Study on trace element concentration in hair, blood and urine of roadways cleaners workers in Kerbala city .

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Key word: Trace elements in hair, blood and urine
(Received: March 2012 , Accepted : June2012)

Abstract

Trace metals in biological samples namely hair , blood and urine were examined in roadways cleaners workers exposed to Pb. Hg, Ni, Cuand Crmetals and in controls group.The significant levels exposed and unexposed subjects in hair , blood ,and urine have been computed by student test at $p<0.05$ statistical analysis data showed through the connection relation ship between the two groups (test and control) ,element (Ni, Cu, Hg) non- significant , except (Cr, Pb)significant for the models hair. The serum samples showed a statistical analysis data asignificantrelation ship for (Cr, Pb, Ni), except (Cu, Hg) non- significant models urine sample the statistical analysis data showed asignificant relation ship (Cr, Hg, Cu, Ni)and non- significant for the lead .The behavior has been explained in context to the type of exposure and the periods of exposure for each element .

This study has shown that among cleaner workers ,the blood lead level below thane WHO permissible exposure limite(40 mg/dl for men)

دراسة تركيز العناصر النزرة في الشعر والدم والادرار لعمال تنظيف الطرق العامة في مدينة كربلاء

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مفتاح البحث: العناصر النزرة في الشعر والدم والإدرار

الخلاصة

قدرت العناصر (النحاس,الرصاص, النيكل, الزئبق والكروم) في النماذج البايلوجية (الدم , الشعر والادرار) لعينة من عمال تنظيف الطرق العامة في مدينة كربلاء ومقارنتها بمجموعة السيطرة. وايجاد علاقات فيما بينها .اظهر التحليل الاحصائي من خلال علاقة الارتباط بين مجموعتين الاختبار والسيطرة ان جميع ايونات العناصر (Cr, Pb , Cu, Ni, Hg) معنوية.
اظهر التحليل الاحصائي من خلال علاقة الارتباط بين مجموعتين الاختبار والسيطرة ان العناصر (Ni, Cu, Hg)باستثناء غير معنوية (Cr,Pb) معنوية بالنسبة الى نماذج الشعر.
اما نماذج المصل اظهر التحليل الاحصائي علاقة معنوية (Ni, Pb , Cr) باستثناء (Cu, Hg) غير معنوية . اما نماذج الادرار اظهر التحليل الاحصائي علاقة معنوية

(Cr, Cu, Ni, Hg).والغير معنوية بالنسبة للرصاص ,وفسرت نتائج التباين على ضوء فترة التعرض للعنصر ونوع العنصر. هذا البحث يبين انه نسبة عنصر الرصاص في دم عمال تنظيف الطرق هو ادنى من الحد المسموح به عالميا حسب النسبة المعلنة من قبل منظمة الصحة العالمية(40 مايكروغرام /100مل)

Introduction :-

A number of tissues in the human body such as the kidney and the liver can be used for metal analysis particularly for lead but these are not easily accessible in living individuals . Specimens readily available for analysis include blood , urine , nail, teeth, and hair. Their worth as bio-indictors depends on their capacity to store trace element s[1-4].Blood metal levels reflect transient levels whereas hair metal levels show long –term retention , which may be accounted for along period of exposure [5-6] . Nails also indicate metal body burden[7] .The presence of toxic and trace elements in biological tissues likes hair and nails can be a measure of amount absorbed by a person . The heavy metals that are most often implicated in human poisoning are lead , mercury , cadmium and arsenic [7,8]. People may come into contact with these and other heavy metals in industrial work , pharmaceutical manufacturing , and agricultural activity, as well as through accidental ingestion of contaminated products. Children may be poisoned as a result of inadvertent exposure –for example , from plying on contaminated soil or ingesting lead –based paint[7-9]In continuation to earlier studies[1-8],the present work is study on some toxic and trace elemental concentration of exposed as well as unexposed subjects and the effect of period of exposure, type of work and their correlation ships.

Experimental procedure :-

Samples were collected form 38 malesubjectswith different age working in roadway workshop ,locomotive workshop and exposed to metal in their work environment in particular .Hair samples (4-5 cm long), of male subjects ,were collected from the nape of scalp by cutting approx 2mm from the scalp using a pair of sterilized stainless steel scissors washed with ethanol , a neutral solvent , to remove external contamination ,if any ,and dried [9,10].All hair samples were sealed in plastic bags prior to analysis . Samples taken weight about one gram.
For sample of blood were collected by vane puncture using disposable syringes .For sample of urine collect a.24- hour of urine specimen in clean and dry , To 10 ml of mixed urine sample centrifuge .The sediment is collected by centrifuge of the urine at low speed or by allow it to stand for some time in conical vessel-The sediment was dissolved in 10 ml deionzid water .1- collected a complete 24-hour urine in clean and dry container the volume and refrigerate until . assay2- measure 10 ml of urine into a centrifuge tube, mix and centrifuge at low speed for (5) minutes or by allowing it to stand for some time in conical vessel 3-pour off the supernatant fluid , and dry the precipitate.4- Dissolve the precipitate in about 50 ml deionzid water .

Procurement of requisite details of subjects:

The personal and medical history as well as the details of the subjects taken for study was obtained through a questionnaire as per the recommendation of world health organization . The

information required to be filled in the Performa includes age, hair color, personal habits (smoking ,drinking , and food habit), place of residence , occupation , possible metal exposure. Use of hair cosmetics and number of tooth amalgam fillings .volunteers also answered question about how long the exposed or periods of exposal .We selected those who had work for average (6-8) hour/ day .

Preparation of samples:-

The hair samples werecut into pieces (1cm) so as to ensure feasible and fast digestion of the samples in digesting solution to prepare a water clear solution . Samples pre-wash with nonionic detergent were soaked in deionized water for 10 min . This was followed by soaking in acetone to remove external contamination followed by washing with deionized water . Subsequently they were dried in an oven at 110 c° for 1 h and stored for later mineralization. [18]The dried hair samples were digested with 1:1perchoric acid and nitric acid mixture .

Analysis and Assay :

The concentration of metals was determined by using atomic absorption spectrophotometer (Schimatzu AA -646) with graphite furnace and air acetylene flame. A series of standers were prepared in deionized water for instrumental calibration by diluting commercial standards containing 1000 ppm of the metals . All reagents were also prepared for mineralization of contaminated errors .The main instrumental parameters (like wave length, band width , lamp current)for the estimation specific metal by Atomic Absorption spectrophotometer were also set up for each metal separately- standards solution of metals prepared from metal powder and AR salts used as reference material .For Mercury Ion: used could Atomic Absorption Spectrophotometer.

Experimental procedure :

Samples were analysed for mercury glass wares were acid washed after first soakin in Alcon ox solution for 24h .After acid washing ,the glass ware was rinsed in three separate washed of deionized water.

For blood samples assay . 0.1ml of serum was diluted to total volume of 1ml using 6% n-butanol solution .The diluted solutions were aspirated directly into air-acetylene flame .[5,11]

The results were analyzed statistically,and values were expressed as (mean ± SED)The level of significance was determined by employing (t) test .Only when the P value was less than 0,05 , the difference between two groups was considered as statically significant.

Results and Discussion :-

The mean concentration of metals in hair , blood and urine 38 roadway cleaners worker and 35 unexposed volunteers subjects (control group) have been shown in table and figures (1,2,3).

Statistical analysis data showed through the connection relationship between the two groups (test and control), elements (Ni, Cu, Hg) non-significant ,except(Cr, Pb) significant for the models hairs .

Serum sample showed a statistical analysis data a significantrelationship for (Cr, Pb, Ni), except (Cu, Hg) non-significant, models urine sample the statistical analysis data showsignificant relationship(Cu, Hg,Cr, Ni), and non-significant for the lead similar results were obtain by other [11-12].

For the relationship between elementstatistical analysis data showed in test group for the chromium element , non-significant relationship with the(Cu, Hg, Pb) and with the (Ni) significant relationship.The copper element was found that non-significant relationship with the (Cr , Ni) and a significant with the (Hg, Pb).The mercury element was found that the relationship was non-significant with (Cr) and significant with the (Cu, Pb, Ni) .The Nickel element found that the relationship with the (Cu, Pb) non-significant and significant with the (Cr, Hg).The lead element found that the relationship with (Cr, Ni)non-significant and significant with the(Cu, Hg).

Statistical analysis data also showed in the control group for the chromium element , that non-significant relationship with(Cu, Ni)and significant with the(Hg, Pb). The copper element found to be non-significant relationship with the (Cr, Pb, Ni, Hg).

The mercury element found to be non-significant relationship with the (Cu) and significant with the. (Cr, Pb, Ni).The Nickel The mercury element found non-significant relationship with the(Cr, Pb,Cu) and significant with (Hg). The lead element found to be non-significant relationship with the(Cu, Ni) and significant with the. (Cr, Hg).

From three periods of exposure (1-10,11-20and 21-30) metal concentrations were significant in (21-30) exposure periods. In addition to background concentrations of Cr and Ni and other metals like Pb ,Cuare present in appreciable amounts in hair .

This indicates that metal body concentration is function of metal in the work environment as also supported by Buchancova[14] et.al .Significantaly high values of metals in exposed subject (cleaner workes)relative to controls group may be occupation ally related .

It is knowing that metals such as iron and zinc called essential elements which have biological importance .But metal such copper consider as trace essential element because the body needs it in trace quantity .The essential and trace essential metals contribute in composition of many enzymes and molecules that have biological activity . The trace metal has not biological importance and hence it called poison metal.

The main factors that effect the metal level in biological tissue and fluid are the duration and intensity of exposure ,Which in turn , depends on metal content in the environment , and its physicochemical state.

The develop an in depth knowledge ,the study was extended to assess the metal concentration in hair of subjects in volved in specific type of workers such us lead battery workers , machine man , fitter ,back smith , painter , mechanic , welding , gear fabrication and assembly fitting . In agreement to other workers .[12-18], results show that contents in blood is equial or higher relative to hair for all metal except Pb^{+2} .However , aunified relationship could not be established between the elemental composition of hair and blood . The different treatment , adopted by the subjects for washing the hair , effects the metal profile in hair as compared to blood samples . This is because few metals can be easily washed out of hair during treatments, which may lead to low levels[17] .

Blood and serum do contain minerals, but they may not be completely representative of the body's mineral storage .

In many cases ,the serum level of minerals is maintained at the expense of tissue concentration (homeostatic mechanisms) . serum concentrations may fluctuate with the manner in which the sample is taken, emotional changes , the time of day the blood is drawn , or food eaten prior to taking sample for example ,[16-18]for many elements, hair more closely reflects the body's mineral stores than does blood or urine . Due to ((homeostatic)) mechanisms our mineral blood levels are constrained to normal levels despite inherent and dramatic mineral deficieucies .

Indeed there is often no clear linear relationship between mineral tissue levels indicated in hair and those levels in serum .Serum blood trace mineral levels are believed to be defined extracellular .

Where as the hair trace mineral levels are believed to be defined at intracellular trace element concentrations. This is why hair analysis is considered to be a better record of mineral tissue levels.

Not affect by dietary intake that week and an accurate measurement gauge of the past 3-5 month for mineral tissue level [17].

Thirty to forty days following an acute exposure , elevated serum levels of lead may be undetectable .

This is due to the body's removing the lead from the serum as a protective measure and depositing the metal into such tissues as the liver , bones , teeth and hair [5-8-17].

Table (1)mean metal concentration(mg/g) in hair of of exposed cleaner workers and control group in mg per gram

Variable	Cleaner workers no.38	Control group	p- value
	Mean (mg/g)	Mean(mg/g)	
Cr+3	50	24.9	0.001 Significant
Cu^{+2}	52.2	49.15	0.08Non-Significant
Hg^{+2}	18	15	0.206 Non-Significant
Ni^{+2}	60	61	0.608Non-Significant
Pb^{+2}	17.05	9.35	0.0001Significant

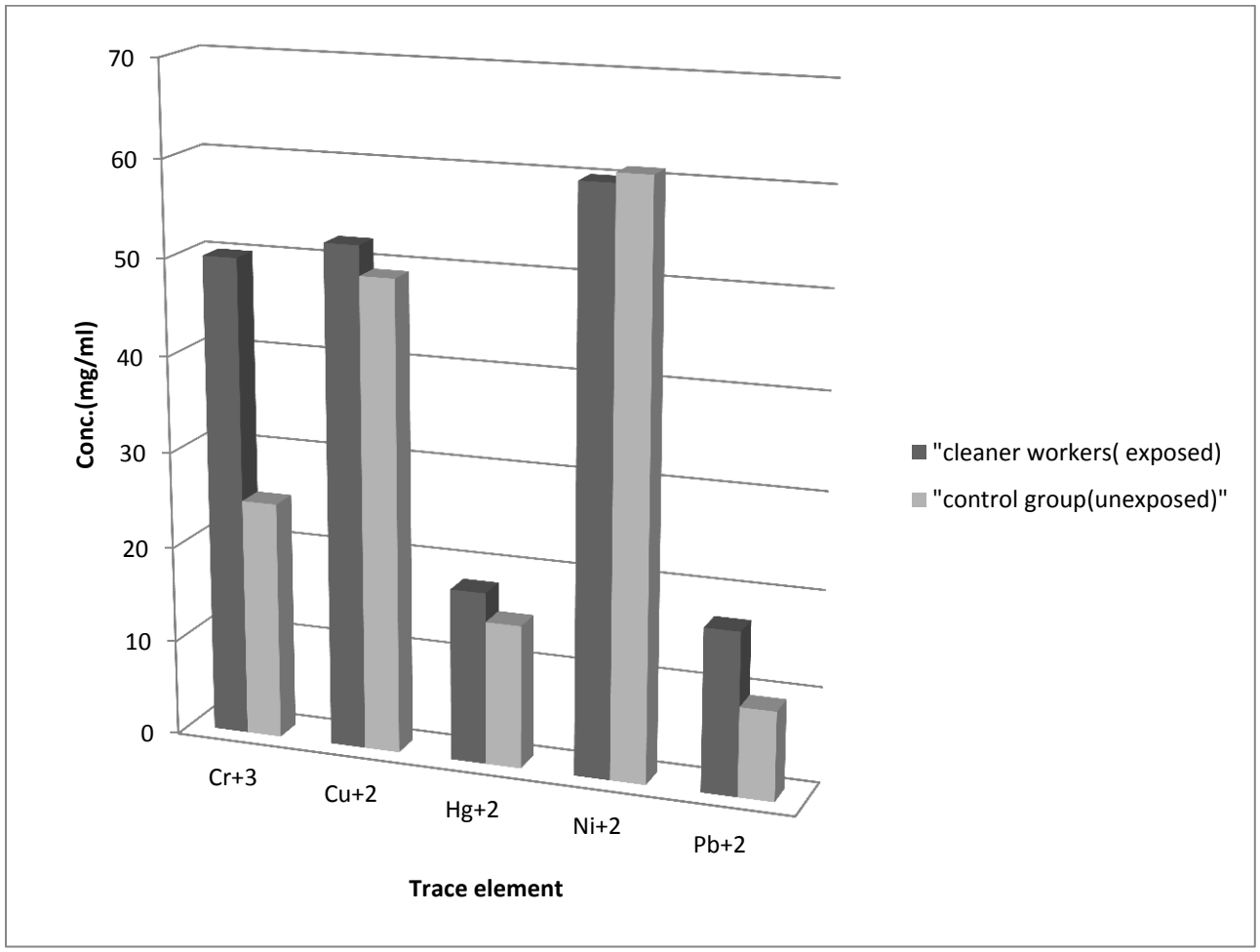

Fig (1) Graphical representation of mean metal concentration in human hair of exposed and unexposed.

Table (2) mean metal concentration(mg/ml^{-1}) in serum blood of exposed cleaner workers and control group

Variable	Cleaner workers no.38	Control group	p- value
	Mean (mg/ml^{-1})	Mean(mg/ml^{-1})	
Cr+3	46.95	22.3	0.001Significant
Cu^{+2}	62.2	58.2	0.053Non-Significant
Hg^{+2}	17	14.52	0.09Non-Significant
Ni^{+2}	120	98.7	0.001Significant
Pb^{+2}	9.2	3.85	0.001Significant

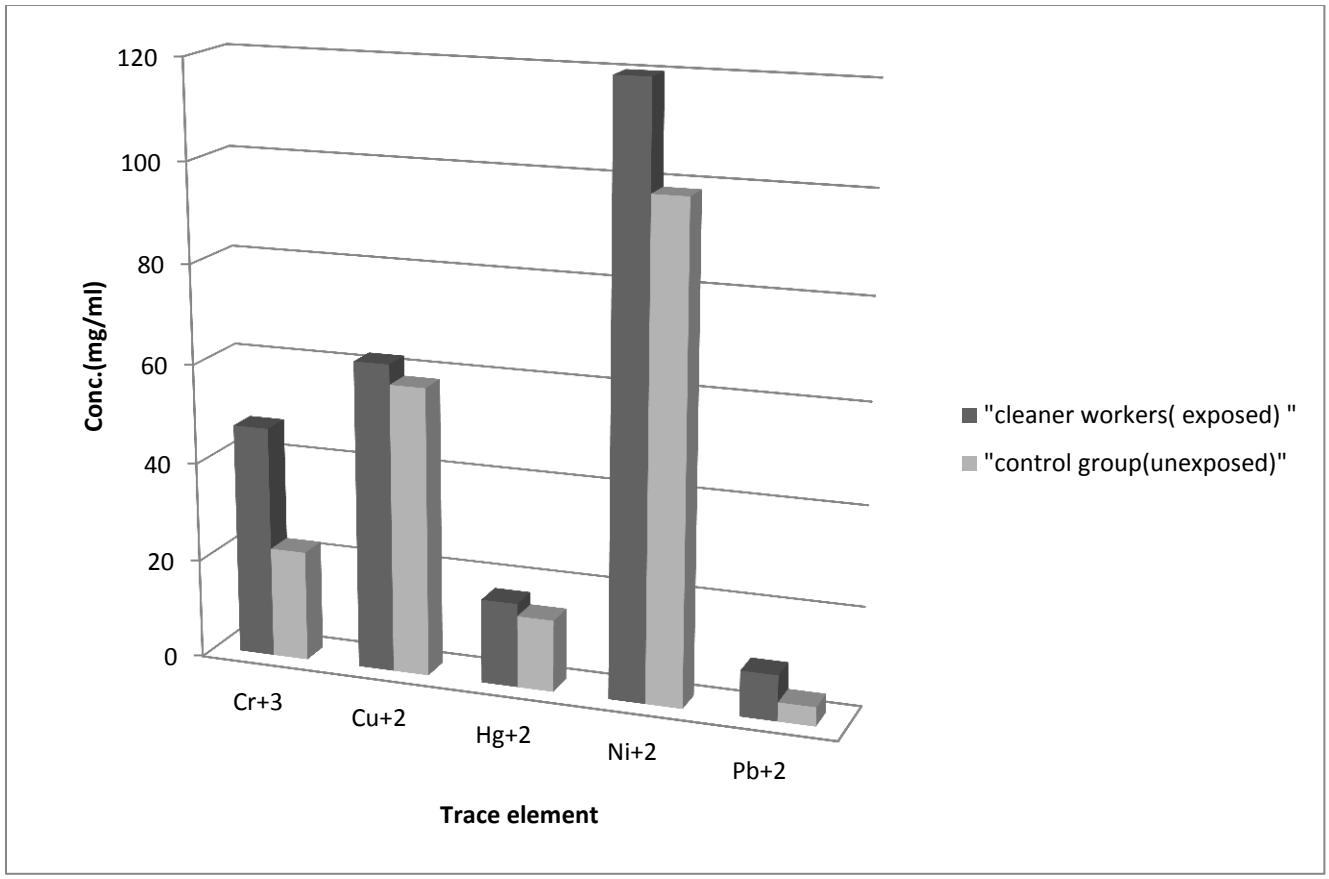

Fig (2) Graphical representation of mean metal concentration in human serum blood of exposed unexposed.

Table (3) mean metal concentration(mg/ml^{-1}) in urine of exposed cleaner workers andcontrol group in mg per gram

Variable	Cleaner workers no.38	Control group	p- value
	Mean (mg/ml^{-1})	Mean (mg/ml^{-1})	
Cr+3	40	21.55	0.001Significant
Cu^{+2}	75.85	60.8	0.001Significant
Hg^{+2}	5	2.0	0.004Significant
Ni^{+2}	40.7	3.52	0.03 Significant
Pb^{+2}	7.2	3.85	0.06 Non-Significant

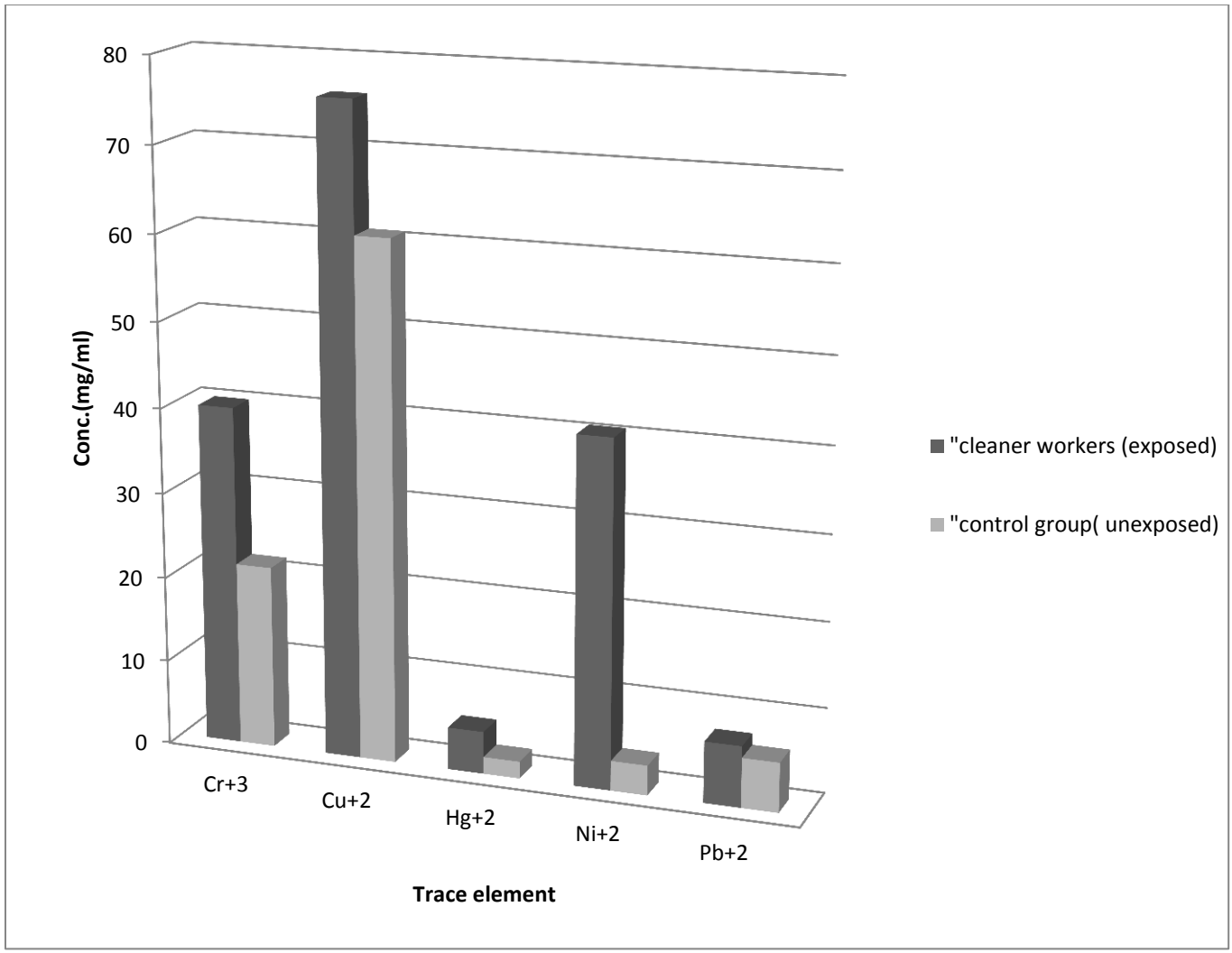

Fig (3) Graphical representation of mean metal concentration in human urine of exposed unexposed.

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