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Determination of some trace elements in nails from population nearby oil fields in Southern Iraq

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Abstract:

Level of some trace elements Cadmium (Cd), Cobalt (Co), Cupper (Cu),Nickel(Ni), Lead (Pb), and Zinc (Zn) in nails from 10 human being samples taken randomly from population nearby oil fields were examined from different subjects with respect to gender, age, smoking habit, the period of time living or working nearby the oil fields area and the health case were carried out using flame atomic absorption spectrophotometer (Sens AA GBC Scientific Equipment DUAL). Co showed the highest concentration (56.58µg/g) while no level were reported for Cu (ND) . The levels of the Co, Zn, and Ni elements were statistically higher in male subjects (56.58, 42.03, and 8.99) µg/g compared to 26.72, 36.20, and 0.73 µg/g for female subjects while Pb showed the highest level in female subjects 48.48 µg/g compared to 17.03 µg/g in male subjects. high levels of trace elements were observed in non-smokers, compared to smokers. The highest level of trace elements were appeared to those who are between (20-40) years old and also who are living period of time limited between (8-21) years nearby the oil field areas . Occupationally exposure showed no effect for trace elements accumulation in human finger nails compared to the time living nearby the oil field area that was limited between (9-10) years. One of the voluntaries who have a health problem hypertension as his case showed a highest level for the Pb element compared with the other hypertension case and the diabetes case, and the other voluntaries who have no health problems.

Keywords: Nail, Trace Elements, Flame Atomic Absorption Spectroscopy, Oil field , Occupational effect.

تقدير بعض العناصر النزره في أظافر السكان قرب الحقول النفطية في جنوب العراق

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الخلاصة

تم تقدير مستويات بعض العناصر النزره : الكادميوم والكوبلت والنحاس والنيكل والرصاص والخارصين في عينات أظافر عشرة أفراد متبرعين جمعت بشكل عشوائي من ساكنين في مناطق قرب الحقول النفطية وتم تصنيفها حسب الجنس والعمر وعادة التدخين وفترة السكن أو العمل قرب مناطق الحقول النفطية فضلاً عن الحالة الصحية وذلك باستخدام جهاز الامتصاص الذري اللهبي. اظهر عنصر الكوبلت التركيز الأعلى (56,58 مايكرو غرام/غرام), بينما لم يظهر النحاس أي مستوى في كافة العينات, ومن جهة أخرى سجل عناصر الكوبلت والخارصين والنيكل ارتفاعاً في مستوياتها لدى الذكور وبالقيم 58,56 و 42,03 و 8,99 مايكرو غرام /غرام مقارنة بالقيم 26,72 و36,20 و 0.73 مايكرو غرام/غرام لدى الإناث. وسجل الرصاص المستوى الأعلى 48,48 مايكرو غرام/غرام عند الإناث مقارنة بالقيمة 17,03مايكروغرام/غرام لدى الذكور. كما سجلت مستويات للعناصر النزره بمقادير أعلى لدى غير

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المدخنين مقارنة بالمدخنين. وظهرت أعلى التراكيز لمعظم العناصر النزره عند الذين تتراوح أعمارهم بين (20–40) سنه. وتحددت أعلى مستويات المعادن النزره عند الذين يعيشون قرب مناطق الحقول النفطية لفترات مابين(8–21) سنوات. أن التعرض المهني اظهر عدم التأثير في تراكم العناصر النزره بأظافر الإنسان مقارنة مع فترة العيش قرب مناطق الحقول النفطية وتحددت بين (9–10) سنوات. متطوع واحد لديه مشكلة صحية ويعاني من ارتفاع ضغط الدم أظهرت حالته أعلى مستوى لعنصر الرصاص مقارنة مع الآخرين المصابين بارتفاع ضغط الدم أو السكري أو الذين لا يعانون من أي مشاكل صحية.

كلمات دالة: أظافر, العناصر النزره, مطيافية الامتصاص الذري اللهبي, حقول نفطية, تأثير موقع العمل.

1- Introduction:

In recent years of urban development and industrial progress industrialization causes environmental pollution affecting in whole the eco-systems parts which in turn affect the health of the people who interact with them. The main threats to human health comes from toxic trace elements related with occupational exposure in the work places (Moses and Prabakaran, 2011) .

Human nails can be useful specimens for detecting an exposure that occurred in the month or more prior to specimen collection. Detection of elements in nail is somewhat correlated to half-life of the elemental form (Keil, *et al*., 2011).

To study the effectiveness of working and living nearby the oil fields nail was the first tissues to be analyzed for its trace elements contents, it is also considered one of the indicated metal body burden. The nails growth is used as an indicator of health and physiological imbalances of human, and also are used as indication of aging, for this various biological specimens, we chose nail samples for the metal analysis as a best bio-indicator (Priya and Geetha,2011). The nails in which trace elements are accumulated can be used to effectively monitor the highest priority toxic elements (Kazi *et al*, 2008). For that The advantages of nail tissue analysis over other diagnostic samples is that trace elements concentrations are not subjected to rapid variation due to diet, air, and water; hence, there is long-term stability over nutritional status (Ayodele and Bayero,2009).

Trace elements accumulate in the body after a periods of time, therefore, they reflect the history of the human being situation and his exposure to certain environmental conditions (Suhonen, *et al*,.1999).
Keratin-rich proteins, are largely constituted of human nails , which incorporate trace elements in proportion to their dietary intakes and other exposures by various mechanisms including protein synthesis (VCH,1988). Moreover, nails are one of the suitable tissues for this kind of analysis because they are easier to sample, transport and store unlike other body fluids that are exposed to pollution (Abdulrahman *et al* ,2012).Therefore , finger- and toe-nails are useful markers for trace elements that are used in clinical studies (He, 2011).

In the study of Lapatto *et al*., (1989) concentration values for the elements Ca, Cr, Mn, Fe, Ni, Cu, Zn, Se, Br, and Pb were determined from human nail samples .

Vance *et al.*, (1988) study shows the concentrations of 17 elements in the nail and hair of 117 subjects from a non industrialized environment were determined by instrumental neutron activation analysis (INAA), concentrations of nonessential trace elements were positively correlated in hair and nail, whereas concentrations of essential elements showed no correlations

Harrison and Tyree,(1971) determined the concentrations of calcium, zinc, magnesium, copper and iron in the fingernails of seven females and ten males have been determined by atomic absorption spectroscopy.

Momen *et al*.,(2015) have used ICP/OES for more sensitive clinical studies for the determination of trace elements in scalp hair and finger nails .
Chemical elements accumulate in the body over given periods of time, for that reason they reflect the biomedical and environmental history of the body as well as long term metabolic changes (Srogi, 2004) .

The test analysis of trace elements in nails have been used in clinical research for many years. For some hypotheses, nail measurements have been verified to be useful in the study of element status as it relates to chronic diseases including cancer and CVD(He, 2011).

Natural and anthropogenic activities are the main sources for trace elements in the environment. On a global scale, emissions from these sources are similar in level. However, on a local scale anthropogenic sources may control, because the ability of these elements to

accumulated in the environment system sources and in human tissues and cause many health risks

From an environmental and health perspective, this profound geographical development will have a critical influence on our immediate environment and its quality for human health. On a daily basis, numerous human activities, including municipal, industrial, commercial, and agricultural operations, release a variety of toxic and potentially toxic pollutants into the environment. Metals are non-biodegradable and accumulative in nature. Elevated emissions and their deposition over time can lead to anomalous enrichment, causing metal contamination of the surface environment (Coby *et al* ,2006)

2- Materials and Methods:

2-1- Sample Collection:

Samples were taken from 10 voluntaries residential near the oil fields in Burjesiah oil field camp, southern Basrah. Every voluntary has filled a questionnaire contains information about the gender, smoking habit, age, period of the time living and working nearby the oil field and the health status whether the person has some of the common diseases like Hypertension and/or Diabetes.

2-2- The Analysis of sample:

Dried nail samples, 0.5 gm each were digested with equivalence of (1.5ml) concentrated nitric acid (HNO_3) and perchloric acid ($HClO_4$) until dryness, then deionizer water was added to each sample and volume completed to (25ml) in volumetric flask and kept prior to analysis. The concentration of trace elements Cd, Co, Cu, Ni, Pb, and Zn in each nail sample, were determined by using flame atomic absorption spectrophotometer (Sens AA GBC Scientific Equipment DUAL). Calibration curve was employed for different concentrations of each element after dilution of its stock solution.

2-3- The Statistical Analysis :

Statistical analysis was done by using (Spss) program ver.18, correlation coefficient as shown in table 1, revealed that working years is correlated to all parameters ,which showed significant correlation at the level of P= 0.01 . Co and Ni are highly correlated with a positive correlation and a level of P=0.01.

Major levels of these elements in the nail samples of population living nearby oil fields show the same levels of these elements in the environment and the working place exposure of the studied subjects (Momen,*et al*., 2015).

Table 1. Pearson correlation coefficient among studied trace elements and other Parameters

Correlations

	Co	Cd	Age(years old)	Living years	Working years	Zn	Cu	Pb	Ni
Co	1	-.179	-.068	.575	1.000**	.556	.a	-.009	.864**
Cd	-.179	1	-.294	-.236	.a	.415	.a	-.295	-.228
Age(years old)	-.068	-.294	1	.334	1.000**	-.495	.a	-.365	-.249
Living years	.575	-.236	.334	1	1.000**	-.043	.a	.073	.495
Working years	1.000**	.a	1.000**	1.000**	1	1.000**	.a	-1.000-**	.a
Zn	.556	.415	-.495	-.043	1.000**	1	.a	-.178	.585
Cu	.a	.a	.a	.a	.a	.a	.a	.a	.a
Pb	-.009	-.295	-.365	.073	-1.000-**	-.178	.a	1	.036
Ni	.864**	-.228	-.249	.495	.a	.585	.a	.036	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
a. Cannot be computed because at least one of the variables is constant.

3- Results and Discussion:

There are large differences in the reported elemental composition of human nails (Bank, *et al.*, 1981).
Accordingly there is an direct need for public awareness about the hazards of living or working long time nearby this sources especially the oil fields.

The values in table (2) shows the concentration of some trace elements in nail samples with respect to gender, smoking habit, age, period of living time near oil fields, duration of working time in oil fields and the health status**.**

Table 2. Values of some trace elements in the human nail from residential subjects near oil fields areas.

Sample No.		1	2	3	4	5	6	7	8	9	10
Trace Elements	Cd(µg/g)	1.76	5.26	0.31	0.31	0.31	0.31	0.89	0.60	0.60	0.32
	Co(µg/g)	16.76	11.79	6.81	56.58	11.79	11.79	1.83	26.72	26.62	11.69
	Cu(µg/g)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Ni(µg/g)	0.72	ND	0.72	8.99	0.72	0.72	0.72	0.72	0.73	0.73
	Pb(µg/g)	12.20	ND	14.62	17.03	48.48	12.20	4.94	4.94	4.49	12.21
	Zn(µg/g)	26.98	ND	1.75	42.03	12.91	2.24	36.20	21.65	21.75	2.23
Gender	M			M	M		M				M
	F	F	F			F		F	F	F	
Smoking Habit	S						S				S
	NS	NS	NS	NS	NS	NS		NS	NS	NS	
Age(years)	20-40	38	21	31	22	35		20	24		
	40-60						47			45	56
Exposuretime for living &working near oil field(years)	Living years	5	8	5	21	9	7	1	13	10	25
	Working years			9			10				
Health Status	Hypertension				H	H					
	Diabetics										D

• ND = below the detection limit of the instrument, M=Mail, F=Female,S=Smoker, NS=Non Smoker, H= Hypertension, D= Diabetics

The elements Zn and Co showed the higher concentration in male objective voluntary, Cu shows no sign, Pb and Cd showed the higher concentration in female objective. Co was reported as the highest metal in the nail of male subject (56.58 µg/g) and the lowest in the nail of female subject (1.83 µg/g), both were nonsmoking and for age range (20-40) years.

All of the studied trace elements Zn, Pb, Ni, Co and Cd except Cu showed higher concentrations for non smoking voluntary samples, voluntaries in the range of age between (20-40) years old, as well as those who live for a period of time nearby the oil field area ranged between (8-21) years.

The other samples taken from persons who have some of the common diseases like Hypertension and Diabetes. High values of Zn, Ni, Co and Cd recorded in samples have no health problems, but Pb showed the higher concentration in a sample for a person with Hypertension case .

In this study, Cd reported nearly the same levels for hypertension and diabetics subjects which were lower than normal people (table 2). For Ni and Pb levels for diabetic patient were nearly the same as normal people but very low compared to levels for hypertension patient. On the other hand Zn showed low levels for diabetic patient compared to both hypertension patient and normal people being the highest for hypertension patient.

Moreover, it is found that the concentrations of Cd, Co, and Pb, trace elements in human nail samples from Basrah were higher, while Cu, and Zn, were lower compared to the levels in the nails of human from Arabia Saudi as shown in (table 3) (Momen, *et al*., 2015).

Table 3. Values of trace elements in human nails from Basrah and KSA.

Trace element	Concentration of trace elements in nails (µg/g)	
	Basrah residence, This study	KSA residence, Momen *et al*., 2015
Cd	0.39-5.26	0.59
Co	1.83-56.58	1.47
Cu	ND	9.0
Ni	ND – 8.99	-
Pb	ND – 48.48	3.67
Zn	ND-42.03	124.43

ND = below the detection limit of the instrument

Conclusion

This paper goal is to provide analytical study for occupational exposure to the trace elements that accumulate in nails of population nearby oil field and set the results as a base line for other factors and those related to health effects such as hypertension and diabetic mellitus. From the study we can raise the environmental and general health awareness to the people against the hazards of occupational exposure to the trace elements in many industrial fields specially the oil fields and also the hazards of other types of chemical pollutants .

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References:

Abdulrahman, F. I., Akan, J. C., Chellube, Z. M., and Waziri, M., (2012). Levels of Heavy Metals in Human Hair and Nail Samples from Maiduguri Metropolis, Borno State, Nigeria. World Environment, 2(4): 81-89 .

Ayodele JT and Bayero AS(2009). Lead and zinc concentrations in hair and nail of some kano inhabitants. African J Env Sci Tech 3(3):164–170.

Bank , H. L., Robson, J., Bigelow, J. B., Morrison, J., Spell, L. H., and Kantor, R. (1981). Preparation of fingernails for trace element analysis. Clinica Chimica Acta,116(Issue 2):179–190.

Coby S.C., Wong Xiangdong Li and Iain Thornton (2006). Urban environmental geochemistry of trace metals, Environmental Pollution 142, 1-16.

Harrison , W. W., and Tyree, A. B., (1971).The determination of trace elements in human fingernails by atomic absorption spectroscopy. Clin. Chem. Acta, 31:63-73.

He, K. (2011).Trace Elements in Nails as Biomarkers in Clinical Research. Eur J Clin Invest. 41(1): 98–102.

Kazi, T. G., Jalbani, N., Kazi, N., Jamali M. K., Arain, M. S., Afridi, H. I., Kandhro A., and Pirzado, Z. (2008). Evaluation of toxic metals in blood and urine samples of chronic renal failure patients, before and after dialysis. Ren Fail 30(7):737–745.

Keil, D. E., Berger-Ritchie , J., and McMillin, G. A. (2011). Testing for Toxic Elements: A Focus on Arsenic, Cadmium, Lead, and Mercury. National Health and Nutrition Examination Survey, pp:1-24.

Lapatto, R., Hietamäki, A., and Räisänen, J. (1989). Quantitative trace element analysis of human nails with external beam PIXE. Biol Trace Elem Res.19(3):161- 70.

Momen AA, Khalid MA, Elsheikh MA and Ali DM. (2015). Trace elements in scalp hair and fingernails as biomarkers in clinical studies. J Health Spec.,3(1):28-34

Moses, F. and Prabakaran, J. J. (2011). Evaluation of Occupational Exposure to Toxic Metals using Fingernails as Biological Indicators. Research Journal of Environmental Toxicology, 5: 65-70.

Priya, Malarveni Damodaran Lakshmi and Geetha, Arumugam (2011). Level of Trace Elements (Copper, Zinc, Magnesium and Selenium) and Toxic Elements
(Lead and Mercury) in the Hair and Nail of Children with Autism, Biol Trace Elem Res. Published onlin 13 July 2010.

Sorgi, Krystyna (2004). Heavy metals in human hair samples from Silesia Province: The influence of sex, age, and smoking habit. Problems of Forensic Sciences, vol. LX :7–27.

Suhonen R. P. R., Dawber D. H., Fungal infection of the skin, hair and nails, Martin Dunitz, London 1999.

Vance, D. E., Ehmann, W. D., and Markesbery,(1988). Trace element content in fingernails and hair of a nonindustrialized US control population. Biol. Trace Element Res. 17(Issue 1):109-121.

VCH,1988. VCH Publishers, New York. pp 224-254