Nat. Volatiles & Essent. Oils, 2021; 8(6): 3138-3145

NVEO
Natural Volatiles &
Essential Oils

Studying The Effect Of Lead And Cadmium On Some Physiological And Biochemical Aspects Of Workers In The Industrial District And Traffic Police In The City Of Tikrit

Noor Qutaiba Saleh Al-Azawy , Prof. Dr. Yaseen Hussein Uwaed Al- Juboury , Prof Dr. Muneef Saab Ahmed Al-Janaby

Abstract The current study, which has taken place in the city of Tikrit, targets the negative effects of environmental pollution with trace elements emitted from cars, soldering and painting on the lives of its workers, as well as the effect of the accumulation of these elements in their bodies and for different exposure periods.It is divided into five different groups according to the place and nature of the work.It includes workers in the industrial district, traffic police, owners of shops overlooking the street, gas stations and the village of Al Aali, and it is considered the control group. Approximately 60 blood samples are collected, with lead and cadmium nominated for the study and knowing their effect on some liver functions. The results show a discrepancy in the values of the studied variables and their concentrations in these studied groups. The results are as follows:

Measuring the concentrations of trace elements in the blood serum of those exposed in the studied groups shows a significant increase at the significant level ($p \leq 0.01$) in the concentrations of cadmium in the blood serum of the silencer soldering group, followed by the car paintings group, and decreasing in the rest of the studied groups. The results also show a significant increase in lead at the significant level ($p \leq 0.05$) in the silencer soldering group and the car paint group, followed by the traffic police group.

These pollutants have had an effect on the concentrations of some enzymes in the blood serum, as they increase significantly at the significant level ($p \leq 0.01$) of the concentrations of the aminotransferase enzymes AST, ALT and GGT in the car paint group, followed by the silencer soldering group.

Introduction

Air pollution is one of the most common environmental pollution problems due to the easy spread of pollutants and their transfer with the air from one area to another in a short period of time (Popov et al., 2019).

Among the main sources of air pollution are air pollutants associated with traffic, and it is considered one of the dangerous pollutants in the current era due to the increase in the number of vehicles in cities all over the world(Jacyna et al., 2017).

These traffic-related pollutants may have direct or indirect health effects on humans due to the residents' living habits and daily activities, as they are exposed to trace elements through food, skin contact and air inhalation (Manisalidis et. al., 2020).

Exposure to environmental pollution is more significant for workers such as motorists, gas station workers, traffic police, workshop workers, tunnel workers and roadside vendors in trafficked areas. These places are more susceptible to metallic pollution from motor vehicles (Gu et al., 2019). It may lead to diseases, and damage to the functions of important parts of the body such as the liver, kidneys, nervous system, heart and brain, and affects the fetus, children, the elderly, cardiovascular patients and angina pectoris. It is also due to air pollution and its effect can be fatal, especially at high concentrations (Glencross et. al., 2020).

Cars of all types constitute a major source of pollution and poisoning with lead and cadmium, and its damage to the health of human societies, especially in industrial areas and densely populated areas. The high population density in urban areas also leads to an increase in human activities and the corresponding pollution risks compared to rural areas (Osuagwu et al., 2019).

Trace elements affect the activities of enzymes by distorting their structure and affecting their action as they act on specific substrates of metabolism (Durkalec et al., 2018). The levels of enzymes have diagnostic value because under normal conditions very low amounts of intracellular enzymes are released into the blood serum and compared to changes in the activities of these enzymes is an indicator of pathology (Asrani et al., 2019). Sensitive analysis gives insight into pathological changes resulting from exposure to trace elements. Increased levels of liver enzymes indicate possible liver toxicity due to mineral contamination.When tissue damage occurs, enzymes enter the blood according to their size, and enzymes such as alkaline phosphatase (ALP) act , aspartate transaminase (AST), alanine transaminase (ALT) and gamma-glutamyl transaminase (GGT) peptides work as useful substances and an indicator of extent of contamination (Das et.al.,2015)

Aims of the study :

- Estimating the concentrations of some trace elements (lead, Pb, cadmium, Cd) in the blood serum of people exposed to environmental pollution.
- Estimating the concentrations of some liver enzymes variables by measuring (GGt, AST, ALT) in the blood serum of people exposed to environmental pollution.

Materials and working methods:

Collecting samples from the study sites:

The study samples are taken from five different locations and professions in the city of Tikrit, and 60 samples are collected as follows:

The first site (St1): This site represents the industrial district of the city of Tikrit, and includes (a group of workers in welding car silencers G6 and a group of workers in car paints G3).

The second site (St2): represents the group of workers in the gas stations G2 from several different areas of the city of Tikrit.

The third site (St3): represents the group of shop owners G4 overlooking the street of the city of Tikrit.

The fourth location (St4): represents the group of traffic policemen G1 who are located at different traffic intersection points.

The fifth site (St5): villages and countryside. This site represents the Aali area and is considered as the control group G5.

Phlebotomy:

An quantity of (10) ml of venous blood samples are drawn from the volunteers included in the study using a sterile plasticdis posable syringe. It is placed in plastic plain tubes with tight covers and free from anticoagulant.The blood is left at room temperature 25°C until clotting and then placed in a centrifuge for 15 minutes at a speed of 3000 rpm. The serum is withdrawn by a micropipette and saved directly in the freezer (-20 m) after being distributed in four abenddr of tubes until used for biochemical assays and trace elements measurement.

The samples are taken from the workers with the trace elements estimated. The modified method is employed which is used by (Rand, 1976), and the method by (Kunnaths and Jean, 1981).As (1) ml of blood serum is taken and placed in a glass beaker of (50 ml) volume, and (2) ml of H2SO4 are added reaching the point of charring.Then, (2) ml of HNO3 are added to turn the solution into a filtrate, put on a hot surface and left until reaching the lowest possible volume. It is cooled, and (1) ml of HCL is added and placed on a hot surface to reach the lowest volume, and cooled and diluted to (50) ml of distilled water.It is measured by the Atomic Absorption Spectrometer Model AA-6200-JAPAN supplied by Shimadzu Company, according to the wavelength for measuring each element, where cadmium is measured at a wavelength of 8.288 nm and lead is measured at a wavelength of 283.3 nm.

Statistical Analysis

The results are statistically analyzed by applying the statistical program Minitab (Ver - 17). The ANOVA variance analysisis used. Arithmetic means are compared using Duncun's Multiple Range test at 0.05 and 0.01 probability levels (Al-Rawi, 2000).

Cadmium concentration in the blood serum of workers in the city of Tikrit:

Figure (1) shows the results of cadmium concentrations in the serum of workers, with no significant differences between the studied groups compared to the control group, except for the silencer soldering group (G6). Cadmium concentrations are significantly high at a significant level (P≤0.01)), followed by the car painting group G3 compared to the control group G5.These results are in agreement with numerous studies (Pizzino et al., 2014)). It is observed that a high percentage of cadmium is present in the blood of industrial workers.Al-Fahadi (2002) found an increase in cadmium in the blood serum of oil workers, traffic employees, bus drivers and generator operators in Mosul compared to a group of people living in rural areas far from sources of pollution.

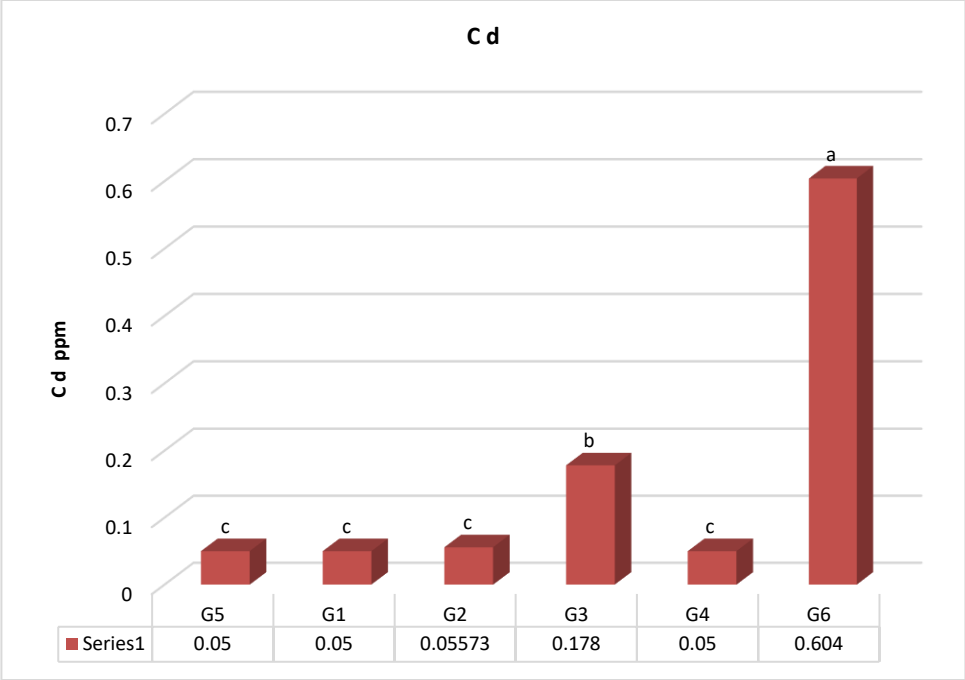

Figure (1): The effect of pollutants on cadmium concentrations in the blood serum of workers in .the study groups in Tikrit city

Measuring the concentration of lead in the blood serum of workers in Tikr it city:

Figure (2) shows the concentrations of lead in the serum of the workers, and it is found that there are no significant differences between most of the studied groups. It increased significantly at a significant level (P≤0.05) for three studied groups, namely silencer soldering group G6, car paint group G3, and traffic police group G1 in comparison with the control group. These results are in agreement with the findings by Al-Aqidi (2020).The reason for the high concentrations of lead in the blood serum of industrial workers is due to their proximity to sources of pollution with this element, such as in car repair and welding workshops, and their presence in areas crowded with cars that use gasoline or other fuels that contain tetraethyl lead or tetramethyl lead, in order to avoid the occurrence of the crack of combustion (Goyal et al., 2021).It is noted, in general, that there is a high concentration of lead in the blood serum of the six studied groups, and this confirms that the main source is what is emitted from car exhausts, which is an increasing source of pollution in the environment.

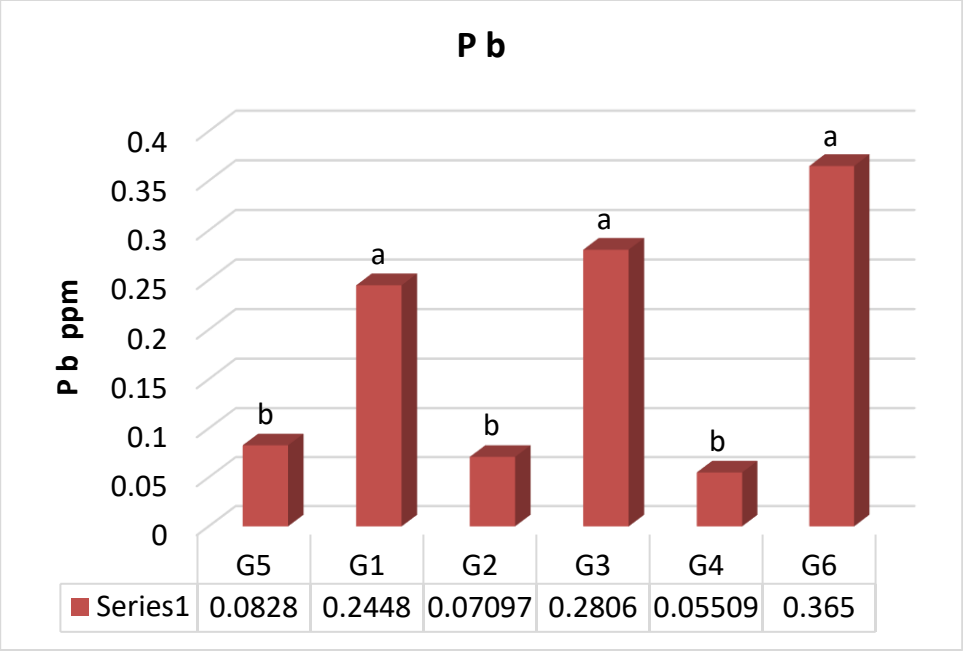

Figure (2): The effect of pollutants on lead concentrations in the blood serum of workers in the study groups in Tikrit city

Effect of casted pollutants on the concentration of the aspartate amino group transporting enzyme (AST) and the concentration of the alanine amino group transfer enzyme (ALT) in the blood serum of workers in Tikrit city:

Figure (3) shows the effectiveness of the concentration of the transporting enzyme of the amino-aspartate group AST, as there is a significant and high increase at a significant level (P≤0.01)) in the car painting group G3 followed by the silencer soldering group in comparison with the control group G5. There are no significant differences for the rest of the studied groups compared with the control group G5, respectively.

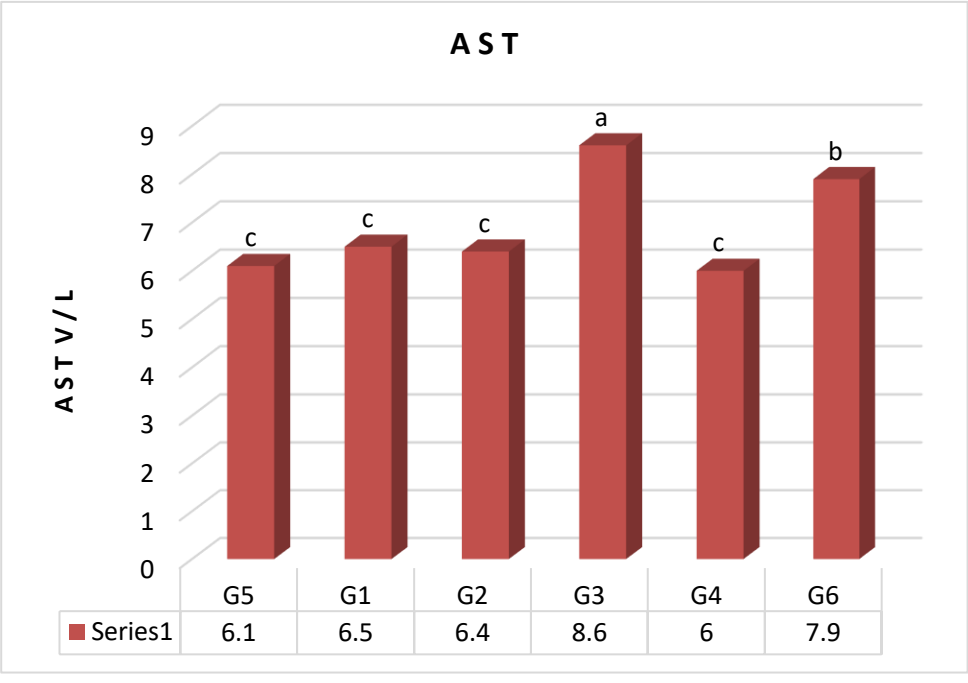

Figure 3: The effect of pollutants on the effectiveness of the concentration of the aspartate amino group transporting enzyme (AST) in the blood serum of workers in Tikrit city.

Figure (4) shows the results of the effectiveness of the concentration of ALT in the blood serum of the workers, as there is a significant increase at the significant level (P≤0.01) in the silencer soldering group G6 and the car paint group G3 followed by the group of gas stations G2 compared to the control group G5, and there are no significant differences for the rest of the studied groups.It is observed that the liver enzymes in industrial workers are significantly higher, as exposure to trace elements is associated with an increase in the activity of liver enzymes, and this indicates an increased risk of hepatotoxicity and hepatocellular carcinogenesis.The increase in the activity of AST and ALT enzymes can be explained by damage to liver cells as a result of exposure to the toxic effect of trace elements, as the liver suffers from cell necrosis, which leads to the release of more enzymes. These results are in agreement with the study by Okpogba et. al.(2021).

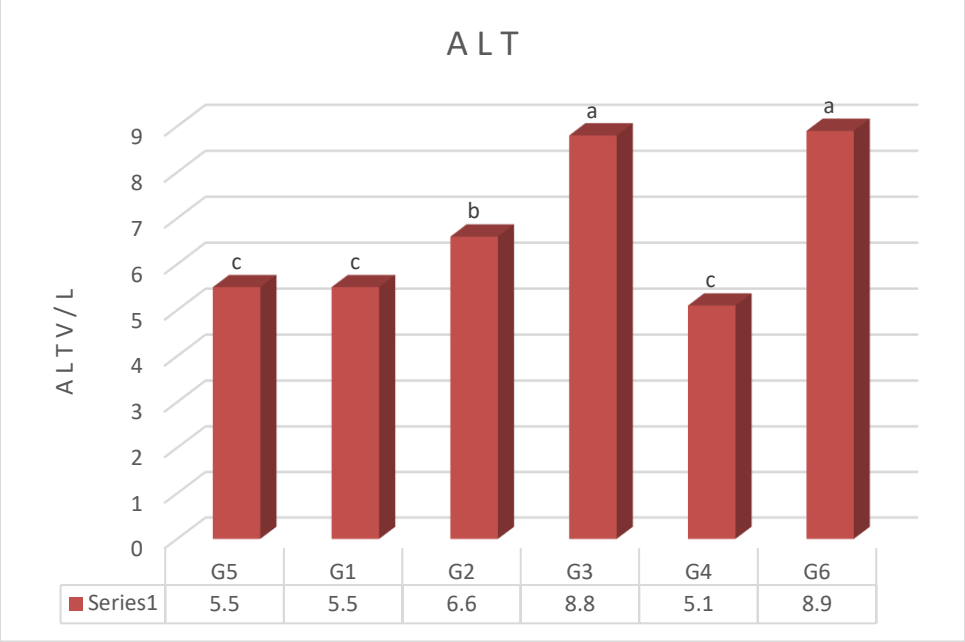

Figure (4): The effect of pollutants on the effectiveness of the concentration of the amino-alanine group (ALT) transporter enzyme in the blood serum of workers in Tikrit city.

The effect of pollutants on the effectiveness of the concentration of GGT enzyme in the blood serum of workers in Tikrit city:

Figure (5) shows that there is a significant increase at the significant level (P≤0.01)) in the car paint group G3 followed by the silencer soldering group G6 compared to the control group G5 and there are no significant differences for the rest of the studied groups. These results are in agreement with Lee et al. (2019 .).It is found that chronic exposure to trace elements and gases from car exhaust as well as

volatile organic compounds found in car workshops are associated with the health effects of liver enzyme activities, including an increase in GGT enzyme activity as a result of exposure to trace elements in the car paint group and the silencer soldering group. However, the results of this study do not show any indication of hepatotoxicity in automobile workers as a result of the activities of these enzymes in exposed workers, although it is higher than those in the control group.

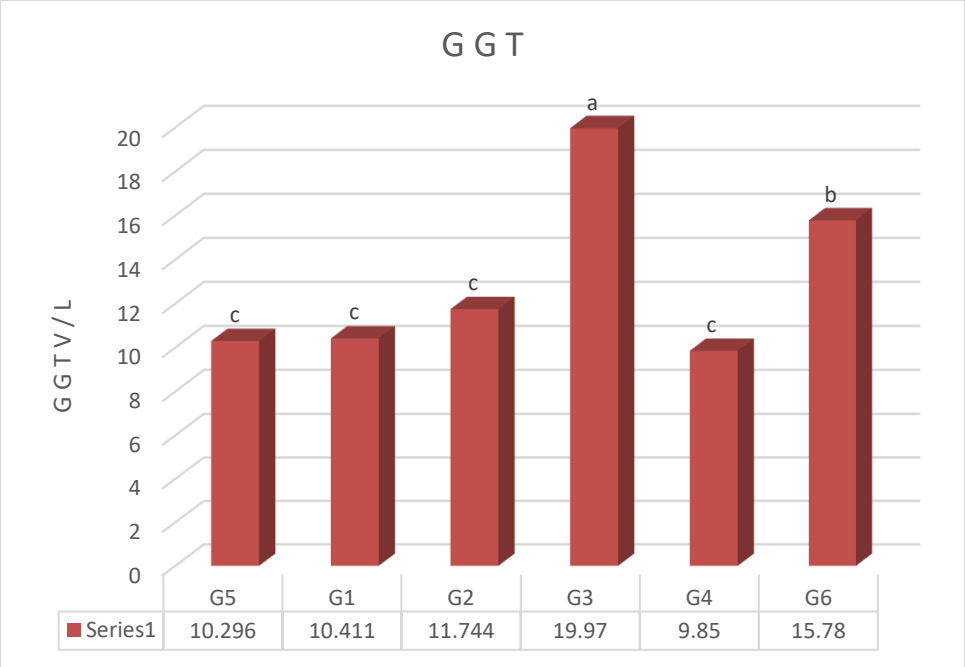

Figure (5): The effect of pollutants on the effectiveness of the concentration of GGT enzyme in the blood serum in the Tikrit city

Conclusions and Recommendations

It is found from the study that the polluted trace elements have negative effects on some liver functions, as they cause a disturbance in some biochemical blood variables represented in the alanine transporter enzyme, the aspartate transporter enzyme, and the peptide transporter enzyme gamma-glutamyl.

References

- **Asrani, S. K., Devarbhavi, H., Eaton, J., and Kamath, P. S. (2019).** Burden of liver diseases in the world. Journal of hepatology, 70(1), 151-171.
- **Das, A. K., Chandra, P., Gupta, A., and Ahmad, N. (2015).** Obesity and the levels of liver enzymes (ALT, AST and GGT) in East Medinipur, India. Asian Journal of Medical Sciences, 6(1), 40-42.
- **Durkalec, M., Nawrocka, A., Krzysiak, M., Larska, M., Kmiecik, M., and Posyniak, A. (2018).** Trace elements in the liver of captive and free-ranging European bison (Bison bonasus L.). Chemosphere, 193, 454-463.

- **Glencross, D. A., Ho, T. R., Camina, N., Hawrylowicz, C. M., and Pfeffer, P. E. (2020**). Air pollution and its effects on the immune system. Free Radical Biology and Medicine, 151, 56-68.
- **Goyal, T., Mitra, P., Singh, P., Sharma, S., and Sharma, P. (2021).** Assessement of blood lead and cadmium levels in occupationally exposed workers of Jodhpur, Rajasthan. Indian Journal of Clinical Biochemistry, 36(1), 100-107.
- **Gu, H., Cao, Y., Elahi, E., and Jha, S. K. (2019).** Human health damages related to air pollution in China. Environmental Science and Pollution Research, 26(13), 13115-13125.
- **Jacyna, M., Wasiak, M., Lewczuk, K., and Karoń, G. (2017).** Noise and environmental pollution from transport: decisive problems in developing ecologically efficient transport systems. Journal of Vibroengineering, 19(7), 5639-5655.
- **Lee, D., Kang, H., and Kim, Y. (2019).** Association between cigarette smoking and serum gam-ma-glutamyl transferase level. Int J Respir Pulm Med, 6, 125.
- **Manisalidis, I., Stavropoulou, E., Stavropoulos, A., and Bezirtzoglou, E. (2020).** Environmental and health impacts of air pollution: a review. Frontiers in public health, 8, 14.
- **Okpogba, A. N., Odeghe, O. B., Ogbodo, E. C., Okwara, N. A., Izuchukwu, E. C. O., Ejovi, O., and Obi-Ezeani, C. N. (2021).** Effect of occupational exposure to heavy metals on the liver functions in persons working in cable manufacturing factory in Nnewi. IP International Journal of Forensic Medicine and Toxicological Sciences, 6(1), 20-27.
- **Osuagwu, J. C., Agunwamba, J. C., and Okoli, S. A. (2019).** An investigation on the extent of soil pollution resulting from vehicular emission. Nigerian Journal of Technology, 38(3), 798-803.
- **Pizzino, G., Bitto, A., Interdonato, M., Galfo, F., Irrera, N., Mecchio, A., .and Altavilla, D. (2014).** Oxidative stress and DNA repair and detoxification gene expression in adolescents exposed to heavy metals living in the Milazzo-Valle del Mela area (Sicily, Italy). Redox biology, 2, 686-693.
- **Popov, O., Iatsyshyn, A., Kovach, V., Artemchuk, V., Taraduda, D., Sobyna, V., and Dimitriieva, D. (2019).** Physical features of pollutants spread in the air during the emergency at NPPs. Ядерна та радіаційна безпека, (4 (84)), 88-98.
- **Kunnaths S.S and Jean C.M (1981).** A Rapid Electrothermal atomic absorption Spectrophotometric method for cadmium and lead in 'human whole blood. Clin. Che. 27(11),1866-1871.
- Al-Aqeedi, S. A. I. (2020). Measuring lead levels in some filling stations in some areas of Salah al-Din and studying some physiological parameters of blood for workers in these stations. M.A. thesis, College of Education for Girls, Tikrit University.
- Al-Fahadi, N. H. A. (2002). A comparison of the effect of carbon monoxide, lead and cadmium in the blood of workers in contact with these pollutants.
- Al-Rawi, Kh. M. and Khalaf Allah, A. M. (2000). Statistical methods in agricultural experiments, House of Books for Publishing and Printing. University of Mosul .