

Study of the Effect of Nickel and Copper on Kidney Function and Some Antioxidants among Workers in the Industrial District and the Traffic Police in Tikrit City

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Abstract

The present study, carried out in the city of Tikrit, aimed at the negative effects of environmental pollution with trace elements emitted by cars, solders and paints on the lives of their workers, as well as the effect of the accumulation of these elements in their bodies and for different periods of exposure. Shops overlooking the street, gas stations and the village of Al Aali were considered the control group, as around 60 blood samples were taken from them. The results showed a discrepancy in the values of the variables studied and their concentrations in these studied groups, and the results were as follows:

Measurement of the concentrations of trace elements in the blood serum of people exposed to the studied groups showed a significant increase in the moral level ($p \leq 0.01$) in the concentrations of nickel in the serum of the salsa solder group, followed by the traffic police group, where versus copper which increased significantly in the moral level ($p \leq 0.01$). For all groups studied except for the parsley welding group, where the copper concentration decreased. As for urea, it increased significantly at the significant level ($p \leq 0.01$) in the control group, followed by Street View group, and decreased significantly in the meat sauces group. On the other hand, uric acid showed a significant increase in the group of traffic police officers and a decrease in the group of street-facing shops. Moreover, creatine increased significantly at a significant level ($p \leq 0.05$) in the gas station group, followed by the parsley welding group, and decreased in the traffic police. As for the antioxidants, the results stated a significant increase in glutathione at the moral level ($p \leq 0.01$) in the salsa meat group, followed by the street-viewing shops group, and it decreased in the car paint group. The catalysts showed a significant increase at the moral level ($p \leq 0.01$) in the group of shops overlooking the street and decreased in the traffic police group.

Key words: nickel, copper, kidney function, antioxidants

Introduction

Air pollution poses a serious and widespread threat to the environment, and is responsible for many adverse health effects. This pollution likely reflects anthropogenic sources emitted from road traffic that contain not only vehicle exhaust emissions, but also tire and brake wear and resuspension of dust (Orru et al., 2017). The air in cities is polluted with trace elements, especially in areas with traffic congestion and industrial areas (Han et al., 2018). One of the most important causes of air pollution is the result of non-artificial natural sources, for example, increased gases from volcanoes, lakes and swamps, or industrial sources of pollution resulting from human activities, such as burning

fuels, gases and nuclear radiation. Or waste emitted from transport vehicles or steam stations laden with toxins. Industrial, including trace elements that pollute the air first, then water and soil, which leads to an imbalance in the proportions of substances available in their components (Nakazato et al., 2021).

The large number of human industrial activities in the recent times led to an increase in emissions and then an increase in metal concentrations in the atmosphere (Sancini et al., 2012). Thus, it leads to an increase in their concentrations in cities at high levels. In recent times, researchers have been interested in studying trace elements in terms of their spread in the environment, their biological effects and their relationship to human health, because they are one of the types of environmental pollution resulting from human industrial or agricultural activities. A group of these elements is important for the continuation of life Living organisms despite their low required concentrations, which do not exceed parts per million, and if the concentration of these elements exceeds the normal limit within the tissues of living organisms, it may cause damage to their physiological functions, as it is very toxic (El-kady and Abdel-wahhab, 2018).

Research has shown that most of the copper that enters the environment quickly becomes stable in a way that does not pose a threat to the environment. In fact, copper does not accumulate in the body and does not accumulate in the vital chain (Cancan et al., 2020), the presence of copper in the human body helps in the production of hemoglobin in the blood, In spite of its importance, it causes anemia, liver and kidney damage at high concentrations, and causes stomach and intestinal (Taylor et al., 2020).

Nickel deficiency has not been stated to be a concern in humans, although this may cause biochemical changes such as decreased iron resorption that leads to anemia (Wu et al., 2017). As acute exposure of the human body to nickel may cause several health problems in the liver, kidneys, spleen, brain, tissue damage, lung and nose cancer (Buxton et al., 2019). Although the biological function of nickel is still somewhat unclear in the human body, yet nickel is found in the body in the highest concentrations in nucleic acids, especially RNA, and nickel may help in the production of prolactin and thus participate in the production of milk (Alfano and Cavazza, 2020).

The aims of the study

- The concentrations estimation of several trace elements (Cu, Ni) in the blood serum of people exposed to environmental pollution.
- The concentrations estimation of renal function variables: urea, creatinine, and uric acid in the blood serum of people exposed to environmental pollution.
- The concentrations estimation of some antioxidant variables (glutathione, catalase) in the blood serum of people exposed to environmental pollution.

Materials and Methods

Samples Collecting from the study sites:

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

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

The second site (St_2): represents the group of workers in the gas stations G_2 from several different areas of the city of Tikrit.

The third site (St_3): represents the group of shop owners overlooking the G_4 street of the city of Tikrit

Fourth location (St_4): represents the group of traffic policemen G_1 who are located at different traffic intersection points

The fifth site (St_5): villages and countryside This site represents the Al Aali area and the G_5 control group promised.

2- Draw blood

(10) ml of venous blood samples of the volunteers included in the study were withdrawn using a sterile plastic syringe disposable syringe and placed in plastic tubes with tight covers and free from the anticoagulant substance Plain tube. Centrifuge for 15 minutes at a speed of 3000 rpm. The serum is withdrawn by means of a micropipette and then stored directly in the freezer ($-20\text{ }^{\circ}\text{C}$) after being distributed in four abenddrof tubes until they are used for biochemical assays and trace elements measurement.

The samples were taken from the workers and the trace elements were estimated using the modified method that was used by (Rand 1976), and the method (Kunnaths and Jean, 1981). As (1) ml of blood serum was taken and placed in a glass beaker of (50 ml) volume, and (2) ml of H_2SO_4 was added to it to the point of charring, and then (2) ml of HNO_3 was added to turn the solution into clear and put it on a hot surface and left until it reached The lowest possible volume, then cool, then add (1) ml of HCL and put it on a hot surface to reach the lowest volume, then cool and dilute to (50) ml of distilled water and measured by atomic absorption spectrometer model AA-6200-JAPAN supplied by Shimadzu Company, according to The wavelength to measure each element, where copper is measured at a wavelength of 324.8 nm and nickel is measured at a wavelength of 232nm.

Results and Discussion

2- The effect of pollutants on the concentrations of some trace elements in the blood serum of workers in the study groups in the city of Tikrit:

Table (1) states the copper concentrations in the blood serum of workers in the industrial district 6G in the city of Tikrit according to the studied groups and those exposed to pollution in their places of residence and in different professions. The results showed that there were no significant differences between the studied groups and the control group (G_5) at a significant level ($P \leq 0.01$), except for the salsa meat group G_6 , which showed a significant decrease in the concentration of copper in the blood serum compared to the control group G_5 . It is noted that copper concentrations decreased with the increase in exposure to pollution among the studied groups. These results agreed with the study (Al-Janabi, 2008), where his study indicated a decrease in copper concentrations at Baiji power station. The low levels of copper in the G_6 salsa group could be a result of an adaptive response to oxidative stress or an increase in the generation of free radicals as a result of exposure to trace elements.

Copper plays an important role in the redox activity in tissues, especially the enzyme Cytochrome oxidase, which is important in many activities. Vitality, especially in the production of energy needed for growth and for the biological activity of copper also has a major role in the oxidative

enzymes found in some glands such as the thyroid and pituitary glands, as well as in the lung, liver, brain and red blood cells. Therefore, copper deficiency leads to many metabolic and growth disorders, and severe deficiency may lead to cases of anemia and hair loss, as it leads to weakness and necrosis of the bones (Zanco 2020, 2020).

Table (1) also clarifies the results of the study of nickel concentrations in the blood serum of the workers, and there was a significant increase at a significant level ($P \leq 0.01$) in the Salasat meat group G_6 , followed by the traffic police group G_1 , and there were no significant differences between the rest of the studied groups compared with the control group G_5 , respectively. The results of this study agreed with (Znad and Al-Sinjary, 2020).

The results of the study indicated a high increase in the concentration of nickel in the workers blood in industrial areas, which may cause environmental problems and a health hazard in the workplace, the least polluted and the safest.

Table (1) the effect of some pollutants in Tikrit city of on some ionic variables (trace elements)

Ni ppm	Cu ppm	Variables groups
0.31±0.28 B	1.01±0.04 a	Traffic Police Group G_1
0.05±0.00 D	1.00±0.26 A	G_2 Gas Station Group
0.15±0.22 C	1.04±0.22 A	G_3 car paint group
0.05±0.00 D	1.04±0.12 A	A group of shops overlooking the street G_4
2.37±0.44 A	0.70±0.08 B	G_6 Soldering Sauces Set
0.05±0.00 D	1.06±0.22 A	G_5 control group

Numbers followed by different lowercase letters on the same column mean that there are significant differences with a probability level ($P \leq 0.01$).

Numbers followed by similar lowercase letters on the same column mean that there are no significant differences

2-The effect of pollutants on kidney functions in the workers' blood serum in the study groups in Tikrit city:

Table (2) shows the results of creatinine concentration and a significant increase at a significant level ($P \leq 0.01$) in the gas station group G_2 , followed by the salsa meat group G_6 , respectively, compared to the control group G_5 , and it decreased significantly in the traffic police group G_1 . Creatinine in the exposed blood is due to the fact that creatinine is a metabolic waste that is naturally excreted through the urine. Glomerular filtration any decrease in the glomerular filtration rate leads to an increase in creatinine in the blood. These results confirm that the increase in the concentration of trace elements in the blood with the increase in the duration of exposure to the studied groups led to an increase in creatinine concentrations, and these results are consistent with what was reached (Scammell et al. ,2019).

Table (2) also states the results of uric acid concentration, and there was a significant increase at a significant level ($P \leq 0.01$) in the traffic police group G_1 followed by the car paint group G_3 compared with the control group G_5 and it decreased significantly in the group of shop owners overlooking the street G_4 . Uric acid is made in the liver; it is the end product in the process of assimilation of purines that make up nucleic acids. Then it is transported to the kidneys via the blood, while it is processed in the liver. When there is a disturbance or imbalance in the liver function due to pollutants such as some trace elements, the concentration of uric acid may decrease or increase. The concentration of uric acid increases as a result of taking some medications, and the increase in the concentration of uric acid in the blood may be associated with other symptoms such as kidney stones. The results are in agreement with the findings (2017) (Cui et al.).

Table (2) the effect of some pollutants in the Tikrit city on the function of kidney

Urea Mmol/L	Creatin Mmol/L	Uric Acid Mmol/L	Variables grops
33.10±6.01 B	0.77±0.11 c	7.77±0.82 A	G_1 Traffic Police Group
32.90±6.56 B	0.95±0.13 a	6.46±1.49 bc	Group of gas stations G_2
33.50±5.04 B	0.83±0.12 bc	7.04±0.67 b	G_3 Automotive Paint Set
36.40±5.87 Ab	0.84±0.11 b	5.99±0.53 bc	Group of shops overlooking the street G_4
28.80±5.96 A	0.89±0.15 bc	6.42±0.62 bc	Group of workers in welding sauces G_6
38.90±4.20	0.81±0.08	6.46±0.24	G_5 control group

C	ab	bc	
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Numbers followed by different lowercase letters on the same column mean that there are significant differences with a probability level ($P \leq 0.01$).

Numbers followed by similar lowercase letters on the same column mean that there are no significant differences.

3- The effect of pollutants on the effectiveness of some antioxidants in the blood serum of workers in the study groups in the city of Tikrit:

GSH glutathione also plays an important role in the routine detoxification of many metabolic processes that regulate the function of the immune system. Therefore, the entry of any toxins or pollutants into the body leads to an imbalance in the concentrations of glutathione among the most important glutathione enzymes that work inside the liver. Therefore, the health of the liver And some other organs of the body depend on glutathione, and any imbalance of glutathione leads to damage to this organ. Recent studies have shown that glutathione protects the liver from the effects of radiotherapy and chemotherapy (Hasanuzzaman et al., 2019).

Table (3) clarifies the results of glutathione concentrations, and a significant increase was found at a significant level ($P \leq 0.01$) in the G₆ parsley meat group, followed by the shopkeepers group overlooking G₄ Street in compared with the control group G₅, and significantly decreased in the automotive paint group G₃. Our result indicate that exposure to trace elements affects the exposed antioxidants and links them to oxidative stress and glutathione patterns that play a role in detoxification in humans. When trace elements enter the body, fat oxidation can produce MDA free radical compounds to overcome these free radicals, the body will adapt to produce enzymes. Furthermore, the present study, according to Ajeel et al. , 2021, show that glutathione can help protect against diseases caused by oxidative stress and also play an important role in regulating immune cells, an effective detoxifying agent. They also added that low glutathione levels were associated with impaired liver function, impaired kidney function, impaired immunity and heart disease.

Table (3) also, states the results of catalase concentrations, and there is a significant increase at a significant level ($P \leq 0.01$) among the group of shop owners overlooking the street G₄ compared with the control group G₅. Significantly decreased for the traffic police group G₁, and there were no significant differences for the rest of the studied groups. Catalase enzyme CAT converts hydrogen peroxide to molecule H₂O and O₂, so it leads to an increase in the formation of H₂O₂, and the formation of catalase is increased as this enzyme works to eliminate reactive oxygen species (ROS) by converting this substance into harmless molecules, increasing the activities of the catalase enzyme because this enzyme. It has functions related to SOD and it catalyzes the dissolution of the superoxide anion radical to H₂O₂ and H₂O.

It is detoxified to the H₂O and O₂ molecule by catalase due to the anti-oxidant inhibiting effect. Forming the SOD-CAT system, providing the first line of defense against toxic oxygen radicals. It is usually used as a biomarker or Indicator of ROS production our study is consistent with that of Slota et al., 2021) indicating that catalase plays an important role as an antioxidant against ROS generated

during prolonged exposure to gasoline-derived and, subsequently, in the maintenance of cell turnover in petrol station workers. .

Table (3) the effect of some pollutants in Tikrit city on some antioxidant variables

Catalas $\mu\text{Mol/L}$	Glutathion $\mu\text{Mol/L}$	Variables groups
5.20±0.53 c	0.79±0.17 D	Traffic Police Group G ₁
6.17±0.45 B	0.78±0.14 D	Group of gas stations G ₂
6.17±0.26 B	0.58±0.06 E	G ₃ Automotive Paint Set
9.06±0.28 A	1.27±0.19 B	Group of shops overlooking the street G ₄
6.04±1.83 B	1.57±0.17 A	G ₆ Soldering Sauces Set
5.79±0.49 B	1.07±0.04 C	G ₅ . control group

Numbers followed by different lowercase letters on the same column mean that there are significant differences with a probability level ($P \leq 0.01$).

Numbers followed by similar lowercase letters on the same column mean that there are no significant differences

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