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ESTIMATION OF SOME METALLIC POLLUTANTS IN DIFFERENT POULTRY TISSUES

(With 4 Tables)

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قياس مستويات بعض الملوثات المعدنية في الأنسجة المختلفة للدواجن

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أستهدفت هذه الدراسة تقدير مستويات كل من الرصاص والكادميوم والزئبق والمنجنيز والنحاس والحديد والزنك في بعض أنسجة الدواجن المختلفة. في هذه الدراسة تم إستخدام ٦٧٥ عينه (٥٠ عينه من العضلات و ٤٥ عينة من الكبد و ٤٠ عينة من الكلي من كلٍ من كتاكيت اللحم والبط والأوز والرومي والأرانب). وقد أوضحت النتائج ما يلي: (١) بالنسبة للعضلات ، وجود زيادة معنوية في مستوي الزئبق في كلٍ من كتاكيت اللحم والبط٤,٩٥١) ، ٤,٧٧٣ ميكروجرام/ كجم). وجود زيادة معنوية في تركيز المنجنيز في كلٍ من البط والأوز (٠,٢٢، ٠,٢٨٥ جزء في المليون) ووجود نقص في تركيزه في كلٍ من كتاكيت اللحم والرومي (٠,٠٩٣ ، ٠,٠٩٨ جزء في المليون) . وجود إنخفاض معنوي في مستويات المعادن الأساسية (النحاس ، الحديد ، الزنك) في جميع العينات التي تم فحصها . وعلي الجانب الآخر لوحظ عدم وجود تغير في مستويات الرصاص والكادميوم. (٢) بالنسبة للكبد ، لوحظ وجود زيادة معنوية في مستوي الرصاص في الأرانب (٠,٢٨٥ جزء في المليون) وفي الزئبق في جميع العينات ما عدا الأرانب. وجود زيادة في المنجنيز في البط والأوز (٣,٦٢٩ ، ٢,٧٤ جزء في المليون) بينما إنخفض في كتاكيت اللحم والرومي والأرانب (١,٨٢٩ ، ١,٨٤٩ ، ١,٥٨٩ جزء في المليون). زيادة تركيز النحاس في البط والأوز والأرانب (٥٥,٩٧٧ ، ٨١,٦٩ ، ١١,٦٠٥ جزء في المليون) بينما إنخفض تركيز الحديد والزنك في جميع العينات التي فحصت مع عدم وجود تغير في مستوي الكادميوم. (٣) بالنسبة للكلي ، لوحظ وجود زيادة في تركيز الرصاص في الأرانب فقط (٠,٢٩٦جزء في المليون) مع زيادة في تركيز الزئبق في البط والرومي والأرانب (٨,٠٧٣ ، ٥,٣٦، ٥,٩ ميكروجرام/ كجم) وكذلك تركيز النحاس في البط والأوز والأرانب (٨,٤٢٩، ١٥,٦٧٥ ، ٦,٥٦٩ جزء في المليون). وُجدت زيادة في تركيز الزنك في البط (٤٠,٩٧٢ جزء في المليون) وإنخفاض في تركيزه في الرومي (٢١,٩٧٤ جزء في المليون) وفي العينات التي تم فحصها من العضلات والكبد والكلي لم يوجد أي تغير في مستوي الكادميوم.

SUMMARY

This study was conducted to determine the concentrations of lead, cadmium, mercury, manganese, copper, iron and zinc in the tissues of the different poultry. The samples were 50 muscle, 45 liver and 40 kidney. These samples were taken from each of chickens, ducks, geese, turkey and rabbits. The results revealed that: **(1)** For muscles, there is a significant increase in mercury concentration in chickens and ducks (4.951 and 3.773 µg/kg). Manganese level showed significant increase in ducks and geese (0.22 and 0.285 ppm) and significant decrease in chickens and turkeys (0.093 and 0.098 ppm). The essential trace elements (Cu, Fe and Zn) showed significant decrease in all examined poultry species. On the other hand, no changes were observed in case of lead and cadmium. **(2)** For livers, there is significant increase of lead (0.285 ppm) in rabbits and of mercury in all examined species except rabbits. Manganese level significantly increased in ducks and geese (3.629 and 2.74 ppm), while decreased in chickens, turkey and rabbits (1.829, 1.849 and 1.589 ppm respectively). Copper concentration significantly increased in ducks, geese and rabbits (55.977, 81.69 and 11.605 ppm respectively). Iron and zinc showed significant decrease in all examined species. No changes for cadmium. **(3)** For kidneys, lead concentration was increased in rabbits (0.296 ppm) only. Mercury level increased in ducks, turkeys and rabbits (8.073, 5.36 and 5.9 µg/kg respectively). Manganese level increased in all examined species while iron level showed an opposite results. Copper concentration significantly increased in ducks, geese and rabbits (8.429, 15.675 and 6.569 ppm respectively). Zinc showed an increase in ducks (40.972 ppm) and decrease in turkey (21.974 ppm). For all examined muscles, livers and kidneys there is no changes for cadmium.

Key words: *Poultry- liver- muscles- lead- cadmium-mercury- copper- iron- zinc.*

INTRODUCTION

It is well known that diet has important role in the maintenance of health and the management of specific diseases in chickens, ducks, geese, turkey and rabbits. Commercially prepared rations may contain a wide spectrum of ingredients from many sources. Considering the very large number of constituents in poultry rations, the possibility exists that may be contaminated by agricultural and industrial pollutants during final processing of the finished rations.

Birds (fowl, ducks, geese and pigeons) are all susceptible to lead poisoning. They show anorexia and ataxia, followed by excitement and loss of condition. Egg production, fertility and hatchability decrease and mortality may be high (Clarke *et al.*, 1981). Ataxia, loss of weight, impaction of the upper gastrointestinal tract and bile green diarrhea were the signs of lead toxicity in ring-necked ducks (Mautino and Bell, 1986).

Through the years considerable amounts of Pb have been mobilized into the environment. Industrial smelters, discarded batteries, burning of garbage and old paint wood are the main sources of environmental Pb. Burning of coal and the foil oil constitute a source of Pb that calls for particular consideration is Pb tetra alkyl used as petrol (gasoline) additive. The Pb derived from petrol additives contributes not only to the intake through inhalation but also to the intake through ingestion as a result of fallout from vehicle exhaust on nearby food crops (WHO, World Health Organization 1972).

Cadmium, a toxic heavy metal, has a number of industrial applications, but it is used mostly in metal plating, pigments, batteries, and plastics. However, for most people the primary source of cadmium exposure is food (WHO, World Health Organization 1992), Since food materials tend to take up and retain cadmium. Cadmium is not known to have any beneficial effects, but can cause a broad spectrum of toxicological and biochemical dysfunctions (Theocharis *et al.*, 1994; Funakoshi *et al.*, 1995).

Mercury is considered as one of the most important pollutant in our environment. Mining, smelting, industrial discharge, loss of mercury in water effluent from chloralkali plants, mercury in paper pulp industries and fossil fuel. It is estimated that about 5000 tons of mercury per year may be emitted from burning coal, natural gas and from the refining of petroleum products) are considered as main sources of mercury in the environment (Goyer, 1996). Mercury is popular in agriculture because of its ability to counteract fungi and mold. It therefore has been widely used to prevent grain spoilage. As pesticides (fungicides for seed dressing) and in industry as wood preservative, production of dyes, initial explosive in boosters and igniters (Bartik and Piskac, 1981, Gossel and Bricker, 1990).

The present study was conducted to obtain some baseline data about the concentrations of various known toxicants (Pb, Cd and Hg), potentially toxic element (manganese) and essentially protective constituents like copper, iron and zinc in muscles, livers and kidneys of different poultry species (chickens, ducks, geese, turkeys and rabbits).

MATERIALS and METHODS

Material:

A total number of 675 tissue samples (Table 1) were used in this study. Fifty muscle, 45 kidney and 40 liver samples were taken from each of the following different poultry species (chickens, ducks, geese, turkeys and rabbits) and analyzed for estimation of their metal content (lead, Pb; cadmium, Cd; mercury, Hg; manganese, Mn; copper, Cu; iron, Fe and zinc; Zn).

Table 1: The total number of samples used in this study.

Poultry species	Number of samples from different tissues		
	Muscles	Livers	Kidneys
Meat-type chickens	50	45	40
Ducks	50	45	40
Geese	50	45	40
Turkeys	50	45	40
Rabbits	50	45	40

The birds from which the samples of muscles, livers and kidneys taken were collected from supermarkets and poultry slaughter shops at Assiut and Beni-Suef Cities.

Methods:

A- Estimation of metals:

Samples of muscles, livers and kidneys were collected from the previous mentioned poultry species and stored at -20 C in polyethylene bags for heavy metal analysis. One gram from each tissue was digested by using a mixture of nitric and perchloric acids. Mercury was determined by Shimadzu flame atomic absorption spectrophotometer (Model AA-620). Lead, cadmium, manganese, copper, iron and zinc were determined by using atomic absorption spectrophotometer (GBC 906 AA).

B- Statistical analysis:

Student's "t" test was used to calculate the significance between normal levels and investigated samples. The normal values of metals were according to Vodela et al (1997) for lead, WHO (2000) for cadmium, Bartik and Piskac. (1981) for mercury, Underwood (1977) for manganese, and Puls (1988) for copper, iron and zinc. Probability values 0.05 and 0.001 were considered statistically significant and this according to Kalton (1967).

RESULTS

The results obtained in this study are summarized in tables 2-4. The results revealed that: **(1)** For muscles (Table 2), there is a significant increase in Hg of chickens and ducks (4.951 and 3.773 μg/kg). Mn showed significant increase in ducks and geese (0.22 and 0.285 ppm) and significant decrease in chickens and turkeys (0.093 and 0.098 ppm). The essential trace elements (Cu, Fe and Zn) showed significant decrease in all examined poultry species. On the other hand, no changes were observed in case of Pb and Cd. **(2)** For livers (Table 3), there is significant increase of lead (0.285 ppm) in rabbits and of Hg in all examined species except rabbits. Mn significantly increased in ducks and geese (3.629 and 2.74 ppm), while decreased in chickens, turkey and rabbits (1.829, 1.849 and 1.589 ppm respectively). Cu significantly increased in ducks, geese and rabbits (55.977, 81.69 and 11.605 ppm respectively). Fe and Zn showed significant decrease in all examined species. No changes in Cd. **(3)** For kidneys (Table 4), lead was increased in rabbits (0.296 ppm) only. Hg increased in ducks, turkeys and rabbits (8.073, 5.36 and 5.9 μg/kg respectively). Mn increased in all examined species while iron level showed an opposite results. Cu significantly increased in ducks, geese and rabbits (8.429, 15.675 and 6.569 ppm respectively). Zn showed an increase in ducks (40.972 ppm) and decrease in turkey (21.974 ppm). For all examined muscles, livers and kidneys there is no changes in Cd.

Table 2: Metals concentrations in muscles of different poultry species (mean ± S.E.M.).

Animal group	Pb (ppm)	Cd (ppm)	Hg (μg/kg)	Mn (ppm)	Cu (ppm)	Fe (ppm)	Zn (ppm)
Normal values	0.160 ± 0.002	1.000 ± 0.010	3.000 ± 0.013	0.130 ± 0.001	7.500 ± 0.098	72.500 ± 0.104	27.000 ± 0.121
Chickens	0.040 ± 0.003**	0.016 ± 0.001**	4.951 ± 0.251**	0.093 ± 0.007**	0.343 ± 0.025**	5.581 ± 0.511**	16.360 ± 1.335**
Ducks	0.045 ± 0.002**	0.053 ± 0.004**	3.773 ± 0.191**	0.220 ± 0.016**	4.661 ± 0.322**	35.129 ± 2.990**	21.449 ± 1.923*
Geese	0.041 ± 0.002**	0.104 ± 0.008**	1.947 ± 0.145**	0.285 ± 0.027**	4.025 ± 0.274**	32.445 ± 2.513**	21.275 ± 1.891**
Turkey	0.043 ± 0.003**	0.021 ± 0.002**	1.858 ± 0.173**	0.098 ± 0.007**	0.330 ± 0.027**	5.162 ± 0.390**	17.416 ± 1.039**
Rabbits	0.131 ± 0.010*	0.047 ± 0.064**	1.326 ± 0.087**	0.153 ± 0.014	0.509 ± 0.043**	19.234 ± 1.563**	20.925 ± 1.792*

*: Significantly different at $p<0.05$. **: Significantly different at $p<0.001$.

Table 3: Metals concentrations in livers of different poultry species (mean ± S.E.M.).

Animal group	Pb (ppm)	Cd (ppm)	Hg (μg/kg)	Mn (ppm)	Cu (ppm)	Fe (ppm)	Zn (ppm)
Normal values	0.160 ± 0.002	1.000 ± 0.010	3.000 ± 0.013	2.100 ± 0.032	7.500 ± 0.098	180.000 ± 3.625	72.500 ± 1.121
Chickens	0.076 ± 0.010**	0.026 ± 0.002**	5.044 ± 0.415**	1.829 ± 0.091*	5.059 ± 0.424**	63.695 ± 5.606**	25.724 ± 2.910**
Ducks	0.081 ± 0.007**	0.177 ± 0.026**	6.087 ± 0.360**	3.629 ± 0.312**	55.977 ± 6.901**	66.040 ± 4.955**	55.465 ± 4.366**
Geese	0.122 ± 0.008**	0.232 ± 0.031**	4.014 ± 0.322*	2.740 ± 0.269*	81.690 ± 7.403**	52.458 ± 3.929**	54.605 ± 4.005**
Turkey	0.075 ± 0.007**	0.082 ± 0.006**	4.718 ± 0.347**	1.849 ± 0.101*	4.723 ± 0.424**	58.675 ± 5.297**	31.329 ± 3.063**
Rabbits	0.285 ± 0.022**	0.098 ± 0.009**	2.585 ± 0.179*	1.589 ± 0.189*	11.605 ± 1.184*	39.205 ± 4.414**	58.088 ± 4.107*

*: Significantly different at $p<0.05$. **: Significantly different at $p<0.001$.

Table 4: Metals concentrations in kidneys of different poultry species (mean ±S.E.M.).

Animal group	Pb (ppm)	Cd (ppm)	Hg (µg/kg)	Mn (ppm)	Cu (ppm)	Fe (ppm)	Zn (ppm)
Normal values	0.110 ± 0.001	1.000 ± 0.002	3.000 ± 0.013	1.200 ± 0.001	3.900 ± 0.005	72.500 ± 0.104	27.000 ± 0.121
Chickens	0.037 ± 0.002**	0.729 ± 0.050**	3.437 ± 0.311	1.717 ± 0.161*	3.713 ± 0.365	44.006 ± 4.171**	23.348 ± 3.028
Ducks	0.158 ± 0.013**	0.456 ± 0.041**	8.073 ± 0.809**	2.483 ± 0.256**	8.429 ± 0.885**	53.583 ± 6.125*	40.972 ± 5.636*
Geese	0.115 ± 0.007	0.396 ± 0.042**	2.140 ± 0.236**	1.807 ± 0.227*	15.675 ± 1.704**	49.351 ± 4.149**	22.680 ± 2.719
Turkey	0.121 ± 0.013	0.172 ± 0.022**	5.360 ± 0.395**	1.736 ± 0.155*	3.356 ± 0.376	42.433 ± 4.129**	21.974 ± 1.736*
Rabbits	0.296 ± 0.026**	1.114 ± 0.104	5.900 ± 0.422**	1.858 ± 0.196*	6.569 ± 0.731**	51.639 ± 3.936**	29.541 ± 2.985

*: Significantly different at $p<0.05$. **: Significantly different at $p<0.001$.

DISCUSSION

The concentrations of Pb, Cd, Hg, Mn, Fe, Cu and Zn in muscles, livers and kidneys of poultry (chickens, ducks, geese, turkeys and rabbits) are summarized in tables 2-4. In all examined cases, both livers and kidneys were examined for they are edible tissues consumed by human, and the contaminant levels because of their importance in the accumulation of heavy metals.

1- Lead:

Based on consideration of usage, toxicity and environmental occurrence, many national and international health organization accorded first priority in their programs on the toxic metals as Pb, Cd and Hg and on other few heavy metals. Of these metals, the agencies have devoted by far the most attention to lead and cadmium (Jelinek, 1985). In the present study, Pb content was higher in liver and kidneys of rabbits (0.285 and 0.296 ppm), this may be attributed to high lead concentration in barseem and grasses on which rabbits were fed. The mean values reported for other species were in range of 0.075-0.122 ppm for liver and 0.037-0.158 ppm for kidneys. The difference in Pb concentration in various examined poultry species may be due to variation in feed and water quality admitted to these animals.

One of the most important environmental issues today is ground water contamination. Water contamination with heavy metals has been reported (Schumacher *et al.*, 1990; Srikanth *e' al.*, 1993). Heavy metals emitted by industries, traffic, municipal wastes and hazardous wastes sites have resulted in a steady rise in contamination of ground water (Yang *et al.*, 1989). Acidic water of low mineral content can leach large amounts of lead from lead pipes or solder (Agency for Toxic Substance Disease Registry, 1988). This is particularly apt to occur when water has been standing in pipes for extended periods, much of house hold supplies have lead concentrations greater than the proposed standard of 20 μg/dl (EPA, Environmental Protection Agency, 1991). Lead may also contaminates foods. Soil lead is taken up by root-vegetable and atmospheric lead may fall onto leafy vegetables (Mushak *et al.*, 1989).

As these birds in this study depend mainly on cereals and grains in their food and the high content of Pb in their tissues which may attributed to feeding on contaminated grains where Mumma et al (1986) found that the elemental content in pet foods specially cereal grains contains cadmium (0.01-0.6 ppm), lead (up to 7.5 ppm), and mercury (0.02-0.05 ppm).

Diet, including ingestion of soil and girt, can have a dramatic effect on lead shot erosion and lead absorption, retention and excretion rates, and can be important in mitigating the toxic effects of ingested lead. Dietary components such as calcium, phosphorus and protein, along with the size and hardness of food items, are important in determining the susceptibility of ducks poisoning through the ingestion of lead shotshell pellets (Sanderson and Bellrose, 1986).

Increasing levels of drinking water contaminants (Pb & Cd) and decreasing levels of vitamins and minerals in poultry diets resulted in significant decreased water and feed intake, decreased weight gain and suppression of natural, humoral and cell-mediated immune response (Vodela *et al.*, 1997).

Chickens are very resistant to lead poisoning and dietary Pb at 1000 ppm has been tolerated by ruminants and poultry for several months without visible signs of toxicity. Pb toxicosis in animals is modified by at least the levels of Hg, Cd, Zn, Mo, Se, Cu, Fe and fluorine (National Research Council Subcommittee on Mineral Toxicity in Animals,1980). Vengis and Mare (1974) were concerned with immunologic effects and found no adverse effects when 160 ppm Pb was given po to 6-weeks old broilers for 35 days although Pb accumulated in the tissues.

2- Cadmium:

The concentration of cadmium in the present study (Table 2-4) was found lower than the normal levels. Relative high level was observed in the kidneys of rabbits (1.114 ppm). Nevertheless, the importance of the kidneys from rabbits as a food is negligible. Cadmium concentrations were low in all examined tissues. Cadmium is a cumulative toxicant in the continental ecological cycling, it accumulates mostly in the liver and kidney (Blalock and Hill, 1988), They concluded that iron deficiency increased the concentration of Cd in the kidneys, and Cd tend to reduce the Fe concentration in both liver and kidneys . This result support our obtained results because our results revealed severe increase in iron in both liver and kidneys.

Cadmium in air, drinking water and food has the potential to affect the health of whole populations, but mainly those who live in highly industrialized regions (WHO, World Health Organization, 1994). Either by food, water or air exposure they receive contaminants which are transferred through the food chain to human beings.

3- Mercury:

During recent years the importance of mercury in the food-chain has become better understood. Inorganic and organic mercury derivatives are arising as effluents from industrial processes and converted in the lakes and rivers into Soluble methyl mercury. This is carried down to the Sea, where it is taken by man and animal through drinking water or through eating fishes.

In the present study, Hg increased in muscles of chickens and ducks, and in the livers of all examined samples while increased in the kidneys of ducks, turkeys and rabbits. Generally, the concentrations of mercury were high, recording an overall range of 2.140-8.073 ug/kg in kidneys, 2.585-6.087 ug/kg in livers and 1.326-4.951 ug/kg in muscles samples. The livers and kidneys contained higher levels of mercury than that of muscles.

Mercury occurs widely in the biosphere and has long been known as a toxic element presenting occupational hazards associated with both ingestion and inhalation. No vital function for the element in living organisms has yet been found. The toxic properties of Hg have evoked increasing in recent years due to the extent of its use in industry and agriculture, and the recognition that alkyl derivatives of Hg are more toxic than most other chemical forms and can enter the food chain through the activity of microorganisms with the ability to methylate the mercury present in industrial wastes (Underwood, 1977). Exposure to heavy metals such as cadmium and mercury is of immediate environmental concern. A direct relationship between heavy metal poisoning and thyroid dysfunction was reported in rabbits by Ghosh and Bhattacharya (1992).

4- Manganese:

Manganese is considered to be an essential element for all living animals. Dietary Mn deficiency can result in a wide variety of structural and functional defects. A relationship between Mn and carbohydrate metabolism is now well recognized, while Mn is also a Co-factor for a number of enzymatic reactions, particularly those involved in phosphorylation, and fatty acid synthesis (Baly *et al.*, 1985; Goyer, 1991). On the other hand, Mn toxicity represents a serious health hazard in humans. Toxic intake of Mn (either through the air or diet) may result in severe pathological changes particularly in the CNS, neural damage, reproductive and immune system dysfunction, nephritis, testicular damage, pancreatitis and hepatic damage (Donaldson, 1987; Keen and Leach, 1987; Keen and Zidenberg-Cherr, 1990).

In the present study, the concentration of Mn in the kidneys was higher in the order of chickens, turkeys, geese, rabbits and ducks. The higher Mn requirements of birds compared with mammals arise mainly from lower absorption from the gut. The special importance of Mn in poultry nutrition stems largely from this fact. A second factor is the low Mn content of corn (maize) compared with other cereal grains. Where corn is the main dietary component Mn supplement becomes essential even when calcium and phosphorus intakes are not unduly high (Underwood, 1977). The cereal grains and their by-products vary greatly in manganese concentration (ppm dry basis) wheat 40, bran 120, barley 25, maize (corn) 8 and sorghum 16. Soybean meal, an important protein supplement for poultry, contains 30-40 ppm Mn. It is apparent that poultry rations based on corn and to a lesser extent sorghum and barley, are deficient in Mn unless supplemented with this element or with Mn-rich feeds such as wheaten bran in which the Mn of the wheat grain is concentrated (Underwood, 1977).

5- Copper, iron and zinc:

Iron and Zn levels in the present study were decreased in livers and muscles while Cu showed alternative manner. The obtained results in our study revealed an increase in Cu content in ducks than chickens and this is supported by the results obtained by Wood and Worden (1973), and Bartik and Piskac (1981) they found that almost all Cu from food is stored first in the liver cells. The highest physiological concentration of copper found in the livers of ruminants and ducks. Cu is an essential trace element, a normal constituent of animal tissues and fluids, crucial in hemoglobin synthesis and other enzymes functions. Both deficiency and excess of Cu in the mammalian system result in untoward effects (Hostynek *et al.*, 1993).

Copper absorption is reduced by Zn, Cd and Hg by competing at the absorption site. Pharmacological doses of Zn was shown to induce Cu deficiency in humans, which was ameliorated on copper supplementation. Copper deficiency is associated with skeletal abnormalities in rabbits, chickens and sheep (Abdel-Mageed and Oehme, 1990a).

Birds are considered to be relatively resistant to zinc intoxication, however, intake at concentrations exceeding the physiological mechanisms to compensate can result in a variety of pathological effects (Eisler, 1993). Ducks have become intoxicated through the addition of zinc carbonate (Gasaway and Buss, 1972) or zinc sulfate (Kazacos and Van Vleet, 1989) to their diet or gavage of shot pellets comprised primarily of zinc (Levengood *et al.*, 1999).

The diets for poultry must be supplemented with iron, copper and zinc because cereals and oilseed meals admitted to poultry are poor in these elements. Wiseman and Cole (1990) found that mineral concentrations in some raw food materials (ppm) in cereals and oilseed meals were: (1) Cu 3-10 and 7-25, (2) Fe 35-80 and 20-180, (3) Mn 5 and 60, and (4) Zn 15-30 and 50-80 respectively.

In case of Zn, our results showed a significant decrease are in accordance with Niklowitz and Yeager (1973) who reported that Pb displace Zn or prevent its uptake by the brain. In their study, they showed that rabbits exposed to toxic levels of tetraethyl Pb lost 0.5 molecule Zn from the brain for each molecule of Pb they retained, and also with that obtained by Cerklewski and Forbes (1976). They found that increased dietary Zn impairs intestinal absorption of Pb in rats and thus protected from dietary Pb. Aminolevulinic acid dehydratase enzyme included in the heme synthesis is a Zn-dependent enzyme. The inhibition of the enzyme by Pb is apparently alleviated by Zn (Finnelli *et al.*, 1975).

Manganese absorption may be increased in iron deficiency and decreased in individuals with adequate iron stores. The absorption of Pb was increased in iron-deficient rats (Abdel-Mageed and Oehme, 1990b).

The iron content in this study was lower in all examined tissues and this may be due to that diets admitted for poultry as rations contain inadequate amounts of these elements. The iron content of analyzed animal feeds were 100-250 ppm in grasses, 200-300 ppm in Legumes, 30-60 ppm in Cereal grains, 100-200 ppm in oil seed meals Dietary Zn, Cu, Cd and Mn interfere with Fe absorption by competing at the absorption site (Abdel-Mageed and Oehme, 1990c).

An excess of a given metal through dietary, occupational, or environmental exposure may lead to depletion or repletion of an essential metal at numerous biological levels: at molecular, cellular, tissue or organ, and systemic levels of organization. Cd intoxication produces necrosis in the intestine, which is prevented by sufficient Zn. Our obtained results (decrease in Zn and increase in Fe) are in accordance with Pounds (1985) who stated that Pb intoxication alter tissue levels of many essential elements including Fe, Zn, Cu and Ca.

CONCLUSION

From the present study and the obtained results, the contamination of poultry tissues (muscles, livers and kidneys) with toxic metals is low except that of mercury which showed an increase in its concentrations. No changes were observed for cadmium. Lead level was higher in the liver and kidneys of rabbits. For the essential elements (Mn, Cu, Fe and Zn), the concentrations are species and tissues specific with special view for lower iron level in all examined tissues.

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