مجلة القادسية للعلوم الصرفة المجلد 15 العدد 4 سنة 2010
(بحوث الندوة البيئية الخامسة للبيئة والتلوث والمنعقدة بتاريخ 13-14 ايار 2009)

Determination Of Lead , Cupper, Iron , and Zinc In Blood Of Fuel Station Worker At Al – Najaf City.

Amer M . J . Al-Shamri , Rash S . Nama , Ahmed W.Radhi , Furkan M . Odda
Dept. of Chemistry , College of Science , University of Kufa

Abstract:

The increasing pollution with many heavy metals harmful for living organisms has been the subject of considerable interest .Toxic substances elements occurring in the environment ,as well as in the human body . Many workers are exposed to heavy metals in industry ,particularly in the metal finishing industry or traditional glasswork .

This study aimed to determine cupper, lead, iron, and zinc concentration in the blood of fuel station worker (investigator group) **,**in addition to aged match non-occupationally exposed individuals (control group).The results that were achieved in this study showed a significance in average Pb, Cu, Fe, and Zn concentration in the investigated group of peoples that workes in a high polluted environment compared to control group that works in clean environment .A remarkably close relationships have been shown between amount of estimated heavy metals and duration of works in fuel station . this sta .In conclusion in exposed subjects ,there is a direct effect of working environment and duration of work in the concentration of lead, cupper, iron, and zinc in the blood at the human population.

Introduction:

Environmental pollution is steadily increasing as a result of in adequate utilization of natural resources ,the development of the chemical industry ,non- ferrous metal processing ,and traffic congestion.[1].The development of the industry and expansion of the chemical compounds used in different branches of industry are leading to the environmental spread of heavy metals[2].Toxic substances emitted into air change quantitative relations among elements occurring in the environment ,as well as in the human body. Many workers are exposed to heavy metals .Metal level and concentration of other elements in organ and animal tissues, are indicative of the overall body chemical and mineral status.

The homeostasis of a particular mineral involves different mechanisms depending on the organ involved ;with participation. The study of biological fluids and other materials ,such as blood plasma and fecal material ,is relevant as function indicative of underlying normal biochemical processes ,living conditions and potential diagnostic tool to identify a disease state [3]. It has been determined that humans need

nearly 72 trace elements, including very low concentrations of heavy metals ,such as Zn ,Cu ,Sn ,V ,Cr ,Mo ,Mn ,and Co.

Most metals are toxics at high concentrations Cd ,Pb, and V [4] are pollutants of biological interest due to their biotoxicity [5,6].Due to their high levels of toxicity ,these chemicals have been linked to a wide range of health problems ,for a person already living with liver disease ,repeated exposure to these toxic chemicals can cause further damage to already challenged organ .Because the physiological effects of heavy metals are mediated through interference with protein synthesis and function of enzymes (located in liver)[7].The aim of this work focus on the determination of heavy metals levels, Fe , Cu, Pb ,and Cd .and compared the result with that of general population working in Kufa University (non-occupationally exposed population .

Materials and methods:

This study included 46 healthy male employers working in fuel station at Al-Najaf City Center ,investigator group. The average age of workers was (31 year) range (21-55 year).Working in fuel stations at least 1 years ago .In addition 50 age and sex matched healthy subject (non-occupationally exposed population) ,working in Kufa University (control group). Each subject was interviewed about demographic information ,medical history ,smoking habit ,alcohol intake and other healthy related habits .

Blood samples were taken from the capital vein between 6.00 and 8.00 hours (with fasting) into plastic tubes .Samples were allowed to clot at 37 C° ,then centrifuged at 3000 rpm for 15 min .Sera were removed ,frozen at -20 C° until analysis . The studied heavy metals were measured on an atomic absorption spectrophotometer (PYE-UNICUM SP-9) [8].

Biostatistical analysis:

The results were expressed as mean ±SD. Students t –test and linear regression analysis were used for assessment of results .Significant variation was considered when the P (statistical probability)value was less than 0.05 .

Results and discussion:

The results achieved with the analysis of blood samples of each employer working at fuel station ,investigated group (IG) ,were compared with the results of the blood samples of human control group ,control group are volunteer working in Kufa university ,clean environment ,with out pollution .

Results of this investigation shows ,Table1 and Fig 1,that there exists significant distinction in the average of concentration of the Cupper ,lead ,Iron and Zinc

in the blood at the investigated group with the average of concentration of the Cupper Lead , ,Iron and Zinc in the blood at the control group.

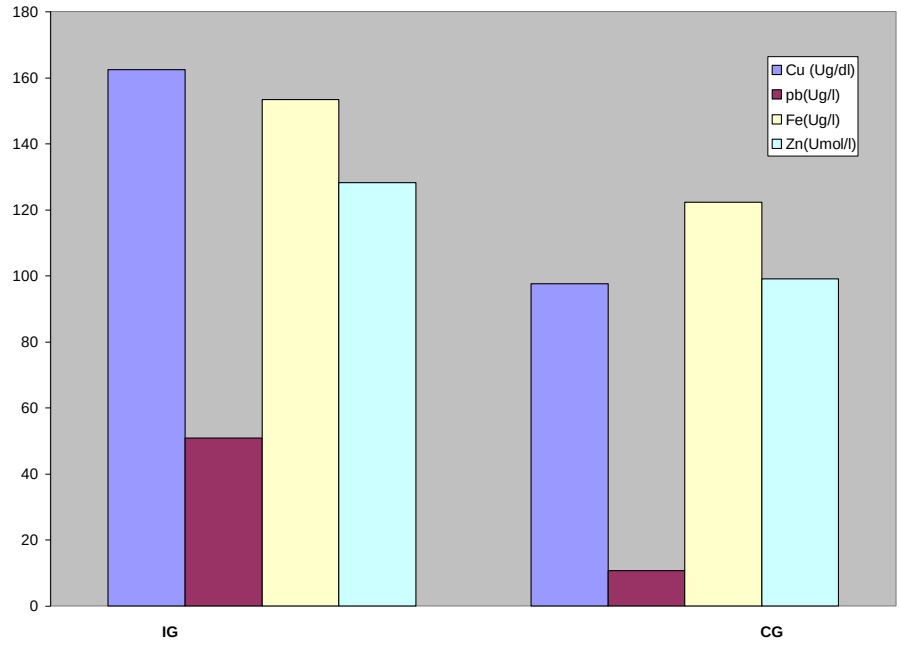

Fig1: Comperative of the Cupper Lead , ,Iron and Zinc levels in blood between CG and IG.

Table 1: : Comperative of the Cupper Lead , ,Iron and Zinc levels in blood between CG and IG.

Heavy elements		CG	IG	P(value)	t
Cu(µg/dl)	**Mean**	97.6	162.46	<0.0001	44.104
	Std.Deviation	4.98	9.97		
Pb(µg/l)	**Mean**	10.7	50.84	<0.0001	39.449
	Std.Deviation	5.85	6.87		
Fe(µg/l)	**Mean**	122.30	153.33	<0.0001	8.98
	Std.Deviation	10.67	23.43		
Zn(µmol/l)	**Mean**	99	128.17	<0.0001	29.416
	Std.Deviation	3.78	6.73		

This difference is as a result of the pollution of environment in the investigated locality. Numerous population groups exposed to environmental heavy metals have been studied to fined reliable biological indicators for detecting the toxic effects of metals .Many studies suggested hat blood concentration s of some heavy metals was a useful indicator of recent exposure [9,10].Our results were similar to

previous report. From the results presented in the Table 2 we see that between (Cu ,Pb ,Fe ,and Zn) and the duration of work for investigated group exists a significant positive relation with high statistical probability ,dose not exist such correlation in control group.

Table2: Correlation between Cupper Lead , ,Iron and Zinc and the duration of work at CG and IG.

Heavy elements	**CG**		**IG**	
	r	p	r	p
Cu(µg/dl)	0.023	0.910	0.812	<0.0001
Pb(µg/l)	0.124	0.38	0.594	<0.0001
Fe(µg/l)	0.263	0.45	0.726	<0.0001
Zn(µmol/l)	0.064	0.73	0.810	<0.0001

Note: r=correlation index p=probability

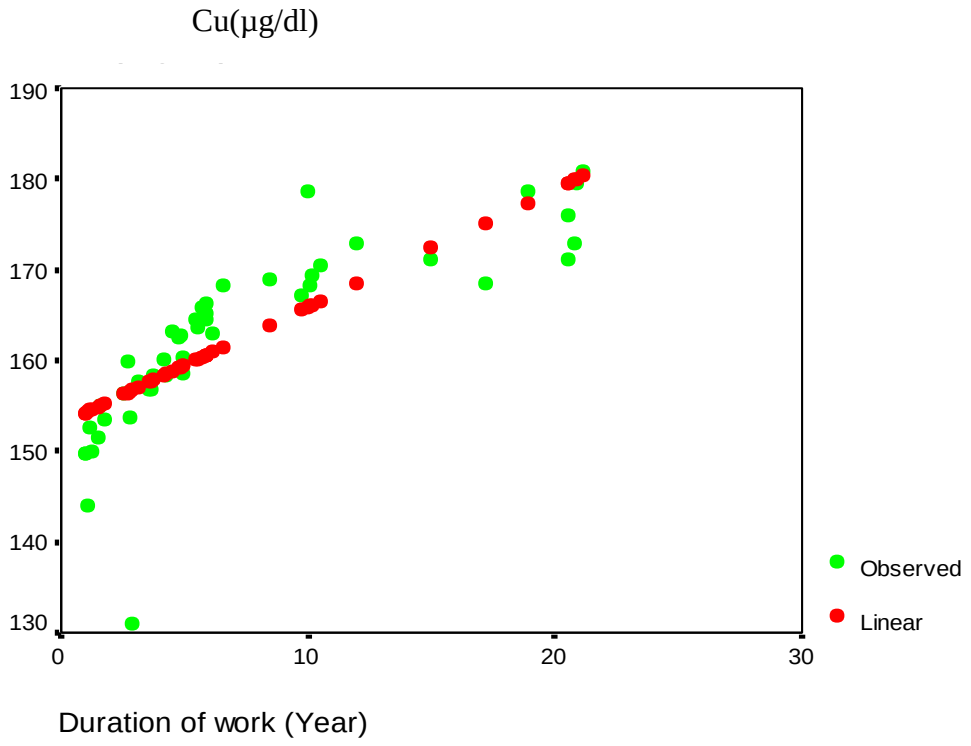

Fig2: Correlation between Cu concentrations and the duration of work for IG.

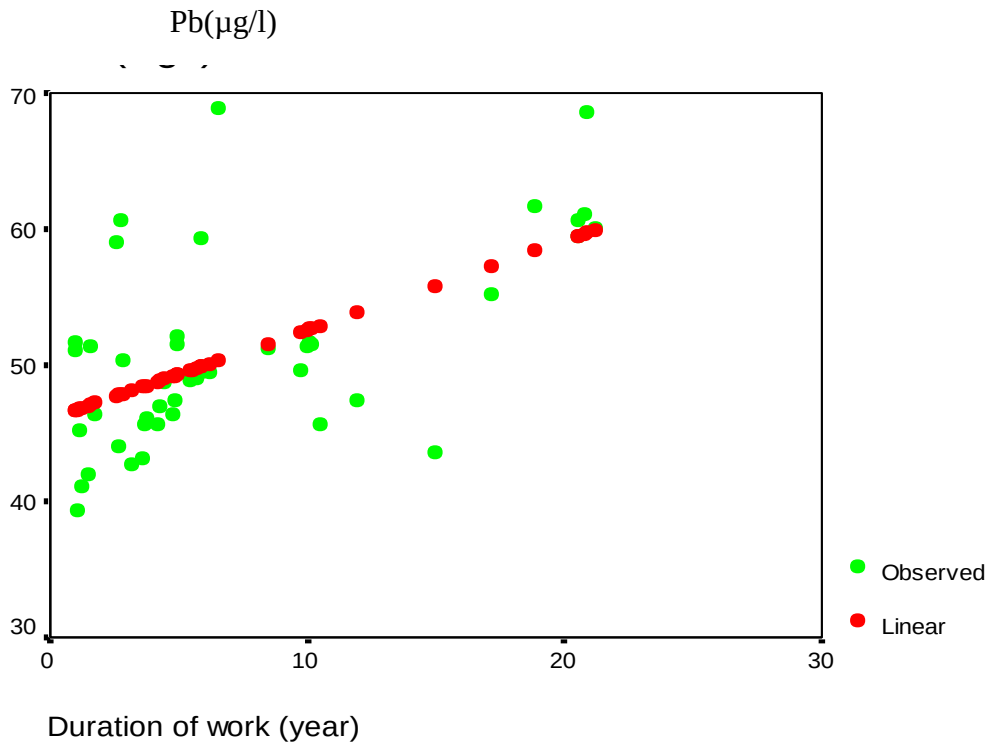

Fig3: Correlation between Pb concentrations and the duration of work for IG.

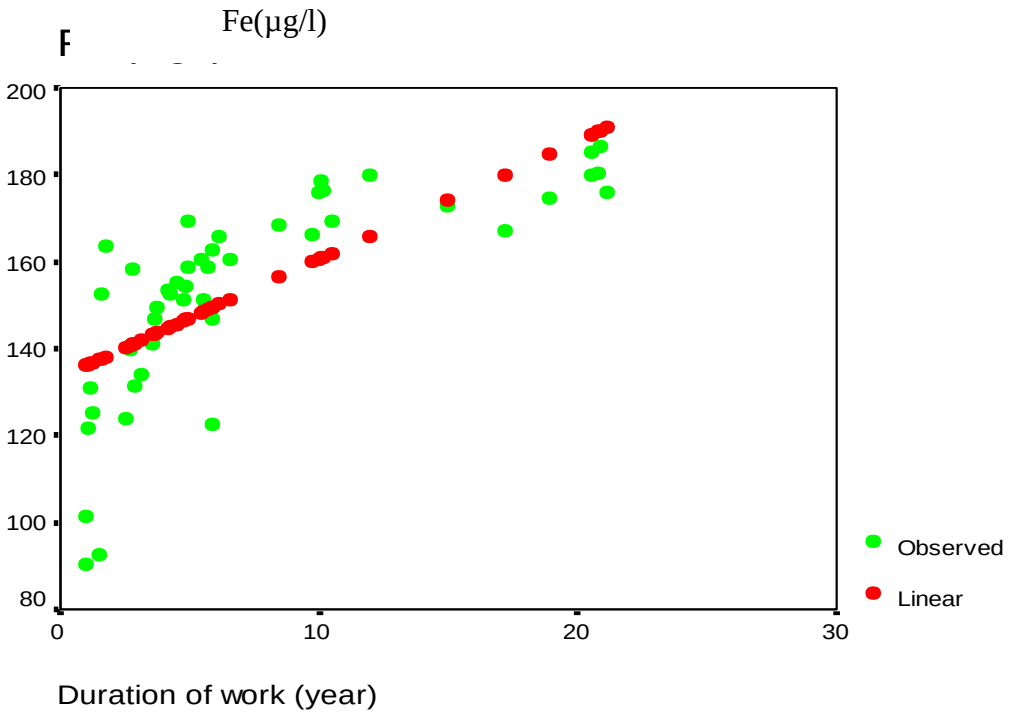

Fig4: Correlation between Fe concentrations and the duration of work for IG.

Fig4: Correlation between Zn concentrations and the duration of work for IG.

Chronic .low level exposure to toxic metals is an increasing global problem. The symptoms associated with the slow accumulation of toxic metal are multiple and rather nondescript ,and overt expression of toxic effects may not appear until later in life[11].

Cupper is the third most abundant trace metal and deficiency is more common than toxicity .In general ,the amounts of cupper ingested in food and water are almost never harmful to humans becomes they are relatively low and because most mammals and vertebrates have the ability to maintain copper homeostasis by a combination of decreased absorption and enhanced excretion[12]. Toxic amounts are encountered only in unusual circumstances, such as when children have accidentally eaten the CuSO4 (Bordeaux mixture) used on some crops to discourage certain microorganisms, or when food is consistently prepared in vessels that can leach high doses [13]. For example, preparation of milk formulas in brass vessels is thought to account for cirrhosis in Indian children .Nevertheless, copper toxicosis does sometimes occur, and it can even acutely lead to death [12].

Lead is found in old paint ,some ceramic products ,lead-soldered water pipes ,industrial waste ,car exhaust and cigarette smoke .Metal like lead are not known to be essential for the functioning of biological systems and the general view is that wherever possible the exposure to these metals should be kept as low as possible [14]. Pb compounds are absorbed by human and animal bodies though alimentary and

respiratory systems .They can also be absorbed by intact skin [1].It can be seen in the investigations carried out by Jakubowski [15-17].,Pb contents of human blood were the highest in men (87.57µg/l),next in children (66.71 µg/l),and the loiwes in women (55.14µg/l) . This is likely due to the fact that the majority of men are employer in industry ,where the exposure to Pb is sever.

The correlation between serum lead level and the duration of work at the investigated group is as a result of prolonged exposure or inhalation of car exhaust. Excessive amounts cause anemia ,renal tubular nephrosis ,diminished intellectual capacity ,headache ,drowsiness ,and gastrointestinal upset [14] .

Iron (Fe): Iron is the most abundant trace metal and is needed to make hemoglobin. Iron deficiency results in anemia and is most commonly seen in children with inadequate dietary intake; adults who exhibit chronic blood loss; and multiparous females who have not received iron supplementation. Iron excess is most often caused by increased ingestion and absorption of iron supplements or exposure from iron pots used for cookware. Some persons absorb excessive iron for unknown reasons. Accumulation of iron in the tissues leads to hemochromatosis which results in renal damage, cirrhosis, and an enlarged spleen and liver. The pancreas may become damaged leading to diabetes mellitus and deposition in other tissues causes inflammatory damage (e.g., deposits in joints cause arthritis)[18].

Zinc is an essential trace element that can cause symptoms of deficiency and can be toxic when exposures exceed physiological needs. This relationship is described by a homeostatic model that takes the form of a U-shaped curve; the arms of the curve express risk of deficiency or excess, with the portion of the curve between the arms expressing the range of exposure (intake) that is related to optimal function (good health). The relationship between intake and health is affected by physiological factors (homeostasis) and by extrinsic factors that affect the availability of zinc for absorption and utilization or that interfere with the metabolism of zinc and biochemical processes that require zinc[19].

Occupational exposure to dusts and fumes of zinc and zinc compounds can occur in a variety of settings in which zinc is produced, or in which zinc and zinc-containing materials are used. Typical airborne exposures observed include 0.19–0.29 mg/m3 during the smelting of zinc-containing iron scrap, 0.90–6.2 mg/m3 at non-ferrous foundries and 0.076–0.101 mg/m3 in hot-dip galvanizing facilities. Far higher exposures are possible during particular job activities, such as welding of zinc-coated steels in the absence of appropriate respiratory protection and/or fume extraction engineering controls**.** Occupational exposure to high levels of zinc oxide and/or nonferrous metals is associated with metal-fume fever. This is usually a short-term, self-limiting syndrome, characterized by fever and chills. Induction of metal-fume fever is most common with ultra-fine particles capable of deep lung penetration under conditions of exposure. Studies on volunteers conducted under short-term exposure conditions (77–153 mg/m3 for 15–30 min) have detected pulmonary inflammation responses (including cytokine induction) which are consistent with manifestations of metal-fume fever and support an immunological etiology for this acute reversible syndrome[20,21].

References:

1-J. Monkiewicz ,H. Geringer ,K. Bas .Pb concentration in Dog Blood as Indicator of environmental pollution .Polish Journal of environmental studies Vol 7,No.5(1998),285-288.

2- Goyer RA. Toxic effects of metals. In: Klassen CD,ed.Casarette and Doull's Toxicology. The basic science of poison, 5th ed. New York: McGrow Hill, 1995: 634-736.

3-Merck.Company clinical laboratory .Medical-chemical investigation methods ,Darmstadt,Federal Repuublic of Germany (1970)259 pp.

4- Rizk S. L. ,Sky-peck H.:Comparison between concentration of trace elements in normal and neoplastic human breast tissue .cancer Res.1984, 44:5390-5394.

5- Bin Q. ,Garfinkel d.:The cadmium toxicity hypothesis of aging :a possible explanation for the Zinc deficiency hypothesis of aging . 1994, Med Hypotheses 42:380-384.

6-Dowd T. , Rosen J. Gundberrg C. and et al :The displacement of calcium from osteocalcin at submicromolar concentrations of free lead .1994,Biochim Biopys .Acta 122(6):131-137.

7- Tamara J.Mariea and George L.Carlo .Wireless Radiation in the Etiology and Treatment of Autism :Clinical Observations and Mechanisms.J.Aust coll Nutr. &Env.Med Vol .26 No.2 (2007) 3-7.

8- Dakhil N. , Ala´a K. ,Ahmed A. ,Determination of Mn ,Fe ,Zn ,in blood of workers in (TV) repair workshops in Hilla City .(2007) ,Journal of Kerbala University ,ISSN-1813-(0410) ,15-20.

9- Jung K, Pergande M, Graubaum HJ, Fels LM, Endl U, Stolte H. Urinary proteins and enzymes as early indicators of renal dysfunction in chronic exposure to cadmium. *Clin Chem* (1993); 39: 757- 65.

10- Moon CS, Zhang ZW, Shimbo S. Evaluation of urinary cadmium and lead as markers of background exposure of middle-aged women in Korea. *Int Arch Occup Environ Health* (1998); 71: 251-6.

11- Chang LW. Toxico-neurology and neuropathology induced by metals. In: Chang LW ed. Toxicology of Metals. Boca Raton: CRC Press; (1996):511-535.

12- Davis GK, Mertz W. Copper. In: Mertz W, ed. Trace elements in human and animal nutrition. 5th ed. Vol 1 . New York: Academic Press, (1987):301-64.

13- Barrow L, Tanner MS. Copper distribution among serum proteins in paediatric liver disorders and malignancies. Eur J Clin Invest (1988): 18:555-60.

14-Aposhian V. DMSA and DMPS – Water soluble antidotes for heavy metal poisoning. *Ann Rev Pharmacol Toxicol* 1983;23:193-215.

15- DUTKIEWICZ T., SWIATCZAK J. Ot6w w srodowiskuw Polsce. Medycyna (1993)Pracy 6, 53,.

16- JAKUBOWSKI M. Poziomy biologiczne olowiu u mieszkancow Polski. (1993) Medycyna Pracy 6, 15,.

17- JAKUBOWSKI M. Narazenie srodowiska na ot6w w Polsce. Pediatria Polska

(1993) , 4 , 15 , .
18- David Quig .cystein metabllism and metal toxicity . Alternative Medicine Review Volume 3, Number 4 _ (1998). Page 262.
19- Schumann K.: The Toxicological estimation of the heavy metal content (Cd ,Hg ,Pb)in blood for infants ands mall children .1990 ,Ernahrungswiss ,29(1):54-73 .
20-binQH. ,Garfinkel D. :The cadmium toxicity hypothesis of aging :A possible explanation for the Zinc deficiency hypothesis of aging .1994 ,Med, Hypothesis ,42 :380-384 .
21-Linder, Maria C, ed, Nutritional Biochemistry and Metabolism with Clinical Applications, 2nd ed, 1991, Appleton & Lange, Norwalk, CT, 191-212.

تقدير عناصر الرصاص ، النحاس ، الحديد ، والزنك في دم العاملين بمحطات الوقود في مدينة النجف

عامر موسى جودة الشمري ، رشا شاكر نعمة ، احمد وحيد راضي ، فرقان معين عودة
قسم الكيمياء / كلية العلوم / جامعة الكوفة

الخلاصة :

ان موضوع زيادة تراكيز العناصر الثقيلة في حياة الانسان ذات اهمية كبيرة ، من خلال سمية البيئة بالاضافة الى سمية جسم الانسان . ان العديد من العاملين في المصانع يتعرضون الى العناصر الثقيلة . هذه الدراسة تهدف لتقدير تراكيز العناصر الثقيلة (الرصاص ، النحاس ، الحديد ، والزنك) في دم العاملين بمحطات الوقود بالاضافة الى اخذ عينات دم تعتبر كقياسية (غير معرضة للسمية) .

اظهرت النتائج لهذه الدراسة الزيادة المعنوية في معدل تراكيز (Zn , Fe , Cu , Pb) في المجاميع المعرضة لها وتم مقارنتها مع المجاميع القياسية ، وتم رسم علاقة لكل عنصر بين تركيز العنصر ومدة تعرض العامل لهذا العنصر في المحطة، بالاضافة الى دراسة العلاقة الاحصائية لكل عنصر . وكاستنتاج لهذه الدراسة اظهر التعرض بصورة مباشرة من قبل العاملين لهذه العناصر ، زيادة تراكيزها في دم العاملين .