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Assessment of Some Hematological and Biochemical Parameters of diesel generator workers in Al-Diwaniyah Province , Iraq

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Abstract. Background: Continuous exposure to pollutants from diesel generators may cause numerous health problems. The current study aimed to determine the effects of diesel generators on workers by examining hematological and biochemical parameters. Methods: The current study was conducted on diesel generator workers in Al-Qadisiyah Governorate. The study consisted of approximately (50) individuals divided into two groups: the first group (25) workers, and the second group (25) healthy individuals (as a control group). The parameters studied included blood parameters (red blood cells, hemoglobin, and pneumococcal size), as well as biochemical tests, including liver function tests (AST, ALT, and ALP), and kidney function tests, including (urea, creatinine, and total protein). Results: The results indicated significant changes ($P<0.05$) in biochemical parameters. There was a significant increase ($P<0.05$) in red blood cell count, hemoglobin, pneumococcal volume, liver function tests (ALT, ALP, AST), urea-creatinine, total cholesterol, and triglycerides. The study results also showed a significant decrease ($P<0.05$) in total protein concentration in generator workers when compared to the healthy group.Conclusion: Direct exposure to pollutants by generator workers may lead to changes in their blood and biochemical parameters because it targets important sites in the body, especially the bone marrow, kidneys, liver, and other organs.

Highlights:

1. Diesel generator workers exhibit significant alterations in hematological and biochemical parameters compared to the control group.
2. Exposure to generator pollutants increases red blood cell count, liver enzymes (ALT, AST, ALP), and kidney markers (urea, creatinine).
3. Reduced total protein levels highlight the adverse effects of prolonged pollutant exposure on overall health.

Keywords: Study, Hematological, Biochemical Parameters, Diesel Generator, Al-Diwaniyah

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Introduction

The phenomenon of private diesel generators has spread throughout Iraq due to the problem of electricity service throughout Iraq that the Iraqi society suffers from, and although it contributed to solving a proportion of the electricity crisis, it caused great environmental damage as pollutants increased with the increase in human activity as a result of the increasing interest in meeting his needs at this age. The most important of which is air pollution due to the emission of toxic gases resulting from fuel combustion, as well as fuel residues. The most affected people are generator workers because they are in direct contact with fuel waste, lubricating oils and gases emitted from fuel combustion [1].

As these pollutants cause an imbalance in the balance of gases in the air, especially in crowded and large areas, which makes other than the air unfit for breathing, as heavy elements are among the most important environmental pollutants, some of which are beneficial to the body in certain concentrations such as iron and zinc, and some are toxic such as cadmium, nickel and lead As its continued emission from industrial sources leads to air pollution [2], as cadmium is classified as a heavy toxic element. It enters the body mainly through the respiratory and digestive systems and is absorbed by them. This absorption is affected by several factors, including age and deficiency. Calcium, iron and protein also depends on the chemical form of the element inside [3], but most cases of cadmium poisoning come by inhalation of laurel or smoke of cadmium, especially its oxides.

A group of studies found that occupational exposure to cadmium leads to an increase in its levels in the blood. Al-Fahadi [4] noted that the level of cadmium is high in the blood among battery workers, generator operators, point workers, traffic employees, and bus drivers in the city of Mosul, and its concentration increases with the length of exposure due to its accumulation. in the blood. Al-Hamish [5] also found an rise in the level of cadmium in the serum of workers in the fertilizer industry and that this increase is directly proportional to the length of exposure, and exposure to lead causes health problems if it affects the nervous and reproductive systems as well as weakening the functions of the kidneys and diseases of the immune system. Blood and hepatitis [6]. Given the importance of the subject, the present study aimed to find out the effect of exposure to diesel generators on workers on the dummy and biochemical

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parameters, as it targets important sites in the body, especially the bone marrow, lymph nodes, kidneys, liver and other organs.

Materials and Methods

A. Sample Collection

Samples were collected from January to August of the year (2020) from different areas in Diwaniyah Governorate . The study consisted of about (50) people divided into two groups: the first group (25) workers and the second (25) healthy individuals (as a control group). Their ages ranged between (20-45) years , and their work period in diesel generators . The average life expectancy of the workers was more than (7) months and less than (6) years, while sick workers, alcohol abusers and smokers were excluded from the study samples.

B. Blood Drawing

(5) ml of brachial vein blood was drawn from each individual and placed in plastic tubes. An amount was placed in a tube that did not contain an anticoagulant for the purpose of conducting biochemical measurements, and another amount of blood was placed in a tube containing the anticoagulant EDTA to perform hematological measurements.

C. Studies Standards

1. Hematological Test

Hematological parameters (RBCs, HG, PCV) were measured using the NSysmex - kx21 (Auto Blood Analyzer).

2. Biochemical Measurements

a. Liver Function

- Determination of Alanin Aminotransferase Activity (ALT)

  The effectiveness of the alline transporter enzyme is estimated using the analysis kit provided by the French company (BIOLABO).

- Determination of Aspartate Aminotransferase (AST)

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The activity of the enzyme transporter of amin aspartate was measured using the prepared kit from the French company (BIOLABO).

- Determination of serum Alkaline phosphates (ALP) level

The concentration of the enzyme base phosphatase was measured according to the method described in the analysis kit prepared from the French company (Bio Merieux).

b. Kidney Functions

Kidney function was measured using a spectrophotometer, and the number of ready analyzes was used for each of the studied parameters (urea, creatinine, total protein) by the French company (BIOLABO).

D. Statistical Analysis

Data analysis was performed using SPSS (version 23v) using T-test to find significant differences between means.

Results and Discussions

A. Hematological Parameters (Rbcs - Hemoglobin HB - PCV Volume)

The results of our study in Table (1) showed a significant rise in both (RBCs) red blood corpuscles , hemoglobin (HB) and (PCV) paced cell volume in the serum of workers compared to the control group as in Figure (1). The current study agreed with the study [7] that was conducted on workers at the Ramadi fuel station, where they showed a significant increase in both the level of RBCs , PCV and hemoglobin (HB) due to the stimulation of the red bone marrow by gasoline, while many studies have shown the role of gasoline in causing disorders in blood formation and the occurrence of diseases [8].

Whereas, the increase in blood cells may be due to the cumulative effect of pollutants in the blood, where the length of exposure to pollutants increases their toxic concentration in the body. Also, continuous exposure to pollutants leads to the efficiency of the lungs in the process of gas exchange, where the blood acts as an adaptive measure by increasing the number of blood cells. Blood to avoid a lack of

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transported oxygen, While high iron levels may be associated with an increase in blood components (hemoglobin and packed cell volume) as a result of the worker's body being exposed As a result of gases coming out of diesel transformer exhausts or workers' handling of generator oils, the high concentration of iron in the body leads to blood viscosity, while a study [9], He noted that people who experience from blood viscosity may have cumulation of cadmium and lead in their organs.

B. Biochemical Analysis

1. Liver Enzymes (AST, ALT, ALP) and Total Protein

The results of the study, show in table (2) and Figure (2), showed a significant increase in liver enzymes represented by the two enzymes (ALT, AST) in the blood serum of workers persons compared to the control group , the reason for the increase in the enzymes ALT and AST may be attributed to an increase in permeability. Cells due to lack of oxygen [10], while the study of Penny et al [11] explained that the reason for the increase in liver enzymes is the result of diseases associated with the breakdown of hepatocytes and tissue cells due to prolonged exposure to pollutants at work sites. In the enzyme ALT as a result of exposure to the first carbon oxide or due to the effect of heavy polluting elements or as a result of the interference between them at the work site, the current study agreed with Rodgers et al., 1994), who indicated that there was a significant increase in the level of the enzyme (AST, ALT) in People in service areas, While the results of our current study were consistent with the study (Al-Janabi, 2004) as well as with the study of [4].

The study also indicated that there was a significant increase in the level of the enzyme ALP among the workers, which explains the reason for the increase because it reflects the functional effectiveness of the liver and bones. Biliary tract and liver and bone tissue abnormalities.

While the study [12] indicated that the reason for the increase in the basal phosphatase enzyme in the serum is due to the increased stimulation of the liver to add quantities of it, and this is inferred through the occurrence of a defect in the bone tissue resulting from the replacement of bone elements with lead or cadmium and the release of the necessary elements from the bone mass. Like

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calcium, zinc and phosphorous, this effect corresponds to the release of the base phosphatase enzyme from bone cells due to the effect by toxic elements. Also among [13] that heavy elements cause a loss of bone mass that was observed through high values of the enzyme basic phosphatase in addition to damage to other organs such as the heart, lungs and red blood cells. This was demonstrated by the high values of amine transporter enzymes (AST, ALT).

It was also observed a significant reduction ($P < 0.05$) in the level of total protein (TP) in the serum of workers (generators oils) when compared with the healthy (control group) , as in Table (2) and Figure (2). This decrease reflects the synthetic efficiency of the liver due to a response to the effect of heavy metals in diesel that impede the manufacture of proteins in the liver between [13], so one of the most important functions of the liver is the synthesis of amino acids to form the proteins that the body needs, especially plasma proteins [14].

2. Urea and Creatinine Level

The results shown in Table (3) and (3) indicated that there was an increase ($P < 0.05$) in the levels of creatinine and urea in the serum of workers at a rate of (39.64 ± 0.25) and (43.51 ± 0.40) respectively compared to the control group. The enzymes in the blood serum on the extent of the safety of the kidneys and in view of the high enzymes in the current study, as it is explained by the occurrence of kidney damage, which led to a functional deficit in the filtering of waste and its excretion due to the influence of heavy elements in diesel generators and their effect on working people, as glomerular filtration in the kidney is inversely proportional to Presence of creatinine and urea in serum [14] .

This reason may be attributed to the gases emitted from diesel combustion that stimulate the immune system to form antibodies that interact with each other, forming compounds that are deposited on the kidneys. This results in kidney dysfunction, especially in the renal tubules, and their ability to absorb some substances, especially proteins and amino acids, decreases and rises. The level of urea in the blood.

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This may also be explained by the increase as a result of direct exposure to kerosene to workers in generators, as the minerals that make up benzene lead to a change in the ion exchange in cell membranes as well as on the structure of proteins and fats. The composition of the fuel has a strong relationship in increasing the levels of urea and creatinine, while [15] indicated in a study conducted on rabbits that there was a change in the tissue composition of the liver and kidneys as a result of exposure to benzene, which was reflected in the levels of urea and creatinine [7].

3. Triglycerides and Cholesterol Parameters

The results in Table (3) showed a significant increase ($P < 0.05$) in the level of cholesterol (CHO) and triglycerides (TG) in the blood serum of workers, as in Figure (3), at a rate of (178.05 ± 0.87 and (144.08 ± 1.28) respectively) compared to the control group. The current study also focused on the study [9] conducted on the blood of workers in private generators in Ramadi Governorate. The reason for this increase is explained by the effect of the gases emitted from the exhaust of diesel generators and their impact on public health due to the toxic fumes they carry, as high cholesterol and triglycerides in the blood serum are an indication of the occurrence of heart disease and arteriosclerosis, where the study explains this rise due to increased direct exposure to cadmium Which causes physiological changes in the body as a result of its interference with some vital processes in the body [16], where high cholesterol is associated with coronary heart disease, thyroid disease and some diabetes cases, while its decrease causes acute hepatitis and malnutrition diseases [17].

The high percentage of triglycerides is also a measure of some metabolic disorders, as it is the base unit of two types of lipoproteins (VLDL, Chylomicrons), and its elevation is usually associated with thyroid disease, diabetes, pancreatitis, kidney disease, alcohol abuse and some drugs [18].

Table 1. Shows the Hematological Parameters for Control Healthy and Generators Workers in Diesel Generators

Parameters	RBCs	HB (mg/dl)	PCV%
Generators workers	5.49±0.04A	14.28±0.15A	44.14±0.18A

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Control Healthy	5.09±0.02B	12.81±0.16B	40.82±0.29B
T- test value	8.348	6.425	9.896

- Values represent (mean ± SE).
- Means with different letters indicate significantly different values at ($P < 0.05$).

Table 2. Shows The Liver Function and Total Protein Parameters for Control Healthy and Generators Workers in Diesel Generators.

Parameters	**ALT (U/I)(**	**AST(U/I)(**	**ALP(U/I)(**	**) TP (g/dl**
Generators workers	25.74±0.33 A	26.42±0.45A	72.1±0.91A	7.09±0.01B
Control Healthy	21.02±0.18 B	21.45±0.24B	49.8±0.86B	7.60±0.02A
T- test value	2.464	9.623	17.377	13.660

- Values represent (mean ± SE).
- Means with different letters indicate significantly different values at ($P < 0.05$).

Table 3. Shows the Kidney Functions and Cholesterol Triglycerides Parameters for Control Healthy and Generators Workers in Diesel Generators.

Parameters	**TG)mg/dl(**	**CHO)mg/dl(**	**Urea (mg/dl)**	**Creatinine (mg/dl)**
Generators workers	144.08±1.28A	178.05±0.87A	43.51±0.40A	0.98±0.01A
Control Healthy	124.15±0.84B	164.14±0.82B	29.64±0.25B	0.77±0.01B
T- test value	12.229	11.348	8.090	9.995

- Values represent (mean ± SE).
- Means with different letters indicate significantly different values at ($P < 0.05$).

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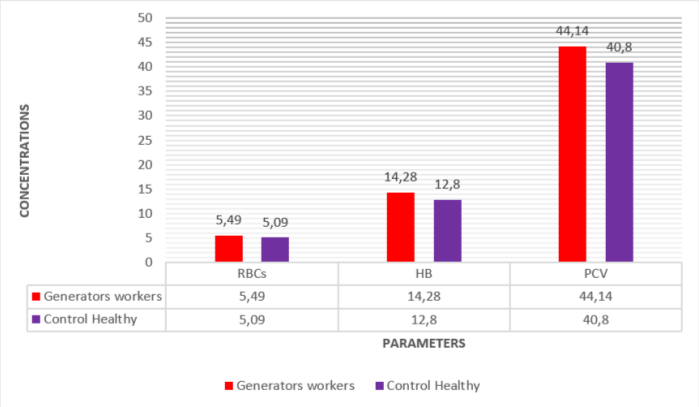

Figure 1. Shown the Levels of (Rbcs , PCV , HB) in Control (Healthy) and Workers in Diesel Generators.

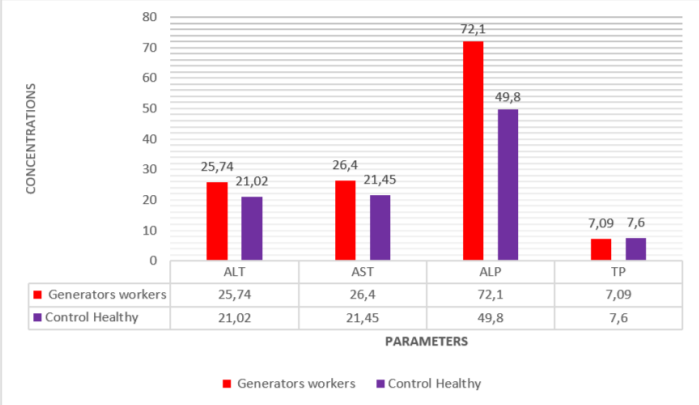

Figure 2. Shown the Levels of (ALT , AST , ALP , TP) in Control (Healthy) and Workers in (Diesel Generators).

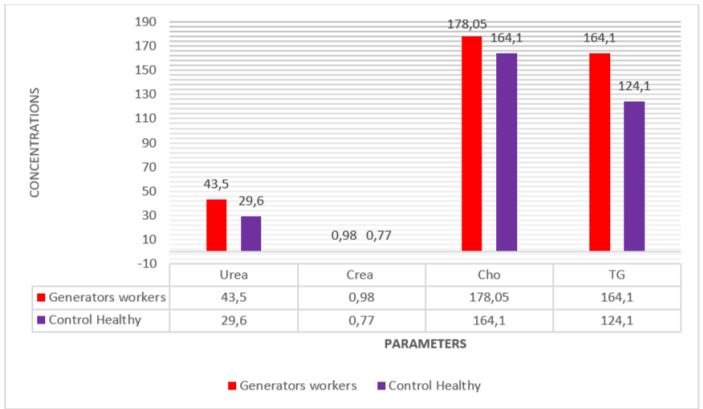

Figure 3. Shown the Levels of (Urea , Crea , TG, Cho) in Control Healthy and Workers in (Diesel Generators).

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Conclusions

The abnormalities in the hematological and biochemical results obtained may be the result of long-term exposure to toxic gases such as carbon monoxide and nitrogen oxide, which have had negative effects on these parameters, potentially affecting liver, kidney, and bone marrow function.

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