Some Studies in Barki Sheep Intoxicated with Cadmium.

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Abstract: Eighteen rams (27 - 28 kg. B.wt and 6 - 1 0 months old) were divided into 3 equal groups (gps. 1-3) and kept on a basal ration to evaluate the cadmium toxicity on the digestibility, blood picture and reproductive status, beside the hepatic and renal fuctions. Gp. (1) was the control. Gps. (2 and 3) were orally given 50 and 100 mg. Cadmium chloride/kg. Bwt respectively for 4 weeks. Heparinized and non-heparinized blood samples were collected for blood picture and serum separation, respectively. The serum was used for the determination of some biochemical blood parameters. Atrophy and necro&is of the testes, liver and kidneys were associated with clinicopathological changes. A significant decrease was detected m the"values of RBCs, PCV, Hb, LH, FSH, Testosterone, total proteins, zinc concentration and digestion coefficient. On the other hand, there was significant increase in levels of ESR, WBCs, ALT, AST, Urea, Creatinine, Sodium, Potassium and Cadmium.
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1. Introduction

The heavy metals are toxic due to the low rate of its elimination from the body. The environmental contamination with heavy metals such as lead, cadmium, zinc, mercury and copper are widely distributed in the agricultural land and water, **Adriana (1986), Hires ct al., (1999), Bryant and Rose (1995).** The heavy metals may be absorbed from digestive tract of the animal, some by grazing, some of these metals are toxic virtually for every system of human body**, Kabata and Peiido (1999)** and may cause serious health problems in man, depending on their levels of contamination, **Fayed and Abdallall (1997)**. Industrial agriculture like coal and oil combustion byproducts chemical and chloride plant emissions, fertilizers and sludge used in agricultural lands **Kajikawa ct al. (1991).** Sewage effluents, some types of plastics and pesticides are considered the primary source of lead and cadmium pollutions for animals and fish, **Abe and Itakawa (1993).** Heavy metals are cumulative poisons for man and animals, therefore the current study was planned to estimate the effect of cadmium on the nutritional status of sheep together with its effect on the liver, kidney and reproductive organs from the clinicopathologic aspect increased.

Ancroxia, depression, emaciation, tucked up abdomen pluse and respiration rates with laboured breathing, exophthaxmia and diarrhea beside frequently odema were encountered after 30 days on treatment.

The objectives of the present work were to study the effects of cadmium toxicosis on digestibility, hematology and reproductive status beside the liver and kidney functions of sheep.

2. Material and Methods

Eighteen rams (6-10 month old and 27-28 kg Bwt) were equally divided into 3 groups (gps. 1-3) and kept on a balanced ration. (Table 1). Gp. (1) was the control. Gp. (2) was orally gived 50 mg cadmium chloride/kg B wt/day. Gp. (3) was orally given 100 mg cadmium chloride/kg Bwt/day. The experiment extended for 4 successive weeks.

Blood was collected from the jugular vein after 30 days of the start of the experiment in heparinized test-tubes for determination of blood picture according to **Jain (1986)** and non heparinized test-tubes for serum collection where test tubes were centrifuged at 3000 r.p.m. for 15 minutes and then the sera were kept in deep freeze at -20°C. Determination of total testosterone was done by **Radiaimuassay method according Ismail (1986).** Evaluation of folliculer stimulating hormone (F.S.H) and leutinizing hormone (L.H.) were determined by **Kulin and Santer (1977) and Fuquay (1983)**. Serum zinc, sodium, potassium and cadmium were estimated by atomic absorption according to **Joseph and Roger (1979).**

The activities of aspartale aminotransferese (AST) and alaninc aminotransferese (ALT), beside the total protein, urea and creatinine were determined by using commercial kits (diagnostic kits-Bio Merieux France).

Three digestion trials were conducted to evaluate the digestion coefficients of nutrients of the

three groups. The animals of each treatment were penned individually in the digestion cages. The cl:«estion trials lasted for 21 days. The preliminary period lasted for the first 14 day^nnd the collection period lasted for the other 7days. The fecal samples were collected daily and dried at 60C for 72 hrs and men stored in screw-top glass jars for determining the different chemical constituents according to **A.O.A.C. (1984).** Statistical analysis of the obtained data were determined by using student (t) test according to **Gad and Weil (1983).**

Table (1): Composition of the basal diet for sheep, according to the national research. Council (1976): Nutrient requirements of domestic animals, National Academy of science, Washington D.C, 5 th edition (4): 10 -26.

Ingredient	Percentage
Cotton seed cake.	30
Corn yellow.	25
Roughages.	25
Wheat bran.	15.5
Calcium chloride.	2
Sodium chloride.	1
Vitamin and mineral mixture	2

Calculated Nutrient Composition:

Crude protein.	18.525
Energy (ME/ kg).	1772.5
Crude fiber.	13.51
Ether extract.	2.85
Calcium.	2.111
'Phosphorus.	0.649

Table (2): Some hacmatological parameters after 30 days of experiments (Means ± SE)

Groups / Paramrters	Control 1	Cadmium chloride 50mg 2	Cadmium, chloride 100mg 3
RBCS 10^6/mm^3	9.08 ± 0.03	8.75 ±0.01*	8.00 ±0.43**
PCV%	34 ± 0.25	32 ±0.14*	30 ±0.27**
HB g/dl.	12.7 ±0.72	11. 8 ±0.08*	10.9 ±0.012**
ESR mm/2hrs	1.04 ±0.32	2.00 ± 0.79*	1.07 ±0.98**
WBCS 10^3/mm^3	7.94 ± 0.32	8.01 ±0.73	8.09 ±0.88**

**P<0.01 *P<0.05

PCV = Packed cell volume. ESR = Sedimentation rate HB = Hemoglobin W.B.C.S = White blood cells.
RBCs = Red blood corpuscles.

Table (3): Effect of cadmium chloride on some biochemical parameters after 30 days of experiments (Means ± SE)

Groups / parameters	Control 1	Cad cl 50mg 2	Cad cl 100mg 3
AST U/L	22.7 ± 0.22	23 ± 0.49*	33.5 ±0.29**
ALT U/L	19.0±0.18	20.5 ±0.37*	23 ±0.28**
Total protein gm/dl	6.97 ±0.85	6.72 ±0.12*	6.3 ±0.27**
Urea mg/dl	14.00 ±0.09	14.50 ±0.73*	15.5 ±0.70**
Crcatinine mg/dl	1.81 ±0.03	1.50 ±0.92*	1.62 ±0.64**
Sodium MEq/L	11. 00 ±0.24	11 2.2 ±0.1 2*	124.3 ±0.17**
Potassium MEq/L	9.3 ±0.72	10.7 ±0.98*	11. 9 ±0.62**
Serum zinc, ppm	2.00 ± 0.72	1.85 ±0.74*	1.25 ±0.07**
.Cadmium ppm.	0.6 ±0.45	0.84 ± 0.20*	1.49 ±0.67**

**P<0.01 *P<0.05

Table (4): Effect of cadmium chloride on some hormonal parameters after 30 days of experiments (Means ± SE)

Parameters \ Group	Control 1	Cad cl 50 mg 2	Cad. CI. 100 mg 3
LH IU/L	1.67 ±0.01	0.89 ±0.04*	0.70 ±0.06**
Testosterone ng/ml	2.74 ± 0.07	2.52 ±0.31*	2.15 ±0.23**
F.S.H U/L	1.87 ±0.24	1.72 ±0.06*	1.50 ±0.04**

**P<0.01 *P<0.05

Table (5): Digestion coefficient of the different experimental rations (Means ± SE).

Groups	Nutrients digestibility %					
	DM	OM	CP	EE	CF	NFE
1	62.3 ±	63.5 ±	60.8 ±	58.7	55.3*	63.1 ±*
2	61.5±	62.8 ±	60.3 ±	59.4	54.7	62.5 ±**
3	43.25±**	43.49 ±**	39.2 ±**	35.4**	30.1**	42.7 ±**
SE	14.3	12.7	15.3	11.8	12.7	13.5

**P<0.01 OM = Organic matter DM = Dry matter. CP = Crude protein.
EE = Ether extract. CF = Crude fiber. NFE = Nitrogen Free extract

3. Results

There was a decrease in the body weight. Necrosis and calcification were detected in the kidney and liver of the dead animals. There was a significant decrease in the RBC, PCV and Hemoglobin (P < 0.01) while there was a significant increase in ESR and WBC count (Table 3).

There was a significant increase in AST, ALT, urea, creatinine, sodium, potassium and serum cadmium, while a significant decrease in TP and zinc concentration were recorded a shown in table (4). There was a significant decrease in mean LH, FSH and testosterone (Table 5). Table (6) shows that the digestion coefficients were in significantly decreased in gp (2) and highly significantly decreased in gp. (3).

4. Discussion

Cadmium is apparently non-essential element that is virtually absent from the body of man and animal at birth. Air pollution with cadmium from industrial sources may be transmitted to man and animals through contaminated food stuffs **Catalaba and Yarland (1986), Bryant and Rose (1995), F ibcrg et al. (1996), Sharl et al. (1999).**

Significant decreases were observed in RBCS, PCV and hemoglobin. On the contrary, there were significant increases in the ESR and WBC. Similar results were obtained by **Fibcrg et al. (1996).** It is well known that the toxicity of cadmium inhibits reproduction in animals. **[Kumimata and Miruo (1986), Hew ct al. (1993), Mircda (1996), Fayed and Abdallall (1997)]**.There was a reduction in the level of LH, FSH and testosterone in comparison with the control. The available litarature concerning the effect of cadmium on the levels of LH, FSH and testosterone are very scarce. These results are in accordance with those obtained by **Kuo et al. (1995), Watanabe et al. (1998), and Santner et al., (1981)** who reported that the LH, FSH, testosterone were significantly decreased in mice. The fertility and libido were lost after treatment with cadmium chloride 5mg/kg Bwt and decreased after treatment with 2mg/kg Bwt, in mice. Such effects could be the result of vascular damage of the testes and the leydig cells, **Nishiyama and Nakamura (1984).** The pollution with cadmium adversely affected the fertility and libido of the exposed animals.

The ALT, AST, urea, creatinine, Na^+, K^+ and cad^+ concentrations were significantly increased. This may be attributed to the necrosis of both kidney and liver. These results are coincident with **Gabiani et al., (1974), Mamkicwicz et al., (1975), Ferguson (1980), Bcrraw and Deaves (1984), Adriana (1986), Abu Salem (1991), Mansi et al., (1993), Bryant and Rose (1995) and Fiberg et al (1996)**. Moreover total protein decreased probably due to necrosis of liver cells.

It could be concluded that cadmium toxicity markedly suppressed the LH, FSH and Testosterone and caused degeneration of testes. On the other hand, it caused atrophy of the liver, kidney, which showed renal calacification due to deposition of calcium.

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