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Estimation of some trace element and antioxidant activity in people exposed to heavy metals from different sources of exposure

تقدير بعض العناصر النزرة والفعالية المضادة للاكسدة في الاشخاص المعرضين للمعادن الثقيلة من مصادر مختلفة

Alaa Abd-Alhasan Hamdan
Israa Abd-Alhasan Hamdan
Muntdhur Mohammad Cani
Kerbalaa University/Collage of pharmacy

Abstract

The human is exposed to a large amount of chemicals during his live, either by applied chemical in agricultural soils likes fertilizers and pesticides, or in industrial field, these applications will cause increasing in the heavy metals level. This study estimated blood concentration of essential elements and heavy metals Se, Zn, Cu, Al, Cu, Cd, Co, MO, Mn, Mg, Pb, Se, Ni, Cr, Hg and (GPx), (TBARS) as antioxidant activities markers, in four groups of workers exposed to different sources of heavy metals. The highest ratios for Hg, Cr, Cu, Mg, Fe and Zn were found in group C (workers in pesticides), the highest ratio for Al and Mo were in group A (workers in fuel station), while the highest ratio of Pb were in group B (workers in liquid battery workshops), the highest ratio for Co, Mn, As and Se were in group D (farmers using chemical fertilizers) . The heavy metals Zn, Pb, Co, Cd and Ni have significant differences for all groups as compare with control. GPx level have lower significant differences in group B. The highest ratio for TBARS were found in group A. as attempt to found correlation between disease and heavy metals in these groups of workers ,we found few number of workers have different type of cancer for each group, workers which have cancer aged over 45 year and practice their work since over 10 years. Cancers distribution among all four groups were varied, and correlated with type of exposed heavy metals, mainly with the type of their works.

Key words: lead, heavy metals, chemical exposure

الخلاصة:

يتعرض الانسان خلال حياته الى كميات كبيرة من المواد الكيميائية من مختلف المجالات الزراعية والصناعية مما يؤدي الى زيادة تركيزها في الجسم. تضمنت هذه الدراسة قياس المعادن الثقيلة والعناصرالنزرة فضلا عن قياس الفعالية التأكسدية في اربعة مجاميع من العاملين المعرضين للتماس مع مصادر مختلفة من العناصر الثقيلة اثناء عملهم، اظهرت النتائج ان اعلى نسبة للعناصر Zn, Fe, Mg, Cu, Cr, Hg كانت في مجموعة العاملين المتعرضين للمبيدات (C)، واعلى نسبة للعناصر Al, Mo كانت في المجموعة العاملين في محطات تعبئة الوقود (A) و اعلى نسبة في مجموعة العاملين في الاسمدة الكيميائية (D) كانت للعناصر Co, Mn, As, Se , واعلى نسبة للعناصر Pb كانت في مجموعة العاملين في ورش البطاريات السائلة (B). مستوى GPx كان منحفض معنويا في المجموعة B، واعلى نسبة لل TBARS كانت في المجموعة A. كما اظهرت الدراسة ان لكل مجموعة من العاملين نوع معين من السرطان، اختلفت الامراض حسب نوع العناصر المعرضين لها وذلك تبعا لنوع العمل، كل العاملين المصابين كانوا فوق ال45 من العمر ويمارسون عملهم مند اكثر من 10 سنوات.

الكلمات المفتاحية: الرصاص، التعرض الكيميائي، العناصر الثقيلة

Introduction

Heavy metals are elements which naturally found in the environment, also have a density greater five times than that of water and a high atomic weight [1]. The applications of heavy metals in agricultural, industrial, domestic, medical and technological fields cause their wide distribution in the environment then raising the dangerous effects on human health and other creatures [2]. Heavy metals even at lower levels of concentration induce many organs damage; it also considers as human carcinogens, the toxicity of heavy metals depends on some factors: route of exposure, dose and nutrition style of exposed individuals [3]. Annually a large amount of chemicals using in agricultural soils as fertilizers and pesticides, this using cause increasing of heavy metals particularly Cd, Pb, and As [4]. Some heavy metals are necessary to living organisms when in very low concentrations to maintain various physiological and biochemical functions, however they become toxic when they exceed threshold concentrations, Various disorders may cause and excessive damage due to oxidative stress induced by free radical formation can occur if heavy metals were over threshold concentrations [5]. Heavy metals can be determine in serum, urine, whole blood, hair and other tissues, in blood, metals are distributed between the part which non-cellular (plasma/serum) and intra-cellular part (erythrocytes) [6]. Heavy metals conceders as environmental pollutants and have dangerous effect for ecological, nutritional, evolutionary and environmental compartment [7]. Heavy metal toxicity can cause damage the functioning of many organs like brain, lungs, kidney, liver, blood composition, cancer can occur if repeated and long-term exposure of some heavy metals [8]. In spite of the potential toxicity of metals in humans is well-established item of research, but few studies estimated the concentrations of metals in population samples. The aim of this study was to analyze levels of heavy metals, trace elements and antioxidants parameters in blood of four groups of workers who exposed to chemicals during their work, and to found the relationship with some disease.

Materials and Methods

Four groups, including in this study, each group consist of 20 individual they were exposed to heavy metals during their work. Group A: workers in fuel station, Group B: workers in liquid battery workshops, group C: workers in pesticides, group D: farmers using chemical fertilizers. All groups were male aged 24–55 year, control group consisted of 20 healthy individual, employed in different governmental offices. The samples of this study collected from three governorates in Iraq, Baghdad, Karbala and Thi-Qar. Venous blood samples were obtained, by centrifugation serum was separated and placed in epindrough tubes and kept at freezing until samples were analysed. Measurement the level of heavy metals Cu, Mg, Pb, Cr, Zn, Mn, Cd and Se in serum were performed by using Atomic Absorption Spectrophotometer UNICAM-929, (Unicam Ltd, York Street, Cambridge, UK) was used. Also plasma GPx activities were estimated using the method of Paglia and Valentine [9]. TBARS concentration in plasma was determined fluorometrically, according to Wąsowicz *et al*. [10].

Statistical analysis

The result of this study were expressed as means ± SD and analyzed to statistical analysis by using computing Statistical Package for Social Science (SPSS 16.0). The statistical significance was considered at $p < 0.05$.

Results:

Table (1): heavy metals level as mean ± SD in all groups as compare with control

Heavy metals	Control n=20	Group A n=20	Group B n=20	Group C n-20	Group D n=20
Al (µmol/L)	0.323±0.334	0.423±0.654	0.322±0.234	0.291±0.121	0.341±0.201
Hg (nmol/L)	1.001±1.261	1.012 ±3.040	2.010 ±3.24	4.002±1.022	0.981±1.201
Mo(nmol/L)	6.021±1.030	14.20±10.800	12.30 ±10.70	9.126±1.021	8.005±0.021
Ni (nmol/L)	20.07 ±52.70	49.60 ± 42.70	51.06 ± 32.70	21.002±0.123	34.032±0.122
Cd(mg/L)	0.001±0.002	0.012±0.021	0.082±0.031	0.022±0.002	0.014±0.023
Co (mg/L)	0.001±0.000	0.003±0.021	0.002±0.021	0.005±0.321	0.033±0.321
Cr (mg/L)	0.004±0.015	0.006±0.0021	0.005±0.0021	0.011±0.012	0.005±0.112
Cu (mg/L)	0.901±0.112	0.852±0.110	0.752±0.110	1.012±0.132	0.921±0.230
Mn(mg/L)	0.845±0.201	0.789±0.213	0.769±0.113	0.799±0.041	0.820±0.031
Mg(mg/L)	9.030±4.230	6.01±12.200	7.010±13.200	13.021±1.09	8.902±1.030
Fe (mg/L)	3.100±0.120	3.102±1.210	3.201±1.210	5.002±1.001	3.201±0.301
Se (mg/L)	0.129±0.031	0.109±0.300	0.042±0.210	0.109±0.230	0.110±0.330
Pb (mg/L)	0.001±0.000	0.041±0.043	0.061±0.053	0.052±0.120	0.050±0.210
Zn (mg/L)	3.000±0.310	2.000±0.100	2.010±0.100	5.201±0.341	4.021±1.201
AS (mg/L)	0.085±0.040	0.078±0.032	0.081±0.032	0.096±0.032	0.201±0.032

The result in table (1) shows that the highest ratios for Hg, Cr, Cu, Mg, Fe, Zn were found in group C (4.002±1.022, 0.011±0.012, 1.012±0.132, 13.021±1.09, 5.002±1.001 and 5.201±0.341 mg/L) respectively**.** The highest ratios for Al, Mo were in group A (0.423±0.654 and 14.2 ±10.8, mg/L) respectively. The highest ratio for Pb were in group B (0.061±0.053 mg/L) while the highest ratio for Co, Mn, As, Se were in group D (0.033±0.321, 0.820±0.031, 0.201±0.032 and 0.110±0.330 mg/L) respectively.

Table (2): mean ± SD for heavy metals in group A as compare with control

Heavy metals	Control n=20		Group A n=20		P value
	Mean±SD	Range(min-max)	Mean±SD	Range(min-max)	
Al (µmol/L)	0.323±0.334	0.120-0.413	0.423±0.654	0.398-0.754	NS
Hg (nmol/L)	1.001±1.261	0.120-2.142	1.012 ±3.04	1.003-2.021	NS
Mo(nmol/L)	6.021±1.030	3.021-6.802	14.2 ±10.8	8.793-16.012	S
Ni (nmol/L)	20.07 ±52.7	8.790-21.050	49.6 ± 42.70	32.76-51.601	S
Cd(mg/L)	0.001±0.002	0.000-0.003	0.012±0.021	0.003 -0.210	S
Co (mg/L)	0.001±0.000	0.000-0.002	0.003±0.021	0.001-0.004	S
Cr (mg/L)	0.004±0.015	0.001-0.005	0.006±0.021	0.002-0.007	S
Cu (mg/L)	0.901±0.112	0.210-1.020	0.852±0.110	0.342-0.897	NS
Mn(mg/L)	0.845±0.201	0.498-1.031	0.789±0.213	0.467-0.931	NS
Mg(mg/L)	9.03±4.23	6.150- 11.21	6.010±12.20	4.671-8.253	S
Fe (mg/L)	3.100±0.120	1.022-5.041	3.102±1.210	2.511-4.124	NS
Se (mg/L)	0.129±0.031	0.101-0.300	0.109±0.300	0.101-0.121	S
Pb (mg/L)	0.001±0.000	0.000-0.002	0.041±0.043	0.021-0.070	S
Zn (mg/L)	3.00±0.31	2.540-5.001	2.00±0.100	1.987-3.021	S
AS (mg/L)	0.085±0.040	0.034-0.097	0.078±0.032	0.053-0.085	NS

$P < 0.05$ significant differences

$P > 0.05$ No significant differences

The result of table (2) shows that the highest ratio for Al and Mo among all groups were in group A, although the ratio of Al have no significant differences as compare with control, Mo ratio (14.2±10.8 mg/L) have significant differences at $p < 0.05$. The level of Ni, Cr, Co, Cd, Se and Zn also have significant differences at $p < 0.05$ (49.6 ± 42.70, 0.006±0.021, 0.003±0.021, 0.012±0.021, 0.109±0.300 and 2.00±0.100 respectively mg/L) as compare with control, other elements have not significant differences.

Table (3): mean±SD for heavy metals in group B as compare with control

Heavy metals	Control n=20		Group B n=20		P value
	Mean±SD	Range(min-max)	Mean±SD	Range(min-max)	
Al (µmol/L)	0.323±0.334	0.120-0.413	0.322±0.234	0.332-0.414	NS
Hg (nmol/L)	1.001±1.261	0.120-2.142	2.010 ±3.240	1.003-3.021	NS
Mo(nmol/L)	6.021±1.030	3.021-6.802	12.30 ±10.70	9.853-14.012	S
Ni (nmol/L)	20.07 ±52.7	8.795-21.050	51.06 ± 32.7	32.06-52.601	S
Cd(mg/L)	0.001±0.002	0.000-0.003	0.082±0.031	0.021 -0.110	S
Co (mg/L)	0.001±0.000	0.000-0.002	0.002±0.021	0.001-0.003	S
Cr (mg/L)	0.004±0.015	0.001-0.005	0.005±0.021	0.002-0.007	S
Cu (mg/L)	0.901±0.112	0.210-1.020	0.752±0.110	0.342-0.877	NS
Mn(mg/L)	0.845±0.201	0.498-1.031	0.769±0.113	0.446-0.940	NS
Mg(mg/L)	9.03±4.23	6.150- 11.21	7.010±13.20	4.632-8.223	S
Fe (mg/L)	3.100±0.120	1.022-5.041	3.201±1.210	2.501-4.134	NS
Se (mg/L)	0.129±0.031	0.101-0.300	0.042±0.210	0.020-0.049	S
Pb (mg/L)	0.001±0.000	0.000-0.002	0.061±0.053	0.031-0.090	S
Zn (mg/L)	3.00±0.310	2.540-5.001	2.010±0.100	1.087-3.021	S
AS (mg/L)	0.085±0.040	0.034-0.097	0.081±0.032	0.050-0.087	NS

$P < 0.05$ significant differences
$P > 0.05$ No significant differences

Table (3) shows that the highest ratio for Pb among all groups were in group B, this heavy metal have significant differences(0.061±0.053 mg/L) at ($P < 0.05$) as compare with control, also the level of Mo,Co,Cr,Mg,Se,Pb and Zn have significant differences(12.30±10.7, 0.002±0.021, 0.005±0.021, 7.010±13.20, 0.042±0.210, 0.041±0.053 and 2.010±0.10 mg/L) respectively at ($P < 0.05$) as compare with control, while other element have not any significant differences .

Table (4): mean ± SD for heavy metals in group C as compare with control

Heavy metals	Control n=20		Group C n=20		P value
	Mean±SD	Range(min-max)	Mean±SD	Range(min-max)	
Al (µmol/L)	0.323±0.334	0.120-0.413	0.291±0.121	0.122-0.332	NS
Hg (nmol/L)	1.001±1.261	0.120-2.142	4.002±1.022	2.432-5.541	S
Mo(nmol/L)	6.021±1.030	3.021-6.802	9.126±1.021	6.478-11.010	S
Ni (nmol/L)	20.07 ±52.7	8.790-21.050	21.002±0.123	9.872-23.021	S
Cd(mg/L)	0.001±0.002	0.000-0.003	0.022±0.002	0.001-0.003	S
Co (mg/L)	0.001±0.000	0.000-0.002	0.005±0.321	0.003-0.006	S
Cr (mg/L)	0.004±0.015	0.001-0.005	0.011±0.012	0.007-0.012	S
Cu (mg/L)	0.901±0.112	0.210-1.020	1.012±0.132	0.802-13.302	S
Mn(mg/L)	0.845±0.201	0.498-1.031	0.799±0.041	0.632-0.902	NS
Mg(mg/L)	9.030±4.230	6.150- 11.21	13.021±1.09	8.902-14.430	S
Fe (mg/L)	3.100±0.120	1.022-5.041	5.002±1.001	3.201-6.312	S
Se (mg/L)	0.129±0.031	0.101-0.300	0.109±0.23	0.100-0.132	S
Pb (mg/L)	0.001±0.000	0.000-0.002	0.052±0.120	0.0322-0.694	S
Zn (mg/L)	3.00±0.310	2.540-5.001	5.201±0.341	3.940-6.980	S
AS (mg/L)	0.085±0.040	0.034-0.097	0.096±0.032	0.052-0.107	S

$P < 0.05$ significant differences
$P > 0.05$ No significant differences

All elements in this table have significant differences as compare with control except Al and Mn as shown in table (4). The highest ratio for Hg, Cr, Cu, Mg, Fe and Zn among all groups were found in group C (4.002±1.022, 0.011±0.012, 1.012±0.132, 13.021±1.09, 5.002±1.001 and 5.201±0.341 mg/L) respectively.

Table (5): mean ± SD for heavy metals in group D as compare with control

Heavy metals	Control n=20		Group D n=20		P value
	Mean±SD	Range(min-max)	Mean±SD	Range(min-max)	
Al (µmol/L)	0.323±0.334	0.120-0.413	0.341±0.201	0.276-0.502	NS
Hg (nmol/L)	1.001±1.261	0.120-2.142	0.981±1.201	0.543-0.991	NS
Mo(nmol/L)	6.021±1.030	3.021-6.802	8.005±0.021	5.954-9.540	S
Ni (nmol/L)	20.07 ±52.7	8.795-21.050	34.032±0.122	30.230-35.210	S
Cd (mg/L)	0.001±0.002	0.000-0.003	0.014±0.023	0.0102-0.016	S
Co (mg/L)	0.001±0.000	0.000-0.002	0.033±0.321	0.0210-0.040	S
Cr (mg/L)	0.004±0.015	0.001-0.005	0.005±0.112	0.003-0.007	NS
Cu (mg/L)	0.901±0.112	0.210-1.020	0.921±0.230	0.629-0.987	NS
Mn (mg/L)	0.845±0.201	0.498-1.031	0.820±0.031	0.103-0.140	NS
Mg (mg/L)	9.030±4.230	6.150- 11.21	8.902±1.030	5.976-9.982	NS
Fe (mg/L)	3.100±0.120	1.022-5.041	3.201±0.301	2.945-4.210	NS
Se (mg/L)	0.129±0.031	0.101-0.300	0.110±0.330	0.100-0.301	NS
Pb (mg/L)	0.001±0.000	0.000-0.002	0.050±0.210	0.034-0.064	S
Zn (mg/L)	3.000±0.310	2.540-5.001	4.021±1.201	2.969-5.054	S
AS (mg/L)	0.085±0.040	0.034-0.097	0.201±0.032	0.090-0.271	S

$P < 0.05$ significant differences

$P > 0.05$ No significant differences

The result in this table shows the highest ratio for Co, Mn, As and Se among all groups were in group D (0.033±0.321, 0.820±0.031, 0.201±0.032 and 0.110±0.330 mg/L) respectively, although the level of Mn and Se have no significant differences, the level of Co, As, Mo, Ni, Cd, Pb, Zn and As have significant differences at ($P < 0.05$) as compare with control as shown in table (5). Other elements have no significant differences.

Table (6): The activities of glutathione peroxidase GPx and TBARS in all groups as compare with control

Groups	GPx U/g Hb	Range(min-max)	TBARS µmol/l	Range(min-max)
Control n=20	17.1 ± 5.0	10.1 – 25.3	1.48 ± 0.35	0.27 –1.89
Group A n=20	10.9 ± 2.7 [S]	7.6 - 14.8	1.56 ± 0.31 [S]	0.97 – 2.03
Group B n=20	8.7 ± 3.4 [S]	5.3 - 9.8	1.51± 0.22 [NS]	1.02-2.14
Group C n=20	9.5 ± 1.9 [S]	7.9 -11.3	1.50 ± 0.23 [S]	1.23 -1.58
Group D n=20	12.9 ± 4.7 [S]	10.6 - 15.7	1.47 ± 0.51 [NS]	1.04-2.09

Mean ± SD for (GPx): glutathione peroxidase, (TBARS): thiobarbituric acid reactive substances

The results in table (6) shows that the lower ratio for GPx were in group B (8.7 ± 3.4 U/g Hb), which have significant differences as compare with control, also GPx level have significant differences for all other groups as compare with control. The highest ratio for TBARS were found in group A (1.56 ± 0.31 µmol/l) which have significant differences, also TBARS level have significant differences in group C (1.50 ± 0.23 µmol/l) as compare with control, while TBARS level was no significant differences for both B and D groups as compare with control.

Table (7): distribution the diseases among all four groups

Groups	Diseases			
	Colon Cancer	Lung cancer	Prostate cancer	CKD
Group A	0	1	0	1
Group B	0	0	0	2
Group C	1	1	0	1
Group D	1	0	0	1

CKD: chronic kidney diseases

Table (7) describe the distribution of diseases among groups of workers, group A have one case lung cancer, and one case CKD. Group B have only two cases with CKD. Group C have one case colon cancer, one case lung cancer, and one case CKD. Group D have two cases, one case with colon cancer and the other with CKD. All cases were in age over 45 years old, and works in their work since 15 year.

Discussion

Heavy metals in the work environment absorbed and enter the body through the lungs and the digestive tract, [11]. The absorption of heavy metals from the inhaled air ranged from 7-10%, while absorption of elements from the digestive tract is lower and ranged from 3-7% [11]. There for the highest ratio of Pb were in group A which works in fuel station and inhaled a lot of smoke of cars which contain toxic heavy metals particular Pb in high ratio. Digestive tract absorption may have an important role in the case of bad hygienic habits such as not washing contaminated hands or ingestion of contaminated food also smoking during exposure to heavy metals at work [12]. At industrial conditions inhalator toxicities is most common, in the case of long-term environmental exposure, disturbances in the resorption in the proximal tubules**,** lung diseases and the skeletal system disorders will occur, like under long-term exposure to cadmium in the work, disturbances in the parameters of antioxidant barrier is demonstrated [13]. In the workers of the liquid battery workshops who including in this study, both Se concentration and plasma GPx activity were found to be significantly lower than in other groups, while lipid peroxidation measured as TBARS concentration, was increased with significant differences in both groups A and C, this disagree with Mongiat *et al*. who found there is no differences in the antioxidant system [14]. In this field a few studies demonstrated that there are changes in the blood levels of essential trace elements in people who exposed to heavy metals. Ellingsen *et al*. report the increase of cadmium on the decrease of blood Se levels in the Norwegian population [15]. The authors of Belgian demonstrated a weak, statistically significant negative ($r=-0.12$) at $p<0.001$ linear correlation between serum Zn and urinary Cd concentrations, this may be explained that in the case of high exposure to Cd, it is accumulated primarily in kidneys and liver [16]. Therefore, if concentration of Cd is high, Zn will redistribute from plasma/serum to kidneys and liver [17]. Wojciech *et al* observe that is a linear correlation coefficient between blood Zn and Cd concentrations in the workers exposed to cadmium ($r=-0.137$) [18]. There are few reports in human antioxidant system in case of exposure to lead, our investigation showed that Zn concentration was significantly lower in group A of workers who have the highest ratio of lead than in the control, this result agree with Wojciech *et al* [18] . We also observed an increased lipid peroxidation process which measured as TBARS concentration in plasma of group A with significant differences as compare with control, this suggest there is relationship between the high level of lead in group A and TBARS concentration, this result agree with the results of Jiun and Hsien of Taiwan [19]. who found relationship between the degree of lipid peroxidation and Pb level in individuals exposed to Pb concentration19. Cumulative exposure to pesticides may occur through food, water, air, dust, soil etc, Pesticides can be absorbed through skin contact, inhalation or accidental ingestion [20]. People who work in pesticide using, have a direct contact with pesticides at work, when a person is exposed to pesticides, body's detoxification mechanisms are activated, some pesticides are metabolized into different chemicals and excreted but some are stored in fatty tissues in the body, several studies demonstrated present of pesticide

residues in blood samples [21]. In group C which included people in direct contact with pesticides, 13 heavy metals have significant differences as compare with control, at the same time GPx and TBARS also have significant differences in this group as compare with control. Result In group D shows the highest ratio of heavy metal As, also GPx was lower significant differences, the arsenic can be exposure via the oral route, inhalation, dermal contact [21]. Natural levels of arsenic in soil usually range from (1- 40 mg/kg), but pesticide using can produce much higher values [22]. Workers can be exposed to higher levels of arsenic if they produce or use arsenic compounds like in pesticide manufacturing [23]. The presence of heavy metals in inorganic fertilizers is demonstrated by testing of a wide range of fertilizer products, that shows some phosphate and micronutrient fertilizers contain elevated levels of arsenic, cadmium, and lead compared to other fertilizer types [22]. Using large amount of fertilizers and pesticides for agriculture cause continuous accumulation of heavy metals in soils [23]. Using in long-term of chemical fertilizers in the vegetable field and the greenhouse vegetable field lead to accumulation of heavy metals in the soils [24]. These metals can accumulate in the soil, then taken up by plants, then enter in the food chain to animals and humans [24]. The group D included farmers who use chemical fertilizers annually in their farms and eating always their crops and vegetable from their farms, there for the heavy metals if not absorb by their hands during using fertilizers or inhaled, it transport to the body by ingestion the contaminated food. heavy metals is harmful because of its ability to reabsorb and accumulate divalent metals, so that the kidney is the first organ for toxicity of heavy metal, renal damage by heavy metals depends on the nature, the dose, route and duration of exposure [25]. Nephropathies are caused by both acute and chronic intoxication, with different levels of dangerous ranging from tubular dysfunctions like acquired Fanconi syndrome to severe renal failure leading to death [26]. Aluminium, can be removed through elimination activities, while other metals will accumulated in the body and food chain, causing some disorders and damage due to oxidative stress induced by free radical formation [27]. Some studies have demonstrated that the toxicity of arsenic depends on the exposure dose, frequency and duration, and individual susceptibilities. In our study group D of workers have the highest ratio of As, also low significant level of GPx, the workers of this group have one cases with colon cancer and one cases with CKD, the high level of As may be implicated in this result. Human toxicity from arsenic occurs by exposure to inorganic arsenic, inorganic trivalent arsenate is toxic over five times than pentavalent arsenate [28]. As can binding to thiol or sulfhydryl groups on proteins, then inactivate over 200 enzymes, this is the most mechanism responsible for arsenic's widespread effects on different organ systems [28]. As also impairment of cellular respiration by the inhibition of various mitochondrial enzymes, and the uncoupling of oxidative phosphorylation, arsenic have the ability to interact with sulfhydryl groups of proteins and enzymes, and to substitute phosphorous in a variety of biochemical reactions [29]. Trouba *et al*. report that exposure in long-time to high levels of arsenic make cells more susceptible to mitogenic stimulation then cause alterations in mitogenic signaling proteins and cause carcinogenic action of arsenic [30]. Other studies have demonstrated the interfering of arsenic with cell signaling pathways, that implicated in the promotion and progression of different tumor types in experimental animal models, and of some human tumors like colon cancer cells and lung cancer cells [30].

Conclusion

From the results of this study, it was observed that the levels of Zn, Pb, Co, Cd and Ni have significant differences for all groups, and all four groups have at least one case with one type of cancer, so, the level of these heavy metals may cause for these cancers. Also we observe group C is the most dangerous group, so they have significant differences for 13 heavy metals from 15 metals. The results of this study found a relationship between toxic and essential elements, with antioxidant system, so that the GPx level was lower significant differences in all groups as compare with control.

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