Sasso chicks supplemented with zinc sulphate.The dietary zinc supplementation induce increase in protein profile due to increase feed consumption and so protein intake and stimulation of anabolic hormones *(29)*.zinc has numerous biological roles including protein metabolism *(34)*. In addition zinc play an important role in DNA synthesis and cell division and multiplication, *(35)*.

In this study, it has been found that cadmium chloride (50mg /kg ration) for 30 day in Sasso chicks showed significant elevation in AST, ALT, alkaline phosphates at1st,25th and 50th day post supplementation. Similar results were reported in broiler *(36)*. Measurement of serum transaminases (AST and ALT) activities are a standard tests for hepatocellular damage. It is well know that the enzyme are intracellular being located in the mitochondria, the cytoplasm or both. Consequently, circulating levels increase following liver cell damage *(37)* and the liver was the major primary target organ for acute cadmium toxicity *(30)*, so the elevation in liver enzymes in Sasso chicks in this study may be due to the toxic effect of cadmium and pathological lesion in the liver due to cadmium intoxication as leukocytic infiltration and edema in the portal area. The increase dietary cadmium led to increase accumulation in all tissues especially in the liver and kidney which lead to liver and kidney damage and induce degenerative chang in liver and kidney *(38)*. It is evident from the present study that Zinc sulphate (40 mg /k gm ration) induce non significant elevation in the activity of AST, ALT, alkaline phosphatase allover the experimental period Our data were reinforced bythe study which demonstrated that zinc (48mg /kg)induce insignificant elevation in the activity of alkaline phosphatase *(39)*.

The present investigation indicated that treatment with cadmium chloride (50mg /kg ration) for 30 day in Sasso chicks showed renalotoxic effect manifested by significant elevation serum uric acid, creatinine and significant decrease in calcium, inorganic phosphorus, sodium, potassium and magnesium levels at1st ,25th and 50th day post supplementation. Change in serum uric acid, creatinine and mineral picture has been observed in rat *(40)*. Increase in uric acid and creatinine and reduction in minerals in this study may be due to damage in kidney which represented by mild coagulative necrosis in renal epithelium beside heterophilic infiltration of extravasted erythrocytes. Same characteristic lesions were observed in the kidney as it is main route of cadmium elimination and the proximal tubules are especially sensitive due to their high reabsorptive activity *(41)*. The obtained data agreed with the available literature regarding the effect of cadmium chloride on mineral picture in laying where an increase in serum uric acid, creatinine and decrease concentrations of calcium and inorganic phosphrous may result from diminished absorption of these elements and increased excretion due to kidney damage *(42)*. Another explanation for reduction in studied mineral ma be due to that the hypoproteinemia in this study which hinder the absorpation of this elements *(43)*. Pathological changes in rat kidney were tubular necrosis *(44)*. Cadmium chloride induce significant increase in uric acid and creatinine*(45)*. And cadmium induce kidney damage which lead to increase in

creatinine levels and reduction in calcium and inorganic phosphorus in albino rats *(46)*.

Combination between cadmium chloride and zinc sulphate in Sasso chicks induce non significant effect on body weight, weight gain, feed conversion rate, protein picture, liver enzymes and kidney function due to the cadmium induce mild or non pathological changes on liver and kidney as zinc decreases the level of cadmium in the body *(1)*. Zinc has been shown to reverse cadmium toxicity *(47)*. and reverse cadmium induced tissue damage and diminish some and of its toxic effects *(26,48)* .

The histopatological results in this study in Sasso chicks supplemented with cadmium chloride (50 mg/kg ration) were recorded in heart which showed mild pericarditis and focal leukocytic aggregation among the degenerated musculature with thickening in the capsule beside severe lymphoid depletion in spleen white pulpes. These results were similar to those recorded in Sasso chickens *(49)*.

Generally, from the results of the present study, it could be concluded that zinc supplementation to the diets of Sasso chicks exposed to cadmium may be effective to improves body weight gain, feed conversion rate and help to regulate normal level of alterated biochemical parameters and alleviate the effect of cadmium.

REFERENCES

*1.Uyanik1, M.; Eren1,A.; Atasver,G .and Kolsuz1, A. (2001):*Changes in some bioche-mical parameters and body weight of broilers exposed to cadmium and effect of zinc on cadmium inducedal terations..Israel Vet. Med. Ass.56(4)1-9.

*2.Vallee,B.and Ulmer,D.(1972):*Biochemical effects of mercury,cadmium and lead. Annu. Rev. Biochem. 41: 91-128.

*3.McDowell,L.R.(1992):*Minerals in Animal and Human Nutrition,Academic Press , New York, pp. 359-361..

*4.Yannai,S. and Sachs,K.(1993):*Absorption and accumulation of cadmium, lead and mercury from foods by rats. Fd. Chem. Toxic. 31(5): 351-55,

5.Khandel,S.; Agnihotri,N. and Tandon,S. (1991): Biochemical response to cadmium dose time effect. Biol. Trace Elem. Res. 29: 157-164,

6.WHO (1992): Cadmium.International Programme on Chemical Safety.Envir. Hea- Health Criteria 134. Genova,

*7. Malave,I.and De Ruffino,D.(1984):*Altered immune response during cadmium administration in mice. Toxicol. Appl. Pharmacol. 74: 46-56; 7

8.Khandel,S.; Agnihotri, N. and Tandon, S. (1991): Biochemical response to cadmium dose time effect. Biol. Trace Elem. Res. 29: 157-164,

9.Todd,W. ;Evehjem, C. and Hart,E.(1934): Effect of zinc on growth in rats. Am. J. Physiol. 107-115.

10.Eassa,A.(1998): Wool and hair an effective tool for diagnosis of some deficiency diseases and environmental pollution. Ph. D.V.Sc. Thesis, Fac.ofVet. Med. Zag Univ.

*11.Chester,J.(1978):*WorldRev.Nutr.Dietetics. 32:135.Cited by Pond,et.al. (1995).

12.Pond,W.;Church, D. and Pond, K. (1995): Basic animal nutrition and feeding 4th Ed., John Wiley and Sons, New York, pp.185-224.

13.Reitman, S. and Frankel, S. (1957): Calorimetric determination of SGot and SGpt activity. Am. J.clin. Path. (28) 56 – 59.

*14.John,D.(1982):*Clinical laboratory mothed for determination of alkaline phosphatase. 9th Ed. 580-581

15.Doumas, B.; Certr, R.; Peers, T. and Schafler, R. (1981): Acandidate reference method for determination of total protein in serum. Clin. Chem. (27)1642

*16.Drupt,F.(1974)*Calorimetric method for determination of albumin.Phar.Bio.(9) 777

17. ***Coalomb,J.and Faurean, l.(1963):*** Anew simple smimicro method for calorim-etric determination of of urea.Clin.Chem.(9)102-10

18. ***Husdan,H. and Roporpot, A .(1968):*** Estimation of creatinine. Clin. Chem (14)222

19. ***Gindler, E .(1972):*** Determination of serum calcium level. Am. J. Clin, Path. (58) 376.

20. ***Goldenbery, H.(1966):*** Determination of serum inorganic phosphorus. Clin. Chem. 12

21. ***Oser,B.(1979):*** Hawk's physiological chemistry. 14thEd.Ta Mc.Graw–Hill publis- hing Co., Ltd. New Delhy.

22. ***Gindler, E. and King , D.(1971):*** Determination of serum magnesium. Clin. Chem (17) 66 Goldenbery, H (1966) Determination of serum inorganic phosphorus.Clin.Chem 12

23. ***Bancroft,J.;Steven,A.and Turner,D.(1990)*** Theoty and practice of histological techniques 3rdEd.Churchill Livingston, Edinburgh, London, and New York.

24. ***Petrie,A. and Watson,P.(1999):*** Statistics for Veterinary and Animal Science 1st Ed. 90-99, The Blackwell Science LTd, United Kingdom

25. ***Bassiouni , A.; Anwaar, M.; El-Gohary , A. and Nariman, A. (1998):*** Clinicoppathogical pathological and 1mmunological aspects of some heavy metals in Broilers.I-Cadmium .J. Egypt Vet.Med .Ass .58 (4) 707–723

26. ***Kjalf,A.and Abdo,K.(2001):*** The protective effect of selenium and zinc against cadmium nephrotoxicity in albino rat.Assuit Vet .Med.J.45(90)220– 242

27. ***Hess,J.;Parson,A.and Downs, K. (2001):*** Influence of complexed zinc products on live performance and carcass grade of broilers.J.ofApplied Animal Res.19(1) 49 -60.

28. ***Kucuk,O.;Sahin,N.and Sahin, K. (2003)*** : Supplemental zinc and vitamin A can alleviat negative effects of heat stress in broiler chickens. Biol. Trace. Elem. Res., 94225-235.

29. ***Orma,A.;Hegazi,S.;El-Gaml,A.and Rania M. (2003)*** :Effect of zinc and selenium supplementation in dietts of heat strssed broiler chick on growth performance and immunocompetance. 3rd International Scientific Conf.,Kafr El-Sheikk .Vet. Med 1235-1254

30. ***Dudley, R.; Svoboda, D. and Klaassen, C.(1982):*** Acute exposure to cadmium causes severe liver injury in rats.Toxico.appl.Phar.(65)302-313.

31. ***Kaneko,J.(1980):***Clinical Biochemistry of Domestic Animals. Academic Press. Inc., 4th ed. New York, London, Tokyo. pp. 365 – 391.

32. ***Latimer, K.; Mahalley, E. and Prasse, K. (2003):*** Duncan and Prasse's Laborat-ory Veterinary Medicine and Clinical Pathology. 4th Edition, lowa state University press. Ames. Iowa USA.

33. ***Saygy,S.;Deniz,G.and Vural, N (1991):*** Chronic effects of cadmium on kidney, liver, testis and fertility of male rats. Biol. Trace Elem. Res.31:209-214

34. ***Forbes, R.;Parker,H. and Erdman, J. (1984)***: Effect of dietary Phytate, calcium and magnesium level on zinc bioavailability to rats. J. Nutr. 114: 1421-1425.

35. ***Rubin,H.and Koide,T. (1973):*** Inhibition of DNA synthesis in chick embryo cultures by deprivation of either serum or zinc. J.Cell.Biol.56: 777-786

36. ***Chapatwala, K.; Hobson, Mand Rajanna, B. (1982):*** Effect of cadmium on hepatic and renal gluconeogenic enzymes in female rats. Toxicol. Lett. 12(1): 27-34,

37. ***Doxey D.L. (1971):***Veterinary Clinical Pathology. 15th ed. London P. 556 – 560.

38.Novelli, E.; Rodrigues,N. and Ribas, B. (1998): Assessment of cadmium toxicity on hepatic and renal tissue of rats. Environ. Res.79(2): 102-105

*39.Moussa, F.I.(1997):*Acute toxicity of zinc and cadmium to the egypation toad bufo regularis biochemical observations.j Egypt Ger.Soc.Zool 22 (A) 343 -363.

40.Rajanna, B., Hobson,M. and Chapatala, K. (1984): Chronic and renal toxicity by cadmium in rats. Drug. Chem. Toxicol. 7(3): 229-241,

41.Madden, E. and Fouler ,B.(2000): Mechanisms on nephrotoxicity from metal combination : a review Drug Chem . Toxical 23 (1) 1- 12 .

42.Kado,N.; Yamashima, S. and Waku, K. (1986): Protection against cadmium toxiciity by zinc:decease in the cadmium high molecular weight protein fraction in rat.liver and kidney on zinc pretreatment.Toxico.40(3)267– 277

43.Kim,Y.;Choi,J.;Kim,J.and Pork, Y .(1988) : Changes in renal function in cadmium intoxicated rats.pharma.Toxi . 63 (5) 342 – 350

44.Aughey,E.;Fell,G.; Scott,R.and Black, M. (1984): Histopathology of early effects of oral cadmium in the rat kidney. Environ Health Perspect. (54)153-61.

45.Chen,R.; Whagner,P. and Weswig, P. (1975): Selenium induced redistribution of cadmium biding to tissue protiens. Bioinorganic Chem. 4,125-133

*46. Shehata,A.;Sharkawy,A. and Mabarak, M. (2000):*Toxic effects of combined exposure to cadmium and nickel on white albino rats.Assiut Vet.Med. J.44 (84) 279 - 295

47.Cheng, S. (1988): Observation by quantitative electron microscopy of the action of zinc in protecting the liver from cadmium toxicity.Bioinorganic Chem. 4: 125-133

48. Sato,M.and Ngai,Y.(1989): Effect of zinc deficiency on the accumulation of metalotionein and cadmium on the rat liver and kidney. Arch. Enviro.Contam. Toxic. 18:57- 59.

*49. Jergy,K.(1994):*Hepatorenal effects of cadmium chloride in Sasso chickens. Envir. Res. 61, 467 – 475.

الملخص العربى

الدور الواقي للزنك في تقليل التأثير الضار للكادميوم على وزن الجسم المكتسب, معدل التحويل الغذائي وبعض الوظائف البيوكيميائية في كتاكيت الساسو

عزت أبو الفتوح حمودة * حسام حسن علاممنى صلاح عبد الخالق***والين منقريوس******

اقسام (الباثولوجيا* الدواجن** الباثولوجيا الاكلينيكية*** والكيمياء****)

كان الغرض من هذا البحث هو دراسة تأثير الكادميوم والزنك على معدل النمو ,معدل التحويل الغذائي وبعض الوظائف البيوكيميائية ودراسة بعض التغيرات الباثولوجية فى بعض الأعضاء الداخلية فى كتاكيت الساسو, في هذه الدراسة تم استخدام مائة كتاكيت الساسو عمر ٢ أسبوع تم تقسيمهم إلي أربع مجموعات متساوية تحتوى كلا منها على ٢٥ كتكوت.المجموعة الأولى تركت بدون اى علاج (مجموعة الضابطة) ,المجموعات الثانية والثالثة والرابعة تم تجريعها ٥٠مجم كلوريد الكادميوم لكل كيلو جرام من العليقة , ٤٠ مجم من كبريتات الزنك لكل كيلو جرام من العليقة وخليط من كلوريد الكادميوم+ كبريتات الزنك بنفس الكمية لمده٣٠يوم يتم وزن الكتاكيت فى كل مجموعة عند بداية التجربة وعند ١ ,٣٥ , ٧٥ يوم من

نهاية التجريع وحساب كمية العلف المستخدمة فى كل مجموعة وذلك لدراسة تأثير تلك المعادن على وزن الجسم ومعدل التحويل الغذائي. عند ١ ,٢٥ ,٥٠ ,٧٥ يوم من نهاية التجريع ,يتم ذبح عدد ٥ كتاكيت من كل مجموعة وتم أخذ عينة دم من كل كتكوت لفصل المصل وذلك لدراسة تأثير تلك المعادن على بعض الوظائف الحيوية واخذ عينات من الكبد ,الكلى ,القلب ,الطحال وذلك لدراسة تأثير تلك المعادن باثولوجيا على تلك الأعضاء.

أثبتت الدراسة أن استخدام٥٠مجم من كلوريد الكادميوم/ كيلو جرام من العليقة نتج عنه نقص معنوى فى وزن الجسم المكتسب للكتاكيت المعالجة عند مقارنتها بالمجموعة الضابطة وكذلك زيادة معنوية فى معدل التحويل الغذائي على مدار التجربة.

كما تشير المؤشرات البيوكيميائية أن الكادميوم أدى الى حدوث نقص معنوى فى البروتين الكلى, الزلال ، الجلوبيولين,الكالسيوم,الفوسفور,الصوديوم ,البوتاسيوم والماغنسيوم طوال فترة التجربة ولكن الكادميوم أدى الى زيادة معنوية فى مستوى انزيم الالانين أمينوترانسفيريز وأنزيم الأسبارتيت أمينوترانسفيريز , الفوسفاتيز القاعدى ,حمض البوليك والكرياتينين.

يتبين لنا من تلك الدراسة أن ٤٠ مجم من كبريتات الزنك لكل كيلو جرام من العليقة أدي الى حدوث زيادة معنوية فى وزن الجسم المكتسب,مستوى البروتين الكلى,الزلال والجلوبيولين ونقص غير معنوى فى مستوى انزيم الالانين أمينوترانسفيريز وأنزيم الأسبارتيت أمينوترانسفيريز,الفوسفاتيز القاعدى بينما حدث نقص معنوي فى معدل التحويل الغذائي,الكالسيوم,الفوسفور,الصوديوم ,البوتاسيوم والماغنسيوم وحمض البوليك والكرياتينين باضافة الزنك الى الكادميوم لم يتأثر وزن الجسم المكتسب, معدل التحويل الغذائي أو الوظائف البيوكيميائية.

اظهر الفحص الهستوباثولوجى لكتاكيت الساسو المغذى على عليقة بها كلوريد الكادميوم عن وجود أفات بالكبد عبارة عن تنكسات فجوية ومائية وأيضا تنكسان بالكلى ونخر بعض الخلايا,تنكسات فجوية ومائية فقط لوحظت عند اليوم الأول من نهاية الامداد بالعليقة الملوثة بالكادميوم.ولكن الكتاكيت التي تم تغذيتها على مياة بها مركب الكادميوم مضاف إلية مركب سلفات الزنك لوحظ بها أفات خفيفة جدا.

نستخلص من هذه الدراسة أن كلوريد الكادميوم لة تأثير سمي ويؤدى الى تغيرات كبيرة فى معدل النمو , وزن الجسم المكتسب,معدل التحويل الغذائي وبعض القياسات البيوكيميائية كذلك نتج عن اضافة الزنك الى الكادميوم تحسن إيجابى فى وزن الجسم المكتسب للطيور,معدل التحويل الغذائي وبعض القياسات البيوكيميائية لذلك يوصى بإضافة سلفات الزنك الى العلائق الملوثة بالكادميوم لتقليل التأثيرات البيوكيميائية المتسببة عن الكادميوم.