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HEMATOLOGICAL CHANGES IN PRISONERS WITH HIGHER BLOOD LEAD LEVELS COMPARED WITH GENERAL POPULATION

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Abstract

Lead (Pb) is one of the major environmental health hazards. From a biological point of view, lead is considered as anon-essential trace element and has no any biological function. The aims of the present study were to study blood lead levels among prisoners in the Northern of Jordan. Two prisons in the northern of Jordan were visited. Blood samples were collected and evaluated for hematological parameters and blood lead level. The study included 73 participants (46 prisoners and 27 participants as control). Study findings revealed low exposure of lead among study participants. The mean blood lead level among prisoners was 0.924 µg/dl, and 0.57µg/dl among control group. Hematological parameters under study were less in prisoners compared control group. Study findings revealed significant relationships between blood lead level and hematological parameters among prisoners.

Taken together, the present study evaluated the effects of lead exposure on prisoners through studying these effects on some hematological parameters. The findings of the present study indicated that even prisoners had more blood lead levels compared with control group; the exposure variations were not statistically significant, but able to induce changes on studied hematological parameters.

Keywords: Blood lead level, prisoners, hematological parameters

Introduction

Lead (Pb) is one of the major environmental health hazards (Jesus et al., 2007). From a biological point of view, lead is considered as anon-essential trace element and has no any biological function. Furthermore, lead exposure is associated with toxic effects including neurological, reproductive, gastrointestinal, hematopoietic and renal systems (Nemsadze et al., 2009; Rosin, 2009; Warniment et al., 2010; Gharaibeh et al., 2014).

There are various sources for lead exposure including tap water contaminated with Pb due to metal corrosion (Zietz et al., 2001), soil and dust exposures (Gasana and Chamorro, 2002), and foods contaminated during processing (Trampel et al., 2003; Raghunath and Nambi, 1998). A significant source of Pb for a child includes Pb-based paint used on surfaces in the house (Kuruvilla et al., 2004).

Pb enters the body through the digestive and/or respiratory tract, and then is absorbed into the blood. About 99% of Pb in blood is bound to the erythrocytes, with the remainder distributed within plasma (Jesus et al., 2007).

An elevated blood leads level is defined by the U.S. Centers for Disease Control and Prevention (CDC) as a concentration that is equal to or greater than 10 µg/dL (CDC, 2004c).

Yılmaz et al (2012) found that patients with lead intoxication had blood lead levels about 44 µg/dl while control group had about 3.3 µg/d, the variation in blood lead levels was statistically significant ($p < 0.001$). It has also been found that patients groups to have significant decrease in hemoglobin (Hb) ($p = 0.018$) and Mean corpuscular volume (MCV) ($p < 0.001$) values in the patients with lead exposure than in the controls.

Gharaibeh et al (2014) reported that lead exposure has an occupational dimension in their study. They reported higher exposure to lead among taxi drivers, automechanics, and wood workers compared to other workers groups.

Methodology

Study population:

Study population included prisoners in prisons in the Northern of Jordan who had criminal behaviors for being in the prison. The managers for these prisons (Qafqafa and Um Allolo) had received formal letters to permit for the prisoners to voluntary participate in the study and to fill a questionnaire and give blood sample.

Study sample

Study sample included 73 participants among which are 46 prisoners and 27 persons as controls outside the prisons from general populations.

Study procedure

Blood samples were collected by a trained person, from each participant, two samples were taken, one for testing lead (Pb) by Atomic absorption, and the other sample for testing other blood cell components.

Study results

As seen in table 1, the mean concentration of lead among prisoners was 0.924µg/dl, and among control group the mean concentration was 0.57µg/dl. The variation in lead concentration was not statistically significant (p 0.480). The mean of red blood cell count was among prisoners $5.08x10^6$/ml and this was less than control group $5.89x10^6$/ml. The variation in red blood cell count was statistically significant (p 0.000). The mean concentration of hemoglobin among prisoners (14.87%) was less significantly (p 0.000) than in control group (16.5%). Prisoners in the present study had less platelet count about $209x10^3$ compared with control sample about 227 $x10^{3.}$ The variation in platelet count between prisoners and control group was statistically significant (p 0.001). The mean count of white blood cells among prisoners ($5.78x10^3$/ml) was significantly (p 0.000) less than that of control group ($9.11x10^3$/ml). The subsets of white blood cells were varied among study groups. Granulocytes in prisoners (1.75%) was significantly lower (p 0.000) than in control group (3.58%). Both of lymphocytes and monocytes were less in prisoners compared with control group, but not significantly varied (p >0.05) (table 1).

Table 1: Blood lead concentration and other blood tests in study groups

Variable	Study sample		Control sample		P value
	Mean	SD	Mean	SD	
Blood lead concentration (µg/dl)	0.924	1.79	0.57	0.56	0.480
Red blood cell count (10^6/ml)	5.08	0.55	5.89	0.589	0.000
Hemoglobin (%)	14.87	1.36	16.5	1.60	0.000
Platelets (10^3/ml)	209.57	78.75	227.35	53.70	0.001
White blood cells (10^3/ml)	5.78	0.62	9.11	2.38	0.000
Granulocytes (%)	1.75	0.62	3.58	1.69	0.000
Lymphocytes (%)	3.03	1.02	4.55	5.05	0.360
Monocytes (%)	1.20	0.74	2.02	0.67	0.550

When compared the effects of blood lead on hematological parameters, lead had profound effects on red blood cell count, hemoglobin, platelets, and blood cell count (p 0.000 for the mentioned parameters), while the effects on lymphocytes were not statistically significant (p 0.051) (table 2).

Table 2: The relationship between blood lead levels and other blood tests

Variable	First variable		Second variable		P value
	Mean	SD	Mean	SD	
Lead –Red blood cells (10^6)	1.60	3.70	5.10	0.42	0.000
Lead- Hemoglobin (%)	1.60	3.70	14.85	1.32	0.000
Lead-Platelets (10^3)	1.60	3.70	255.64	177.86	0.000
Lead-White blood cells (10^3)	1.62	3.76	6.21	2.60	0.000
Lead-Lymphocytes	1.60	3.70	3.02	0.94	0.051

Discussion

Prisoners are not easily accessible compared with other groups in the community. After having written approvals, we had permission to study 46 prisoners in two prisons. Prisoners signed informed consent to participate in the present study.

The importance of the present study comes from being the first study in Jordan to target prisoners based in biological dimensions since this group of community is usually targeted on social levels.

The data of the present study did not show a high exposure level to lead among study groups and the study variations in lead level were not significant since our data showed blood lead levels less than 1 µg/dl. Because lead has no biological functions as reported in several studies (Nemsadze et al., 2009; Rosin, 2009; Warniment et al., 2010; Gharaibeh et al., 2014), any blood lead level should be considered significant.

The data of the present study showed significant lower means of blood various components in prisoners compared with control group including Red blood cells, Hemoglobin, platelets, white blood cells and granulocytes ($p < 0.05$ for the all). Both of lymphocytes and monocytes had also less means in prisoners compared with control group, but variations were not significant ($p > 0.05$). These results are interesting from different points. First of all, it is plausible to explain these variations as a result of lead exposure. The second interesting point is that the blood values of prisoners were within lower limit of normal range. These prisoners seem to have a tendency for having disease from one side, and from another side their current blood levels even within normal range, but due to the presence of lead, may be not optimally functioning. From this point, other abnormalities associated with lead may emerge. Another interesting point is derived from our daily observations in which some groups of people who have deficiencies in their blood values and take intervening medicines without exhibiting improvements may be recommended to assay their blood lead levels. Our findings agree with other studies in which lead exposure have effects on blood parameters (Yilmaz et al, 2012; Gharaibeh et al., 2014).

Our results showed that prisoner's blood values were significantly (p 0.000) associated with blood lead levels which act on retaining these values within lower range limits. Lymphocytes were the exception.

Conclusion

The present study evaluated the effects of lead exposure on prisoners through studying these effects on some hematological parameters. The findings of the present study indicated that even prisoners had more blood lead levels compared with control group; the exposure variations were not statistically significant, but able to induce changes on studied hematological parameters.

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