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Estimation of Lead, Copper and Zinc Elements in Livers and Kidneys of *Columba livia domestica* which infected with *Raillietina sp.* in Al-Nassiriyah City/ South of Iraq.

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***Abstract*— The present study aimed to evaluate the effect of the concentrations of Lead (Pb), Copper (Cu) and Zinc (Zn), in liver and kidney of *Columba livia domestica* infected with *Raillietina sp.* 300 birds of *C. livia* were collected from local market at Al-Nassiriyah city. The birds were divided in to two groups: first one was infected with *Raillietina sp.* and second group was healthy group. 129 birds were infected with tapeworms which belong to three genera: *Raillietina sp.*, *Cotugina sp.*, *Apronia sp.*, with infection rates of 52,8%, 27,9% and 19,1% respectively, for the period from April 2019 to February 2020. Heavy element concentrations were measured by flame atomic absorption spectrophotometer (FAAS). The highest Pb concentration in liver was elevated in Summer (0.589 µg/ g) dry weigh. While , the highest kidney Pb concentration was equal in Summer and Spring (0.440 µg/ g) dry weigh. In liver, the highest concentration of Cu was in Summer (0.799 µg/ g) dry weight, however, in kidney, the concentration of Cu was in Spring (0.610 µg/ g) dry weight. In Winter, Zn concentration was elevated in livers and kidneys (1.00 and 1.21 µg/ g, dry weigh respectively) In *Raillitiena sp.* the highest concentration of Pb was in Summer (0.608 µg/ g) dry weigh, however the highest concentrations of Cu and Zn were in Winter (1.42 and 1.99 µg/ g dry weigh for Cu and Zn, respectively).**

***Keywords*— *Raillietina sp, Columba livia doemstica,* Heavy elements. FAAS**

I. Introduction

One of the major sources of animal protein is birds, on which humans depend on food (Permin and Hansen, 1998). In addition to its large role in the biological resistance through feeding it on insects and other harmful pests to humans, animals and plants, therefore many countries prohibit hunting at certain times of the year in order to protect them from extinction (Abu Al-Hob, 1994)). Pigeons, like other animals, are infected with parasites, including tapeworms that belong to several families. Among these families is the Davaineidae family, which includes 14 genera. Foremost among them is the genus *Raillietina sp.* , which is common in birds and in a few cases infects mammalian (Yamaguti, 1959). The life cycle of these worms requires a medium host which is represented by several types of insects, such as ants, beetles, or earthworms (Soulsby, 1968; Dang *et al*., 2009).

Pollution problem is one of the most serious problems that have environmental, economic and social dimensions dangerous. At the international level, in Iraq the environment was exposed during various years to various types of pollution as a result of wars and the increasing in industrial, agricultural and commercial activities (Lazim, 2019). Moreover, pollution of the natural environment with heavy metals is a global problem, as these pollutants pose a serious threat to the stability of the ecosystem and in particular the effects of cadmium and lead that are toxic and pose a major threat to human health (Zahraw et al., 2019). heavy elements are natural constituents for all environments. They are very dangerous material because of their persistance, toxicity at low concentration and their ability to be in concentrated in to the food chains and concentrated by biota (Khalil *et al*., 1994). The danger of pollutants lies when they enter the food chain and accumulate in the bodies of living organisms then transferee to to human (Burger *et al*., 2007). Hence the need to adopt biological indicators that can be used as biological evidence for pollution, including pollution with heavy metals, was recommended (Najm and Fakhar, 2015). *C. livia* pigeons as a biological guide to pollution with heavy metals because they are sensitive to environmental pollutants as well as their habits and behavior in nutrition. Beside, their neutrino way on fed on the ground level and in roads, sidewalks and waste, which explains the reason for their ability to grow and reproduce (Carpenter *et al*., 2004). The relationship between parasitism and pollution is not a simple relationship, as it is a double-edged phenomenon. Parasitism may increase the host's impact on toxic pollutants, or pollutants increase the spread of parasites, as long-term exposure to heavy metals causes behavioral, physiological, and biochemical changes in birds that ultimately affect the spread and the density of parasites by weakening the immune system of birds , helminthes have a high ability to collect heavy metals in their tissues and at a higher concentration than in the tissues of their hosts (Sures, 2017). Interest has increased in recent years to study the relationship between parasitism and pollution, especially in ecosystems. Parasitic worms are considered biotic indicators of heavy metal pollution (Huspeni and Lafferty, 2004, Nam *et al*., 2004, Sures, 2001, Vidal-Martinez, 2007). Therefore, many parasitic worms such as Acanthocephala worms and tapeworms were used as indicators or biological evidence of Bio indicators pollution with some heavy elements such as lead, cadmium and nickel Malek (2007) , Vashishat and Kler (2014).

Iraq, have large number of birds with wide diversity and the relationship between pollution and parasitism has not received enough attention, so this study was aimed to compare the concentrations of Pb, Cu and Zn metals between infected *C. livia* with *Raillietina sp.* and healthy birds. It was also aimed to evaluate the ability of *Raillietina sp.* to accumulate these elements in their bodies.

II. MATERIALS AND METHODS

This study was carried out in the laboratories of Department of Biology/ Science college/ Thi-Qar university, for the period from April 2019 to February 2020. 300 samples of *C.livia* were collected from local market at Al-Nassiriyah city. Of all, 129 birds were infected and 171 were healthy(Controls groups). The birds were killed by ether solution. Dissection has been performed to separate different organs (liver and kidney). The separated organs were put in petri dishes to dry at below 60° C until reaching a constant weight, which has been separated drying and grinding.

A. Isolation of tapeworms

A magnifying lens and anatomy microscope were used to isolate large and medium-sized of intestinal worms. Small-sized worms were isolated using fine needle. After that, different worms were classified according to its form. The worms were washed, calculated and saved in test tubes containing 10% formalin, then it transported to 70% ethyl alcohol. The worms were diagnosed according to (3,19.20,21,22).

B. Heavy metals analysis

A method of (23) was used to preparation of *C. livia* tissues and tapeworms to analysis of heavy metals. In which, 1 g of each was dried liver, kidney and tapeworms was taken and was placed in a test tube. The samples were digested by adding 10 ml (mixtrue 4 ml Hcl and 1.5HNO3), then evaporated up to nearly dry on the hotplate at 80° C. A mixture concentration of Hclo4 and HF was (1:1). Finally, the samples were completed to 25 ml by adding deionized water. After digestion, Heavy elements concentration were measured by Flam Atomic Absorption Spectrophotometry (FAAS).

C. Statistical analysis

Statistical analysis of the this study was conducted, using the mean ± standard deviation (Mean ± SD). ANOVA was used to investigate the significant differences among the metal values between study groups. P values less than 0.05 and LSD were considered statistically significant. All statistical analyses were performed using the statistical software package SPSS V.17. (24).

III. RESULTS

Results of this study showed that the concentration of lead in the livers of infected and healthy birds was high in summer, (0.589 µg/g) and (0.071 µg/g) infected and healthy birds, respectively with significant differences between seasons. The concentration of lead in the kidneys of the infected birds was equal in spring and summer (0.440 µg/g) with significant differences compared to Autumn and winter (LSD=0.045). In the kidneys of healthy birds, the highest concentration of Pb was(0.056 µg/g) in Autumn and the lowest concentration was (0.036 µg/g) in Summer with significant differences between seasons (LSD=0.007). Table(1).

TABLE I. Pb concentration in different organs of infected and healthy birds

Season	Infected birds (N=129)		Healthy birds (N=171)	
	Liver (M±SD)	Kidney (M±SD)	Liver (M±SD)	Kidney (M±SD)
Spring	0.551a ± 0.15	0.440a ± 0.14	0.052c ± 0.01	0.047b ± 0.011
Summer	0.589a ± 0.09	0.440a ± 0.07	0.071a ± 0.01	0.036c ± 0.009
Autumn	0.170b ± 0.05	0.220b ± 0.07	0.063ab ± 0.01	0.056a ± 0.014
Winter	0.210b ± 0.03	0.264b ± 0.05	0.058bc ± 0.01	0.047b ± 0.014
LSD	0.042	0.045	0.015	0.007

Similar letters mean no significant differences. Different letters mean significant differences

Copper is one of the essential elements in living organism. The current study in table (2) showed that the highest concentrations of copper in the livers of infected (0.799 µg/g) and healthy (0.164 µg/g) birds were in summer with significant difference compared to autumn and winter (LSD=0.051) for infected birds and (LSD=0.02) For healthy birds. In the kidneys of infected birds, the highest concentration of copper was in spring (0.610 µg/g) and the lowest concentration was in winter (0.237 µg/g) and the least significant difference (LSD= 0.06). Conversely, the current study showed that the highest concentration of copper in the kidneys of healthy birds was in winter (0.078 µg/g) and lower (0.044 µg/g) in healthy birds with significant differences (LSD= 0.01) Table (2).

TABLE2. Cu concentration in different organs of infected and healthy birds

Season	Infected birds (N=129)		Healthy birds (N=171)	
	Liver (M±SD)	Kidney(M±SD)	Liver (M±SD)	Kidney (M±SD)
Spring	0.792a ± 0.12	0.610a ± 0.16	0.152a ± 0.05	0.065b ± 0.022
Summer	0.799a ± 0.07	0.410b ± 0.07	0.164a ± 0.02	0.048c ± 0.026
Autumn	0.390b ± 0.12	0.400b ± 0.16	0.127b ± 0.03	0.044c ± 0.013
Winter	0.440b ± 0.07	0.237c ± 0.06	0.110b ± 0.03	0.078a ± 0.017
LSD	0.051	0.06	0.02	0.01

Similar letters mean no significant differences.
Different letters mean significant differences

The concentration of zinc in livers of infected birds was highest in the winter (1.00 µg/g) and lowest in the autumn (0.190 µg/g), with significant differences between all seasons (LSD=0.07) table (4-9), while the current study did not found significant differences in the concentration of zinc in livers of healthy birds between all seasons (LSD=0.03). In infected birds, the current study showed that the highest concentrations of zinc were (1.21 µg/g) in the kidneys during winter. The lowest concentrations of this element in the kidneys of infected birds were in summer, with significant differences between all seasons. In healthy birds, the highest concentrations of Zn in kidney was (0.08 µg/g) in summer. This study also showed a significant increase in Zn concentration of kidneys of infected birds, compared with the kidneys of healthy birds. Table (3).

TABLE3. Zn concentration in different organs of infected and healthy birds

Season	Infected birds (N=129)		Healthy birds (N=171)	
	Liver (M±SD)	Kidney(M±SD)	Liver (M±SD)	Kidney (M±SD)
Spring	0.712c ± 0.20	0.540c ± 0.14	0.172a ± 0.04	0.056a ± 0.018
Summer	0.840b ± 0.07	0.413d ± 0.04	0.152a ± 0.02	0.081a ± 0.013
Autumn	0.190d ± 0.06	0.640b ± 0.17	0.167a ± 0.01	0.061a ± 0.010
Winter	1.00a ± 0.23	1.21a ± 0.05	0.167a ± 0.04	0.066a ± 0.019
LSD	0.07	0.055	0.03	0.028

Similar letters mean no significant differences. Different letters mean significant differences

In *Raillietina sp*., the highest concentration of copper was in winter (1.42 µg/g) and the lowest concentration was in Autumn (0.95µg/g).The highest concentration of lead was in summer (0.608 µg/g) and the lowest concentration was in Autumn (0.429 µg/g). This study indicated that zinc was higher in winter (1.99 µg/g) than Autumn (1.12 µg/g) with significant differences among seasons (LSD=0.042).Table (4)

TABLE4. Heavy elements concentration in *Raillietina sp.*

Season	Pb (M ± SD)	Cu (M ± SD)	Zn (M ± SD)
Spring	0.505c ± 0.07	1.12c ± 0.04	1.41c ± 0.15
Summer	0.608a ± 0.04	1.23b ± 0.04	1.50b ± 0.05
Autumn	0.429d ± 0.05	0.95d ± 0.20	1.12d ± 0.01
Winter	0.561b ± 0.02	1.42a ± 0.02	1.99a ± 0.06
LSD	0.025	0.05	0.042

Similar letters mean no significant differences. Different letters mean significant differences

IV. Discussion

Pb component was recorded various concentration in the tissues of pigeons. It was seen that the high concentrations of lead in liver tissue in summer and in kidney tissue in spring and summer, results of the current study are consistent with what was recorded by (25,26) The reason for the high concentrations of the lead element, especially in hot seasons, is because of the utilization of leaded fuel that goes with the expansion in daylight hours and the reducing of electrical current time, result in an increase in the operation of electric generating devices that lead to an increase in lead concentration in the environment, and this is consistent with (27).

The results of Cu element indicated various concentration in the tissues of pigeons, as it recorded high concentrations in liver tissue in the summer and spring, in the kidney in the spring. This finding agree with (28) who found that Cu element recorded a remarkable rise in the liver in ducks in the lakes of Jeremiah and Maz-Rei in Poland, and this distinction might be because of the difference in environmental conditions and human activities, which play significant role in the difference of pollutants between the reason of creasing Cu in liver in two regions, high concentration is that this organ responsible for controlling heavy metals in the body. This is conflicting with (29) which he recorded in his study low concentrations of copper in the liver. where he recorded in his study low concentrations of copper in the liver. The element of copper recorded its lowest concentration in the kidneys in the winter, may be the purpose behind the low concentration of the copper element is that it is one of the essential significant elements for enzymatic activity and numerous metabolic processes that may happen in these organs. Thusly, these organs are attracted to the remainder of the body or have been absorbed by the tapeworms present in the intestine and concentrated in its bodies.

The element Zn recorded higher concentrations in the tissues of pigeons in the study area compared to other heavy metals. In the Autumn, kidney tissue scored the highest concentration compared with the remainder of different organs, while the liver recorded the lowest concentration in winter, This is consistent with (30) where he recorded a high level of zinc accumulation in the tissues, Zn recorded the lowest concentration in liver tissue in the winter and autumn seasons This is predictable with an examination (31) who was record that the Zn concentration was low in liver tissue. The concentration of Pb in the present study showed that it had the highest value in tapeworms in the summer while the lowest concentration in the autumn this is consistent with a study (Baruš *et al*., 2001). Zinc element showed that it had the highest concentration in tapeworms in the winter, while the lowest concentration in the autumn this is consistent with a study (Hassan, 2018).

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