Study the Effect of increased levels of lead on Sera Alpha Amylase Activity, and Some Biochemical Parameters from a Large Private Electrical Generators Workers

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ABSTRACT

Background Lead poisoning is a health condition that occur when people are showing to lead compound through inhalation, swallowing, and rarely, through the skin. Lead poisoning frequently occurs from repeated contact to small amounts of lead. Objective: The aim of the current study is to evaluate the level of the alpha amylase activity. Lead and several biochemical factors in sera workers which working to turn on and control on the large private electrical generators. Results: The group50 male employed on large private electrical generators workers, mean age (35.47 ± 5.29 years) comparing with 40 male (34.80±4.28) apparently healthy control: the result showed that serum of S. Lead α-amylase activity and specific activity, were significantly increase(p<0.001) in large private electrical generators workers group compared to the control group. Conclusion: Lead poisoning has serious risks to human health, and exposure to lead possibly will decrease lifespan and have health effects in the long term for these workers.

INTRODUCTION

There are many gases and compound estimated from diesel generators, which cause air pollution and negatively affect the health of those who work in their generators. The estimating results show the emissions are nearly 25-68 ton from carbon monoxide CO, 189-515 ton from nitrogen oxides NOx, 10428-28335 ton from carbon dioxide CO2,8-21 ton from volatile organic compounds VOC,66-180 ton from sulfur oxides SOx and 23-64 ton from particulate matter PM [1,2]. Chemical elements present in the form of free ions are readily ionized and ultimately get absorbed completely by the body. Transition metals readily form stable covalent complexes and normally interact as parts of macromolecules(proteins, enzymes, hormones, etc.) according to their chemical characteristics including oxidation state [3-4].

The behavior of metal ion release into biofluid is governed by the electrochemical rule. Released metal ions do not al-ways combine with biomolecules to appear toxicity because active ion immediately combine with a water molecule or an anion near the ion to form an oxide, hydroxide, or inorganic salt. Thus, there is only a small chance that the ion will com-bine with biomolecules to cause cytotoxicity, allergy, and other biological influences [5].

These metals, are complexes with amino acids (glutathione (GSH), cysteine, histidine), Proteins (metall othioneins, transferrin, ferritin, lactoferrin, hemosiderin, ceruloplasmin, melatons transferrin). Health damage caused by toxic metals may be less(iri-ratation) or acute (teratogenic, mutagenic and carcinogenic). These reactive elements of food build complexes with fiber, show low solubility within the intestinal lumen and are poorly absorbed. Absorption of these min-erals is enhanced at low concentration of fiber, and in the absence of phytates and oxalates in the diet [6].

Lead forms a variation of compounds and exists in the environment in various forms.[7] Features of poisoning differ depending on whether the agent is an organic compound, or an inorganic one [8]. Organic lead

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poisoning is now very rare, because countries across the world have phased out the use of organic lead compounds as gasoline additives, but such compounds are still used in industrial settings [8]. Organic lead compounds, which cross the skin and respiratory tract easily, affect the central nervous system predominantly [8]. Lead poisoning can cause a variety of symptoms and signs which vary depending on the individual and the duration of lead exposure.[7,9] Symptoms are nonspecific and may be subtle, and someone with elevated lead levels may have no symptoms.[5]. Alpha (α)-amylases (E.C.3.2.1.1) are the enzymes that are extra-cellular and hydrolyze internal 1, 4-glycosidic linkages in starch to give up low molecular weight yield, such glucose, maltose and maltotriose units [10]. These are the most important class of industrial enzymes that are of great significance in biotechnology and occupy approximately 25% of the world enzyme market [11]. In human physiology, both the salivary and pancreatic amylases are α-amylase. It is formed in the pancreas and the glands make saliva, it exist in different isoenzyme forms; salivary type (S-type) and pancreatic type (P-type) [12]. Nicotine, a main component of cigarette could be absorbed in the mouth, and along with other cigarette compound has been experiential to increase the risk of pancreatic cancer [13]. The harmful effects of tobacco reliance on human health are known. In information, tobacco use is the cause of cardiovascular pathologies, pleuropneumonias and cancers [14]. In addition, tobacco expenditure modifies some biological parameters, including alpha- amylase [15].

The aim of this study to evaluate the effect of lead output from electric generators on alpha amylase activity and some biochemical parameters in sera workers which working to turn on and control on the large private electrical generators.

MATERIALS AND METHODS

This study was conducted from 50 Iraqi workers employed on the operation of diesel generators mean age (35.47 ± 5.29 years) comparing with 40 male (34.80±4.28) apparently healthy control. The blood samples were allowed to clot and then sera were separated by centrifugation at 3000 rpm for 10 min at room temperature. The serum was divided into two parts the first to measure the biochemical parameters and the other part was stored at -18°C until used for the hormone insulin analyst using enzyme linked immunosorbent assay (ELISA), serum total protein was determinate by Lowry at. el. Method [16] while α -amylase levels were estimated by Caraway method[17], in which the amount of remaining starch (after the enzymatic reaction) is assayed by measuring the absorbance of the blue complex at 660 nm after the addition of iodine. serum glucose was measured by using Randox Kit. Lead serum was measured by using atomic absorption spectrometry, The HOMA-IR is easily calculated from fasting insulin and glucose levels and is commonly used for the evaluation of insulin resistance in clinical practice. However, some attention needs to paid to the interpretation of these values as indices of insulin resistance because they mainly depend on the balance between hepatic glucose output and insulin secretion, which is maintained by a feedback loop between the liver and pancreatic [18].

HOMA-IR= [(fasting serum glucose(mmol/L) × fasting insulin(μU/ml))/(22.5)].

Statistical Analysis:
The results are expressed as arithmetic mean ± standard deviation (mean ± SD) by using SPSS version 21.0 for Windows [Statistical Package for Social Science, Inc., Chicago, IL, USA]. For statistical evaluation Student’s t-test was used and p values < 0.05 were accepted as significant.

RESULTS AND DISCUSSION

Mean ± SD of some biochemical parameters FSG, Insulin , S. Lead and HOMO were measured in sera of both studied groups. The results obtained are illustrated in Table (1). The results showed that S. Lead of large private electrical generators workers (Group A) was significantly higher than control group [p < 0.001]. Serum insulin and HOMA indicated no significant different [p>0.05] between groups.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>FSG[mmol/L]</td>
<td>4.33 ± 0.85</td>
<td>4.52 ± 0.52</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Insulin[μU/ml]</td>
<td>10.12 ± 1.80</td>
<td>7.33 ± 1.00</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>HOMA</td>
<td>1.80±0.16</td>
<td>1.70±0.19</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>S.Lead [μg/dl]</td>
<td>16.55±4.93</td>
<td>3.54±0.06</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

FSG=fasting serum glucose, HOMO= homeostasis model assessment

The result showed that serum alpha-amylase activity and specific activity of enzyme were significantly increase [p < 0.01] in large private electrical generators workers (Group A) comparing to control group, Table (2).
Table 2: Alpha-amylase activity and specific activity in fifty large private electrical generators workers (Group A) and 40 normal men (Group B).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A [n=50] mean value ±SD</th>
<th>Group B [n=40] mean value ±SD</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-amylase activity [U/L]</td>
<td>130.00±19.33</td>
<td>45.75±8.25</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>S. Protein [g/dl]</td>
<td>7.00 ± 1.09</td>
<td>7.85 ± 0.92</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>α-amylase specific activity [U/mg]</td>
<td>1.85±0.48</td>
<td>0.54±0.15</td>
<td>&lt;0.01</td>
</tr>
</tbody>
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Table 3 showed a non-significant effect of smoking on large private electrical generators workers and control groups in sera α-amylase activity.

Table 3: Activity and specific activity of sera alpha amylase in 27 large private electrical generators workers (Smokers) and 23 large private electrical generators workers (nonsmokers).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Smokers [n=27] mean value ±SD</th>
<th>Nonsmokers [n=23] mean value ±SD</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>α-amylase activity [U/L]</td>
<td>132.50±16.12</td>
<td>127.75±7.89</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>S. Protein [g/dl]</td>
<td>6.97 ± 1.19</td>
<td>7.05 ± 0.82</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>α-amylase specific activity [U/mg]</td>
<td>1.89±0.48</td>
<td>1.80±0.39</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

Alph-amylases formed by the pancreas, hence its form in serum is analytic of pancreatic disorders [15]. Lead is a toxic metal, which can make various behavioral, biochemical, hematological and histological disorders, both in humans and animals. Chronic exposure usually causes hematological effects, such as anemia, or neurological disorders, as well as headache, lethargy, muscle weakness, convulsions, 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 death [19]. Abe et al showed that lead is a unrelenting toxic metal and associated with impairment of various body functions in personnel employed on the operation of diesel generators [20]. The amount of amylase from serum reflects the balance between the rates of amylase entry and its subsequent removal from the blood. The pancreas and the salivary glands usually account for almost all of the serum amylase, in normal conditions. Hyperamylasemia can be the result of an increased rate of entry into the blood or a decreased rate of clearance. Pancreatic lesions or inflammation can cause hyperamylasemia. A decreased rate of clearance, due to renal impairment, can also cause hyperamylasemia [21]. Pancreatitis has many pathogenic causes. Intoxication with various organic or inorganic substances can be a cause [22]. Hyperamylasemia has a low specificity in the diagnosis of pancreatitis, but it is routinely used for this purpose, together with amylase and other markers [23]. The present result was agreement with our previous study which showed increase lead concentration in sera workers which working to turn on and control on the large private electrical generators [24]. The clinical diagnosis of lead poisoning can be difficult when there is no clear history of exposure, because poisoned individuals can be asymptomatic, signs or 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 [18]. Lead also has been badly affects the antioxidant pathway [25], obtainable evidences indicate that metal induce toxicity may cause derangement of antioxidant mechanisms in living tissues; as a consequence highly reactive oxygen species (ROS) are generated. This antioxidant imbalance might lead to the degradation of proteins, nucleic acids and lipid per oxidation. An oxidative assault of cellular components by ROS is concerned in the pathogenesis of several human diseases including diabetes [26]. The problem of lead poisoning in animals has widely been recognized which needs a special attention for the environmentalist and health personnel. It is a cumulative tissue poison and gets stored in different parts of the body especially in bones, liver, kidney and brain. Besides, direct ingestion of lead leading to increased blood lead levels, accumulated lead in the body also acts as a significant source of blood lead burden [27].

On other hand the present data demonstrate that there were no significant increase (p>0.05) in the α-amylase activity values in serum of smokers, when compared with non-smokers. Table (3). Previous studies disclose that cigarette smoking causes an increase in serum α-amylase activity value [28-31]. On the other hand, another studies showed that smoking cigarette does not affect the α-amylase activity value in serum and saliva [26], the decrease of the enzymatic activity of serum of smokers is almost certainly due to the interaction between smoke aldehyde and –SH groups of the amylase molecule and with result increase in alpha amylase activity as demonstrate in this study [32]. The present result may be due to a little number of man in both groups.

Conclusion:

The results of the present study give details that the high concentration of lead metal in the sera of in sera workers which working to turn on and control on the large private electrical generators effects on sera α-amylase activity which may be led to a symptom of many diseases among them diabetes and diseases of the pancreas and other disease.
REFERENCES


