Original Article
IASR Journal of Agriculture and Life Sciences
Website: https://iasrpublication.com/ijals/journal
ISSN (online): 2583-1259
Page No : 01-05

Detection of Heavy Metal Accumulationsin liver of *Gallus gallus* Within Polluted Areas

Rafal F. J. Aleiqabie[1], Shahad Q. Al-Hamadiny[1], Riyam G. K. Al-Sarray[2], Sarah akar[3]

[1]Pathological Analysis Department, College of Science, Wasit University, Kut, Wasit, Iraq.

[1]Biology Department, College of Science, Wasit University, Kut, Wasit, Iraq.

[2]Ministry of health, Wasit Health Directorate, Wasit Governorate, Kut, Iraq.

[3]Ministry of health, Wasit Health Directorate, Wasit Governorate, Kut, Iraq.

ABSTRACT

Overexposure with heavy metals through ingestion, respiration or skin contact can cause metals to accumulate inside the body on tissue level or on organ level, these heavy metals can disrupt physiological processes, thus affecting overall organ functions for instance brain function, heart and circulatory system and liver function. With the continuation of oil extraction and manufacture of brick from brick factories in Was it province, the heavy metals amounts emitted to the environments are steadily increasing. Hence, can result in high levels of accumulation of these contaminants and intoxication of humans and animals living nearby, that pose a hazard to ecosystems, animals and human health. In this study we detected the concentrations of lead (Pb), cadmium (Cd), zinc (Zn),iron (Fe) and cupper (Cu), in liver tissue of *Gallus gallus* specimens being collected from polluted sites. Results indicates that the highly polluted area can be considered unsuitable for living due to the hazardous effect resulted from high rate of accumulation of toxic heavy menials

Keywords: *Heavy Metal Accumulationsin liver, Gallus gallus*

***Corresponding Author**

Rafal F. J. Aleiqabie
Pathological Analysis Department, College of Science, Wasit University, Kut, Wasit, Iraq.

© Copy Right, IJALS, 2023. All Rights Reserved

INTRODUCTION

Overexposure with heavy metals through ingestion, respiration or skin contact can cause metals to accumulate inside the body on tissue level or on organ level, these heavy metals can disrupt physiological processes, thus affecting overall organ functions for instance brain function, heart and circulatory system and liver function [1][2]. "Heavy metal bio-toxicity" refers to the adverse effects of heavy metals on the body when taken in excess of bio-recommended limits [3]. When consumed, they interact with the body's biomolecules, such as proteins and enzymes, to generate toxic complexes that mutilate their structures and impede their bioreactions [4].In humans, continues long-term exposure to cadmium can lead to kidney failure and pulmonary damage [5]. High amounts of exposure can also cause obstructive lung disease, or death in extreme cases [6].Lead is the most toxic heavy metal, and the inorganic forms are absorbed by food and drink [7]. Lead poisoning also inhibits hemoglobin production, as well as kidney, joint, and reproductive system malfunction [8]. Other side effects include gastrointestinal (GIT) and urinary tract damage, and neurological dysfunction [9].Zinc has been found to elicit the same symptoms as lead, and can easily be misdiagnosed as lead poisoning [10]. Excess zinc might create system dysfunctions, impairing development and reproduction [11]. Vomiting, diarrhea, bloody urine, liver failure, renal failure, and anemia are all clinical indications of zinc toxicosis [12].Children are more vulnerable to iron toxicity due to their increased exposure to iron-containing goods [13]. Excess intake of iron is a severe concern in industrialized and meat-eating countries since it raises cancer risks [14]. Workers who are exposed to asbestos, which contains about 30% iron, are at a high risk of asbestosis [15].Excess copper causes oxidative stress, DNA damage, and decreased cell growth. Copper poisoning, if left untreated, can end in death [16]. A high copper level in the body can harm the liver, kidneys, heart, and brain [17].

Methodology

This study was held in Wasit province, Kut, Iraq. Fresh samples were collected from the targeted polluted areas in Wasit, Kut, Iraq.The studied birds (*Gallus gallus*) were collected from two polluted sites, villages near Al-Ahdeb oil fields, and villages near Al-Hay brick factories. A collective of 20 birds, 10 from each site, weight ranged between 1 and 1.5 Kg were slaughtered and needed sample (liver) were obtained.Samples were dried at room temperature about(28.4 -

33.6 °C) for 11 days. Afterwards, each sample were grinded to powder, and wet digested with nitric acid (1gm sample+ 10 ml acid) overnight.Afterwards, 1 ml Hydrogen peroxide (H2O2) were added,mixture was evaporated then samples were cooled and diluted to 5 ml with distilled water and filtered using Whatman filter paper. The detection of (Pb, Cd, Zn, Fe and Cu) concentration in samples by atomic absorption spectrophotometer, model AA-7000, SHIMADZU brand.

Statistical analysis

Data analysis was performed by using SPSS statistics 20. The obtained data from the current study were expressed as mean ± standard deviation (SD). Analysis One-way and two-way of variable (ANOVA) were applied to assess for significant differences in the levels of heavy metals in liver(the tissue samples) and the sites. As a result the test was considered significant when P value detected<0.05.

Results and Discussion

Lead (pb)

Liver samples collected from *Gallus gallus* analysed by same atomic absorption from area nearby to Al-hay brick factories and Al-Ahdeb oil Fields. The traces of Lead (Pb) was evaluated in both sites compared to control group (0.007 ug\g). There is a rise in the level of lead in Al-Hay brick factories(3.264 ug/g) when compared with Al-Ahdeb oil fields(2.592 ug/g), however no significant difference (p value =0.0510) was seen between two sites of sample collection as shown in (table 1) and (figure 1, 2).

Table 1: Statistical analysis for mineral parameters of liver samples.

Mineral Parameters	Liver Samples (ug\g)		95% confidence	X2	P value
	Al-hay brick factories	Al-Ahdeb oil Fields			
	Mean ±SD	Mean ±SD			
Lead (Pb)	3.264± 0.370	2.592± 0.605	3.03 to 3.49	2.910	<0.0001*
Iron (Fe)	1144.02± 76.46	570.85± 109.03	500.1 to 1178.08	7.992	0.0034*
Zink (Zn)	48.133± 1.078	41.258± 3.164	39.116 to 48.663	2.965	0.0648
Copper (Cu)	27.224± 1.893	19.643± 1.783	15.877 to 28.004	6.848	0.3651
Cadmium (Cd)	0.228± 0.048	0.05 ± 0.0295	0.033 to 0.230	18.72	<0.0001*

***significant differences (p<0.05), X2:chi square , SD: standard deviation**

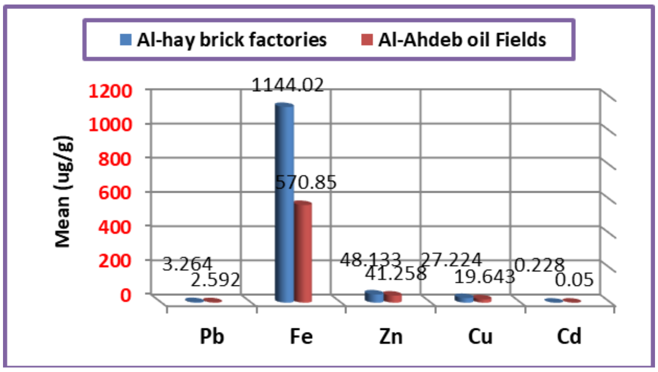

Figure 1: A graph showing the mean value of mineral parameters forliver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

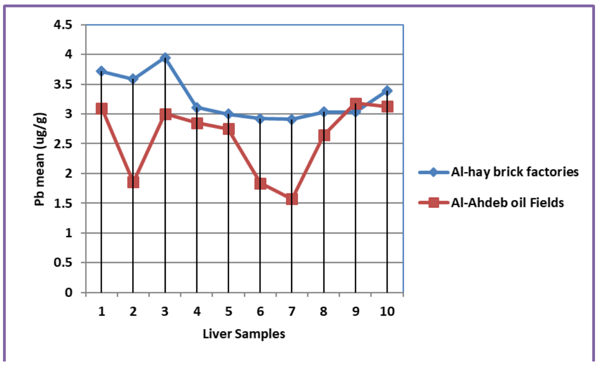

Figure 2: A graph showing the mean value of Lead (Pb) forliver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

Iron (Fe)

The Iron traced in same tissue were also evaluated in samples from both the areas included in present study compared to control samples (249.52 ug/g). Moreover, the results demonstrate haphazard increase in iron level which is almost doubled in the Al-Hay brick factories (1144.02 ug/g) compared to Al-Ahdeb oil field (570.85 ug\g) (figure 1, 3). There was a high significant difference (p value =0.0171) between the samples from both the adjoining areas as shown in (table 1).

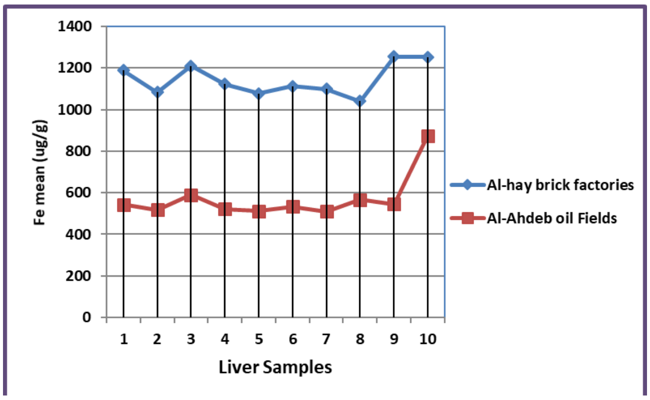

Figure 3: A graph showing the mean value of iron (Fe) forliver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

Zinc (Zn)

An evaluation also seen in samples collected from two above mentioned areas for Zinc compared to control group(14.088ug/g), however no significant difference (p value =0.1001) was seen between two sites of sample collection. The amount of Zn trace was 48.133 ug\g in Al-hay brick factories and 41.258 ug\g in Al-Ahdeb oil Fields as shown in (table 1) and (figure 1, 4).

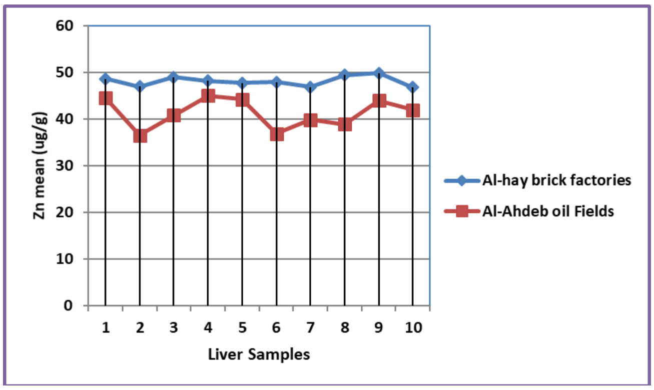

Figure 4: A graph showing the mean value of zinc (Zn) forliver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

Copper (Cu)

The other heavy metal detected in the current study was copper. Compared with the control group (2.672ug\g), both sites show higher trace of copper in the collected liver samples (control table and liver parameters table). As seen with iron level, there was significant evaluation(p value= 0.0481) noticed in amount of copper trace in the liver tissue samples from Al-hay brick factories (27.224 ug\g) compared to Al-Ahdeb oil Fields (19.643 ug\g) as shown in (table 1) and (figure 1, 5).

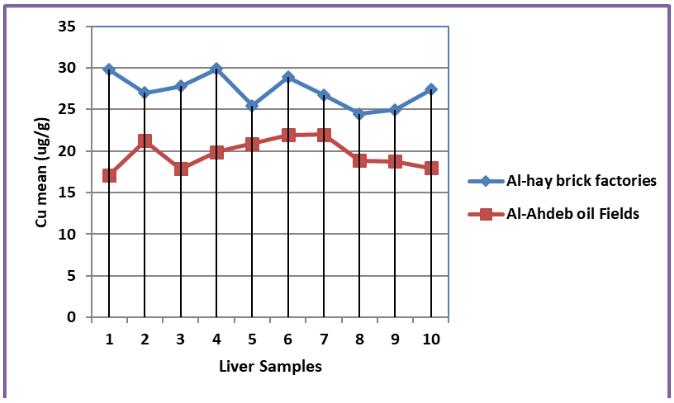

Figure 5: A graph showing the mean value of copper (Cu) forliver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

Cadmium (Cd)

Furthermore, there was a high increase in trace of Cadmium in liver tissue samples from Al-hay brick factories area (0.228ug\g) compared to AI-Ahdeb oil field samples (0.05 ug\g) which is showing high rise in both the areas with control group(0.0040ug\g). Moreover, high significant differences (P value =0.0002) was seen in Cadmium trace between Al-hay brick factories area and Al-Ahdeb oil Fields samples as shown in (table 1) and (figure 1, 6).

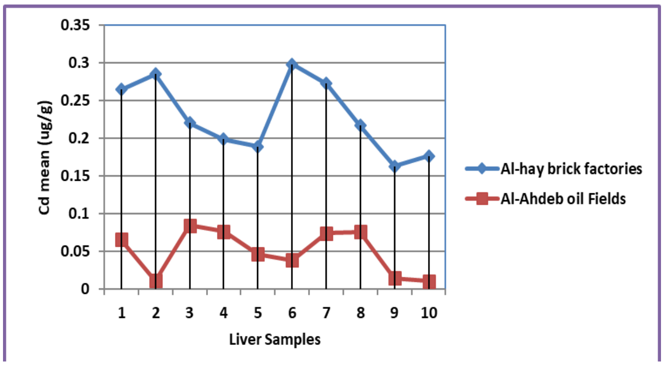

Figure 6: A graph showing the mean value of cadmium (Cd) for liver samples taken from Al-Hay brick factories and Al-Ahdeb oil field.

CONCLUSION

All mineral parameters studied were considerably higher in samples taken near Al-Hay brick factories than in samples taken near Al-Ahdeb oil fields. This indicates that these areas are heavily contaminated and may be unsafe for human habitation due to the hazardous effect associated with high rate of concentration of toxic heavy menials. Nevertheless, it should also be remarked that the variable percentage of accumulation between the two aforementioned regions could be due to the fact that those in responsible for managing the oil field equipped filters to decrease the quantity of pollutant emitted from combustion of gases produced from oil extraction operations.

Conflict of interest: None.

REFERENCES

1- Ronco C, Haapio M, House AA, Anavekar N, Bellomo R, (2008). Cardio-renal syndrome. J Am Coll Cardiol. 52:1527–39.

2- Bellomo R, Auriemma S, Fabbri A, et al, (2008). The pathophysiology ofcardiac surgery-associated acute kidney injury (CSA-AKI). Int J ArtifOrgans. 31:166 –78.

3- Mishra J, Dent C, Tarabishi R, et al, (2005). Neutrophil gelatinase-associated lipocalin (NGAL) as a biomarker for acute renal injuryafter cardiac surgery. Lancet 365:1231– 8.

4- Youn-Joo A,(2003). Total, dissolved, and bioaccumulation in freshwater fish with emphasis on the dietary influence. Water Res 34: 4234-4242

5- Harikumar and Nasir,(2010). Ecotoxicological impact assessment of trace elements in core sediments of a tropical estuary. Ecotoxicol Environ Safe 73: 1742-1747.

6- Terzano, C., Di Stefano, F., Conti, V., Graziani, E. & Petroianni, A, (2010). Air pollution ultrafine particles: toxicity beyond the lung. Eur Rev Med Pharmacol Sci 14, 809–821.

7- Chen, J. et al, (2014). Impact of Relative Humidity and Water-Soluble Constituents of PM 2.5 on Visibility Impairment in Beijing, China. Aerosol Air Qual Res 14, 260–268.

8- Georgieva, E., Stoyanova, S., Velcheva, I., Vasileva, T., Bivolarski, V., Iliev, I., and Yancheva, V, (2014). Metal effects on histological and biochemical parameters of common rudd (Scardinius erythrophthalmus L.). Archives of Polish Fisheries, 22(3), 197-206.

9- Förstner, U., and Wittmann, G. T, (2012). Metal pollution in the aquatic environment: Springer Science & Business Media.

10- Cheng, W. W., and Gobas, F. A, (2007). Assessment of human health risks of consumption of cadmium contaminated cultured oysters. Human and Ecological Risk Assessment, 13(2), 370-382.

11- Hordyjewska A, Popiołek Ł, Kocot J, (2014). The many "faces" of copper in medicine and treatment. Biometals. 27(4):611-21.

12- Al-Najare, G.A, (2012). Concentration of metals in the fish Lizathe Iraqi marine Estimation. Journal of King abdulaziz university /Marin sciences. 23.(1)

13- Al-Samawi, S.M., (2017). Detection of some heavy metals at different levels of biological organization on two fish species in Tigris River. MSc. Thesis. Coll of Vet Med Univ of Baghdad, p. 120.

14- Olgunoğlu, M. P. and Olgunoğlu I. A, (2011). Seasonal variation of trace elements in muscle tissues of two commercially valuable freshwater fish species Silurus triostegus and Barbus grypus (Heckel, 1843) from Atatürk Dam Lake (Turkey). African Journal of Biotechnologyl, 10(34): 6628-6632.
15- Nicoara A, Patel UD, Phillips-Bute BG, et al, (2009).Mortality trendsassociated with acute renal failure requiring dialysis after CABGsurgery in the United States. Blood Purif. 28:359 – 63.
16- Chertow GM, Burdick E, Honour M, Bonventre JV, Bates DW, (2005). Acute kidney injury, mortality, length of stay, and costs in hospital-ized patients. J Am Soc Nephrol. 16:3365–70.
17- Aregger F, Wenaweser P, Hellige GJ, et al, (2009).Risk of acute kidneyinjury in patients with severe aortic valve stenosis undergoing trans-catheter valve replacement. Nephrol Dial Transplant. 24:2175–9.