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Study the Effect of Gases Rising From Electric Generators on Sera Lead, Advanced oxidation protein products, Acid, alkaline DNaes and Ecto-5-prime-nucleotidase Activityin Iraqi Workers Employed on the Operation of Diesel Generators

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ABSTRACT

Background: Lead poisoning happens when lead builds up in the body, frequently over a period of months or years. Insignificant amounts of lead can cause serious health complications. The present study aimed to assessedthe effect of gases rising from electric generators on Iraqi workers employed on the operation of diesel generators mainly increased lead poisoning symptoms on them. Materials and Methods:SerumAdvanced oxidation protein products (AOPPs), lead,Acid ,alkaline DNaes and Ecto-5-prime-nucleotidase Activities were analyzed in fiftyIraqi workers employed on the operation of diesel generators. Results: The results of the study showed a significant elevation in Advanced oxidation protein products (AOPPs), lead, Acid, alkaline DNaes and Ecto-5-prime-nucleotidase activities in Iraqi workers employed on the operation of diesel generators in association to healthy control samples. Conclusions: The results Exposure to lead possibly will decrease lifespan and have health effects in the long term for these workers.

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INTRODUCTION

Diesel generators which are used in the living quarters when electricity is cut off, is a significant source of emissions of polluted air. In electricity generation, an electric generator is a device that converts mechanical energy to electrical energy[1]. Carbon monoxide is the product formed by the incomplete combustion of materials containing carbon. The molecular formula is CO. Carbon monoxide is usually present in the workplace as a gas. It can, however, be liquefied and solidified. Carbon monoxide is produced in large amounts by several industrial processes carbon monoxideis produced by the incomplete combustion of materials containing carbon[2]. Lead poisoning (also known as plumbism) is a medical condition in humans and other vertebrates caused by increased levels of the heavy metal lead in the body. Lead affects on a variety of body processes and is poisonous to many organs and tissues as well as the heart, kidneys, bones, nervous systems , and intestines. It interferes with the improvement of the nervous system and is therefore predominantly toxic to children, producing potentially enduring learning and behavior disorders. Symptoms include abdominal pain, confusion, headache, anemia, irritability, and in severe cases seizures, coma, and death[3]. Deoxyribonucleases are a great group of enzymes categorized by considerable structural and functional variety. In eukaryotic cells they are complicated in a range of cellular jobs, including DNA repair, recombination and genome degradation. The degradation of nuclear DNA, a stamp of programmed cell death (PCD), is a development that happened both in animals and in plants(4).The two main types of DNase originate in humans are known as Alkaline DNase (DNase I) and Acid DNase (DNase II) [5]. The activity of alkaline DNase is the result of a group of enzymes which depolymerise DNA in alkaline situations, whereas that of acid DNase, a group of enzymes have optimal activity in acid pH[6]. Ecto-5-prime-nucleotidase (5-prime-ribonucleotide phosphohydrolase; EC 3.1.3.5)is an enzyme that in humans is encoded by the NT5E gene [7]. It is catalyzes the conversion at neutral pH of purine 5-prime mononucleotides to nucleosides, the preferred substrate being AMP. The enzyme consists of a dimer of 2 identical 70-kD subunits bound by a glycosylphosphatidyl inositol linkage to the peripheral face

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of the plasma membrane. The enzyme is used as a indicator of lymphocyte differentiation. Accordingly, a deficiency of Ecto-5-prime-nucleotidase happens in a variation of immunodeficiency diseases. Other forms of 5-prime nucleotidase be present in the cytoplasm and lysosomes and can be illustrious from ecto-NT5 by their substrate affinities, requirement for divalent magnesium ion, activation by ATP, and inhibition by inorganic phosphate[8]. The AOPPs are one of the biochemical parameters indicative of oxidation stress. The AOPPs are proteins, predominantly albumin and its cumulative damaged by oxidative stress [9]. The AOPPs are the dityrosine-containing and crosslinking protein products formed during oxidative stress through reaction of plasma protein with chlorinated oxidants[10]. The aim of the present study is to determine the effect of gases rising from electric generators on Iraqi workers employed on the operation of diesel generators especially increased lead poisoning symptoms such as headaches,muscle weakness irritability, fatigue, difficulty sleeping, difficulty learning or concentrating, aggressive behaviour, stomach pain, constipation, vomiting, nausea, weight loss, anemia, unusual paleness, kidney function disorder , and loss of appetite on some biochemical parameters.

MATERIALS AND METHODS

The sampling procedure was done in 50 Iraqi workers employed on the operation of diesel generators (35.47±5.29years) comparing with 40 male healthy (34.80±4.28) years.The medical history was taken, bodyweight and height were measured and body mass index (BMI) was calculated as kg/m^2.The blood was allowed to clot for 10-15 min. at room temperature, centrifuged for [10] min. at (3000xg). Serum was removed to measure the biochemical parameters.Serum total protein was determined by Lowry *et al.* method [11] using bovine serum albumin (BSA) as a standard protein.AcidDNase activity was determinedin serum by a method of Kunitz [12] with somemodification, where [0.05] ml of serum added toa mixture consist of 0.75 ml of substrate and0.75 ml of Tris-HCL buffer.The rate of increasein the absorbency of the sample solution wasrecorded at 260 nm and 25°C after 1.5 min.Alkaline DNase activity was determined in serumby a method of Kunitz[13]. Serum Lead was measured by atomic absorption spectrometry.The serum AOPP was measured by Enzyme Linked Immunosorbent Assay (ELISA)(CUSABIO BIOTECH COM.). All statistical analysis in the study was performed using SPSS version 22.0 for Windows (Statistical Package for Social Science, Inc., Chicago, IL, USA). Descriptive analysis was showed the mean and standard deviation of variables. The significance of differences between mean values was evaluated by Student t-test. The probability $p<0.05$ was considered statistically significant, while $p>0.05$ was referred to statistically insignificant. Correlation analysis was used to test the linear relationship between thefactors. ANOVA test was used to confirmation the differences between variables of different groups.

Results:

The results were observed as follows of fifty Iraqi workers employed on the operation of diesel generators[group A], 30 normalmen [group B]were serveas control group.Demographic distribution of groups of man according to definite characteristics wereshown intable 1.

Table 1: The mean and standard deviation of Age, weight ,height and BMI in group A and group B.

Characteristic	Group A[n=50]	Group B[n=40]	*p* Value
Age[year] Mean ±SD Range	35.47±5.29 25.00-42.00	34.80±4.28 22.040-41.00	>0.05
Weight[Kg] Mean ±SD Range	85.51±11.88 78.50-115.00	86.43±7.77 80.00-100.00	>0.05
Hight [m] Mean ±SD Range	1. 78±0.52 1.75-1.80	1.79±0.47 1.76-1.83	>0.05
BMI [Kg/m^2] Mean ±SD Range	28.65±2.05 26.55-30.21	28.90±1.95 27.15-29.41	>0.05

As shown in table 1 there were no significant different between two groups in age ,weight , hight and BMI.

As the results in table 2 show there are highlysignificant increases ($p>0.001$) in the mean value of serum lead and AOPP in group A [Iraqi workers employed on the operation of diesel generators] when compared to group B [control group].

Table 2: The level of S. lead in of group A and Group B

Characteristic	Group A[n=50]	Group B [n=40]	*p* Value
S.Lead [µg/dl]	15.75±0.90	3.39±0.05	<0.001
AOPP [ng/dl]	110.23±24.56	63.75±18.12	<0.001

The results in table 3 and 4 showed a significant increase in both acid and alkaline DNase activity and specific activity in sera group A [Iraqi workers employed on the operation of diesel generators] when compared to group B [control group] ($p<0.001$).

There were a highly significant increase in mean levels of activities and specific activities of sera Ecto-5-prime-nucleotidas of group A [Iraqi workers employed on the operation of diesel generators] when compared to group B [control group] ($p<0.001$) as shown in table 5.

Table 3: Activities and specific activities of sera acid DNase of groupA and Group B.

Characteristic	Group A[n=50] (mean value ±SD)	GroupB[n=40] (mean value ±SD)	*p* Value
Activities*10^3 [U /L]	100.33±22.23	38.22 ±9.99	<0.001
S. Protein[g/dl]	7.00 ± 1.09	7.85 ± 0.92	<0.05
Specific Activities [U/mg]	1.42±0.49	0.48±0.37	<0.001

Table 4: Activities and specific activities of sera alkaline DNase of groupA and Group B.

Characteristic	Group A[n=50] (mean value ±SD)	GroupB[n=40] (mean value ±SD)	*p* Value
Activities*10^3 [U / L]	89.98±21.99	32.88 ±10.29	<0.001
S. Protein[g/dl]	7.00 ± 1.09	7.85 ± 0.92	<0.05
Specific Activities [U/mg]	1.28±0.56	0.41±0.34	<0.001

Table 5: Activities and specific activities of sera ecto-5-prime-nucleotidasof group A and Group B.

Characteristic	Group A[n=50] (mean value ±SD)	GroupB[n=40] (mean value ±SD)	*p* Value
Activities [U / L]	86.28±20.93	12.23 ±4.19	<0.001
S. Protein[g/dl]	7.00 ± 1.09	7.85 ± 0.92	<0.05
Specific Activities [U/mg]	1.23±0.52	0.15±0.24	<0.001

There were a significant positive correlations between alkaline, acid DNase activity and Ecto-5-prime nucleotidase with serum lead in group A [Iraqi workers employed on the operation of diesel generators] as shown in table 6.As our knowledge no previous study referred to these correlation.

Table 6: Correlation between s.lead, AOPP with DNase and Ecto-5-prime nucleotidase in group A [Iraqi workers employed on the operation of diesel generators].

Characteristic	Acid DNase[U / L]		Alkaline DNase[U / L]		Ecto-5-primenucleotidase[U/L]	
	Pearson correlation	Sig. (2-tailed)	Pearson correlation	Sig.(2-tailed)	Pearson correlation	Sig. (2-tailed)
S.Lead	0.80	0.01	0.87	0.01	0.75	0.01
S.AOPP	0.76	0.01	0.83	0.01	0.75	0.01

Disscution:

The current reference range for acceptable blood lead concentrations in healthy persons without excessive exposure to environmental causes of lead is less than 5 µg/dl for children(14). It was less than 25 µg/dl for adults[15]. The National Institute for Occupational Safety and Health (CDC/NIOSH) reference blood lead level in adults is 10 µg/dl[16]. The U.S. national BLL geometric mean among adults was 1.2 µg/dl in 2009–2010[17].

Lead is a toxic metal whose extensive use has produced extensive environmental contam-ination and health glitches in many parts of the world. Human exposure to lead is estimated to account for 143 000 deaths every year and 0.6% of the global burden of disease [18]. Lead is a accumulative toxicant that affects various body systems, as well as the neurological, haematological, gastrointestinal, cardiovascular and renal systems. Chronic exposure commonly causes haematological effects, such as anaemia, or neurological disturbances, including headache, irritability, lethargy, convulsions, muscle weakness, ataxia, tremors and paralysis. Acute exposures may cause gastrointestinal disturbances (anorexia, nausea, vomiting, abdominal pain), hepatic and renal damage, hypertension and neurological effects (malaise, drowsiness, encephalopathy) that may lead to convulsions and death[17]. The clinical diagnosis of lead poisoning can be difficult when there is no clear history of exposure, because poisoned individuals can be asymptomatic, and signs and symptoms, when they are present, are relatively nonspecific. Laboratory investigations are the only reliable way to diagnose lead-exposed individuals and therefore play an essential role in the identification and management of lead poisoning and in the assessment of occupational and environmental lead exposure[19]. Alkaline DNase , in addition to acid DNase, has been concerned in apoptosis [20]. Alkaline DNase has been found in the nuclei of apoptotic thymocytes[21]. Alkaline DNase was shown to be constitutively expressed in bovine epithelial lens cells [22] or lens fibers [23], and might be reflected as an enzyme associated with nuclear degradation proceedings, mainly with the final phases of the DNA degradation. In addition, another study suggested that Alkaline DNase could behave as a transcription factor which selectively regulated cell surface Fas expression in human cells and pointed towards a central role of Alkaline DNase in the regulation of the apoptotic machinery [24,25]. The primary cause of lead's toxicity is its interference with a variety of enzymes because it binds to sulfhydryl groups found on numerous enzymes.[26] Part of lead's toxicity results from its ability to mimic other metals that

take part in biological processes, which act as cofactors in many enzymatic reactions, displacing them at the enzymes on which they act[27]. Serum AOPP aremainly carried via albumin. Its concentration thoroughly correlates with the level of dityrosine, a hallmark of oxidized protein. Therefore, AOPP have been considered such as the markers of oxidant-mediated protein damage[10]. Lead is able to bind to and interact with numerous of the same enzymes as these metals but, due to its different chemistry, does not properly function as a cofactor, therefore interfering with the enzyme's capability to catalyze its normal reaction [28]. As the present result the association of lead with chromatin in cells recommends that harmful metal effects may in part be mediated changes in gene function.

In conclusion Exposure to lead may also decrease lifespan and have health effects in the long term for these workers. Death rates from a variety of causes may be found to be higher in Iraqi workers employed on the operation of diesel generators with elevated blood lead levels; these include cancer, stroke, and heart disease, and common death rates from all causes. In the present result lead is considered a probable carcinogen in these workers. Suggestion in the current study moreover suggests that age-related mental decline and psychiatric symptoms are correlated with lead contact. According our result the accumulative contact over a continued period possibly will have a more important effect on some features of health than current exposure Some health effects, such as different cancer diseases are a significant risks when lead exposure is prolonged (over about one year).

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