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The Toxicity And Biological Effect Of Exposurring To Lead Among The Workers Of Battery Factory In Baghdad/Iraq

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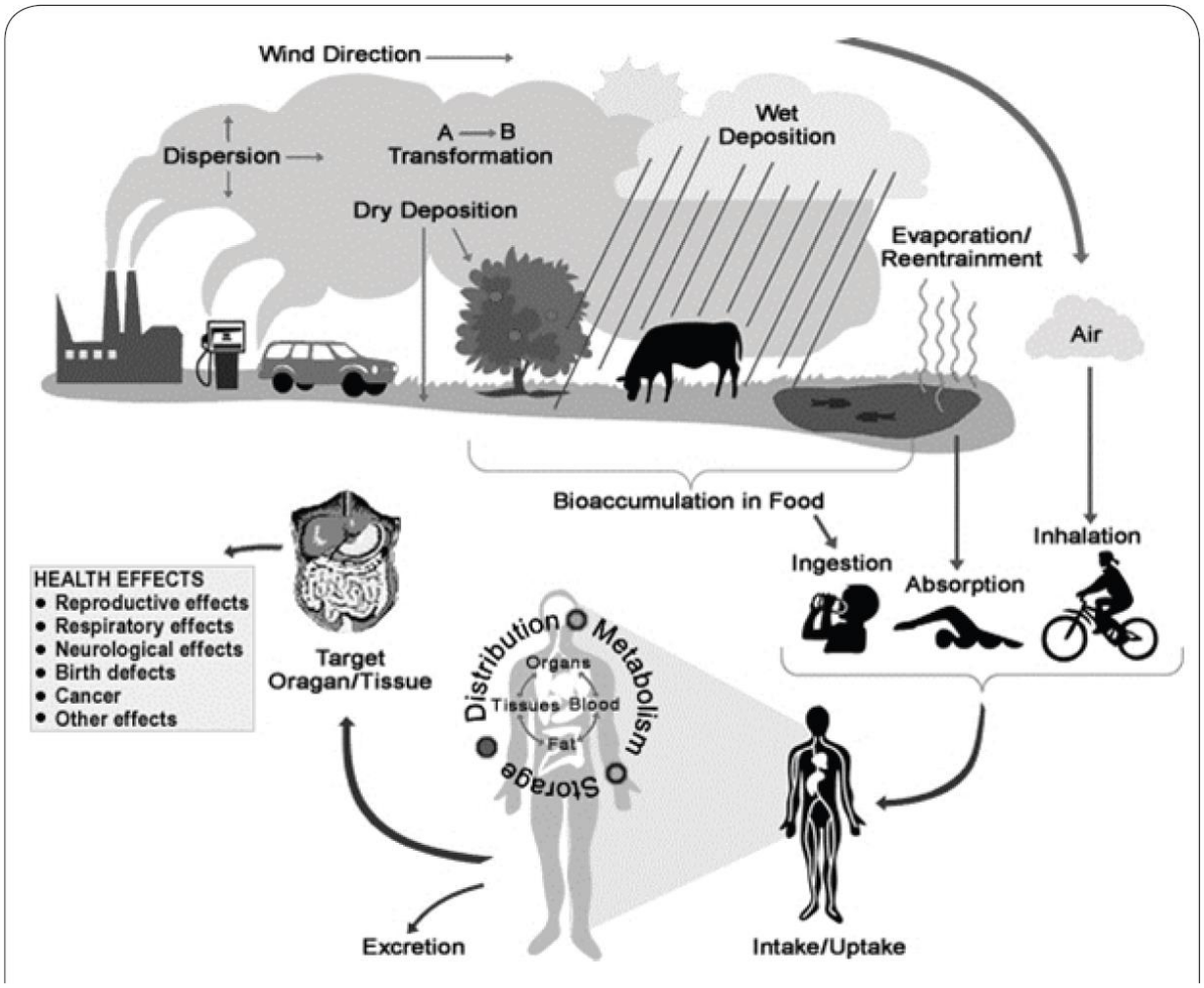
Abstract

Lead is one of widely distributed heavy metal and cause many biochemical , physiological and genetic damage . When exposure to lead may increase the risk of genetic dysfunction (DNA damage). In this work we study the effect of exposure to the lead for long time period among the battery workers factory in Baghdad . Blood sample were collected during march 2017,we divided the study group into two groups: workers group containing 26 male who were expose to lead through their work and control group containing 10 male in order to compare the result with them. Blood lymphocyte were tested by comet assay, the results showed that an increasing level of DNA damage among the tested workers because of the habit of their work that may induce the risk of DNA damage when compare with control. As well as there is a statistical differences in the lead level of control group and battery workers group p value (0.001) in addition to several biomarkers were studied for both worker group and control group

Key words : Toxicity of Lead , Comet assay, DNA damage.

Introduction

Lead is one of most useful metal and has many industrial applications such as batteries industry due to its own properties such as density and low melting point [1,2].On the other side it is consider as one of dangerous and toxic metal cause global contamination of water , air and soil . In addition to that it cause many health problem associated with neurological ,hematologically and gastrointestinal defect[5,6].Exposure to lead may cause a various health problem it may include: enzyme inhibition, DNA damage, mutation and chromosomal aberration as well as many research proved that it can be classified as a carcinogenic compound[4,5].Which elevate the level of DNA damage that in turn increase risk of cancer.[9,10].Lead absorption following oral inhalation or dermal exposure ,then it will absorbed into bloodstream then bound to erythrocytes and freely diffuse through plasma fraction and distribute extensively through out tissue. The high concentration of lead found in bones, teeth, liver, kidney , brain and spleen respectively . where lead may remain in blood is 35 days but it can remain in other tissue 40 days while stay in bone 20-30 years[1,[2,11].Lead can effect on the physiology of human body because of its affinity to sulfhydryl group and electron donor group and affecting many proteins and cellular mechanisms due to its similarity to the divalent cations[33].Lead is absorbed via the lung by inhalation and gastrointestinal tract by ingestion.



Figure(1):This figure explain how individuals expose to the chemicals from environment.

Due to its harmful effect on the human health we proposed to measure the lead concentration in blood sample of battery workers factory in Baghdad/Iraq this is not a first study concern with this problem increase level of lead in blood but our study try to find the effect of these high level on genetic make up.

Materials and Methods

Sampling

A total of 26 blood sample were collected form the worker in batteries factory and 10 sample as a control group during the period of march 2017. All of them were subjected to a personal interview to fill specialized designed questionnaire form with a personal and medical history aspect. They were subjected to measurement of lead level in blood and estimation of lipid profile directly by spectrophotometric method as in [12,13,14,15,27].

Lead level was determine in the laboratory of the battery factory as in the procedure: 5ml of blood sample were collected in EDTA tube and put on the roller shaker for 30 minutes. Then adding of 5ml of trichloro

acetic acid to the blood sample continuing adding of the acid and mixing the sample by vortex in-order to breakdown the RBCs this step take time about 10 to 15 minutes. Leaving samples for 10 minutes after that centrifuge at 1000 rpm for 15-20 minutes, separate the supernatant and finally measuring lead concentration by atomic spectrophotometer at 283 nm[16].

In order to determine the level of DNA damage by comet assay, blood samples freshly suspended in a low melting agarose dissolved in PBS placed on microscopic slide pre-coated with 0.5% NMP agarose. The cells were lysed for one hour at 4^{o}C in a buffer which containing 2.5 M (NaCl), 0.1 M(EDTA),10M (TRIS) and 1% Triton X100 at pH 10. After that all slides were put in electrophoresis unit. DNA allow to unwind for 20minutes in a solution that contain 300mM (NaOH) and 1mM EDTA at pH13.

DNA damage determination by comet assay: fresh blood samples were suspsnding in 0.75% low melting agarose dissolved in PBS placed on microscopic slide pre-coated with0.5% NMP agarose. The cell lysed step for one hour at 4 ^{0}c in a buffer containing 2.5M NaCl ,0.1 M EDTA ,10M Tris and 1%Triton X-100 at PH 10, after that all slides were put in electrophoresis unit.The DNA tail of the comet recording by Tri Tek comet score 1.0.1.0.And statistical analysis was performing by SPSS statistics software ,one-way ANOVA test.

Results:

According to lipid profile estimation the results showed that there are a statistical differences in battery workers group than that was recorded in control group in level of HDL and LDL (table 1 and table 2) while no significant difference in level of VLDL, Triglyceride and Cholesterol (table 3, 4 and 5).Addition to that all sample were subjected to measure the level of lead in blood the results declared a statistical difference between battery workers group and control group (table 6). Table (7) describe a tail moment and amount of DNA in tail ,head and olive moment. As well as figure (1) show the difference between the comet in patient group and control group.

Table (1) : HDL Results mg/dl

	Control	Patients
Number of values	10	26
Minimum	36.00	22.00
25% Percentile	40.50	34.75
Median	60.00	43.50
75% Percentile	68.75	47.25
Maximum	72.00	66.00
Mean	56.90	42.08

Std. Deviation	13.82	9.303
Std. Error of Mean	4.370	1.825

Probability value (0.0007) , probability value < 0.05 significant difference

Table (2) : LDL Results mg/dl

	Control	Patients
Number of values	10	26
Minimum	89.00	61.20
25% Percentile	89.75	127.2
Median	100.00	148.0
75% Percentile	117.3	192.4
Maximum	178.0	467.0
Mean	109.5	176.8
Std. Deviation	29.50	84.53
Std. Error of Mean	9.330	16.58

ρ (0.0200), ρ < 0.05 significant difference

Table (3) : VLDL Result mg/dl

	Control	Patients
Number of values	10	26
Minimum	18.00	61.20
25% Percentile	20.83	127.2
Median	33.00	148.0
75% Percentile	40.00	192.4
Maximum	42.00	467.0
Mean	31.61	176.8
Std. Deviation	9.020	84.53

Std. Error of Mean	2.852	16.58

ρ (0.4511) , ρ < 0.05 significant difference

Table (4) : Triglycerides Result mg/dl

	Control	Patients
Number of values	10	26
Minimum	90.00	73.00
25% Percentile	102.3	114.8
Median	169.0	165.5
75% Percentile	202.5	236.0
Maximum	210.0	353.0
Mean	159.4	179.1
Std. Deviation	46.61	73.16
Std. Error of Mean	14.74	14.35

Probability value < 0.4357 , ρ< 0.05 significant differences

Table (5) : Cholesterol Results mg/dl

	Control	Patients
Number of values	10	26
Minimum	180.0	185.0
25% Percentile	195.8	216.5
Median	229.5	245.0
75% Percentile	289.3	314.0
Maximum	290.0	403.0
Mean	236.6	266.1
Std. Deviation	44.98	59.52
Std. Error of Mean	14.22	11.67

ρ (0.1584), ρ < 0.05 significant difference

Table (6) : Lead Result μg/dl

	Control	patients
Number of values	10	26
Minimum	2.000	10.35
25% Percentile	6.000	13.59
Median	8.500	17.94
75% Percentile	14.50	20..49
Maximum	19.00	25.40
Mean	9.700	17.29
Std. Deviation	5.187	4.358
Std. Error of Mean	1.640	0.838

Probability value < 0.001 , ρ < 0.05 significant difference

Table (7) : Comet Assay Results

	Tail Moment	**DNA% in Tail**	**Head Area**	**Olive Moment**
Number of values	24	24	23	24
Mean	124.6	40.66	7335	61.13
Std. Deviation	120.2	20.58	4463	51.92
Std. Error of Mean	24.54	4.201	930.6	10.60
Lower 95% CI of mean	73.88	31.97	5405	39.20
Upper 95% CI of mean	175.4	49.35	9265	83.05

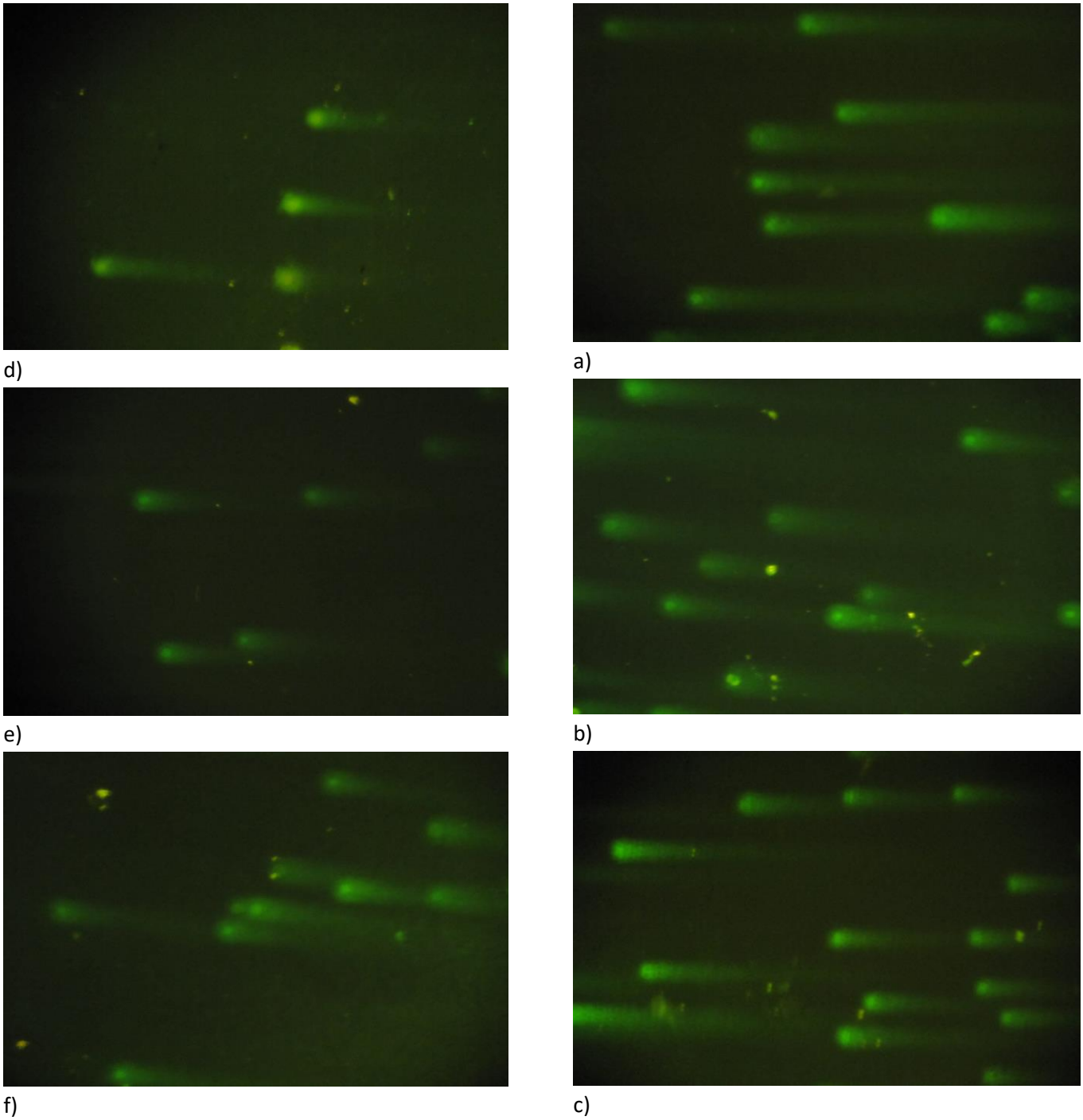


Figure (2): a, b, and c Image show comet shape in worker samples . while d, e and f Image show comet shape for control samples

Discussion

In this study we have been found that there is a significant differences in HDL and LDL level when compared it between battery workers group and control group p value 0.007 and 0.0200 respectively (p

value < 0.05 significantly different). While on the other side there are no significant differences in the level of VLDL, Triglyceride and cholesterol p value 0.451,0.4357 and 0.1584 respectively. These results as the same as that have been found in [28] they were found a significant differences in HDL and LDL level in battery workers group and control group $p < 0.0001$ and was no statistical difference in triglyceride level. These finding indicating that exposure to lead may lead to altering the metabolism of HDL and LDL which play an important role in lipid metabolism and cholesterol exchange between tissue[29,30].
The higher level of lead in blood of battery workers than were recorded in control group as in(table 7),this investigation explain why there is a DNA damage that have been shown in battery workers than in control group (figure 1).So , that there is a relation between the high level of blood lead and the DNA damage. A good explanation is that exposure to lead induce DNA damage by induction of production and accumulation of ROS(Reactive Oxygen Species).The damage may increase with increase time of exposure which in turn increase the concentration of lead in tissue these results in agreement with other study [31] Lead has ability in inducing a DNA damage because that interfere with DNA repair it can inhibit DNA polymerase by competing with zinc ion which play important role in DNA polymerases , in addition to that lead can inhibit protein involve in base excision repair which contain zinc finger [32]

Conclusions

As a conclusion , our investigation indicating that exposing to lead may cause to DNA damage this depending on some factors such as exposing time and lead concentration. And the workers in batteries factory not protected against lead exposing and this may be danger for them by several time of years.

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