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A STUDY OF CERTAIN HEALTH DISORDERS AMONG WELDERS EXPOSE TO CHROMIUM AT THE PRIVATE SECTOR IN AMMAN CITY

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دراسة الاعتلالات الصحية عند اللحامين المعرضين لمادة الكروم في القطاع الخاص من مدينة

عمان

الخلاصة:

من خلال دراسة مقطعية للعاملين في القطاع الخاص لمدينة عمان في مهنة اللحام والمعرضين لأبخرة الكروم تبين ان معدل تركيز أبخرة الكروم في هواء بيئة العمل كانت 84.99 مايكروغرام/م³ والتي تعتبر أعلى من الحد المسموح به، في حين كان معدل تركيز الكروم في الإدرار 3.62 مايكروغرام/لتر والتي تعتبر قريبة من الحد الأدنى المسموح به، هذا وقد وجد فرق مؤثر عند مقارنة اللحامين مع عينة ضابطة بالنسبة لمعدلات التراكيز سواء في هواء بيئة العمل أو الإدرار. لقد كانت نسبة انتشار الاعتلالات الصحية (العيون، الأنف، الجلد، الجهاز التنفسي ووظائف الرئة) أعلى عند اللحامين مقارنة بالعينة الضابطة. الدراسة توصلت الى توصيات.

SUMMARY:

A cross sectional study was conducted among stainless steel welding workers (WW) working at private sector in Amman City. The mean level of chromium concentration in the air (Cr-air) of workplaces was 84.99 µg/m³ which is above the accepted level of TLV, while the mean concentration of chromium in the urine (Cr-urine) of welders was 3.62 µg/L which was within the accepted level of TLV. However, there was a significant correlation between WW & the reference group (RG) with respect to Cr-air and Cr-urine. The prevalence rates (PR) of certain health disorders (eye, nose, skin, respiratory system disease and lung function test (LFT))

among WW were higher than those of RG. Recommendation is given.

INTRODUCTION:

In industrialized nations, about 1% of workers are welders⁽¹⁾, however, there are more than three million workers worldwide who perform welding⁽²⁾. Hazards of welding may be physical, chemical⁽³⁾ and biological⁽⁴⁾; however, the main health hazards among WW are acute and chronic respiratory disorders⁽⁵⁾, as well as eye⁽³⁾ & skin disorders⁽⁶⁾. This study was done to evaluate the health hazards of chromium among WW in Amman - Jordan. This was done through measuring the mean chromium concentration in air (Cr-air) of the workplace and the mean chromium

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concentration in the urine (Cr-urine) of the WW as well as detect any health disorders (eye, nose, skin & respirator system) among WW.

SUBJECTS AND METHODS:⁽⁷⁾

In Amman City there were 21 private welding plants employing 190 workers, but the total number of welders involved in stainless steel welding which contains high concentration of chromium was 33 male (risk group = WW). Other 50 male workers having the same characteristics as WW (except that they were not exposed to chromium) were studied as reference group (RG). Each plant was visited on the 4th working day⁽⁸⁾, the workers were interviewed and examination of eyes, nose, skin, respiratory system as well as lung function tests (LFT) were done. Any health disorders that occurred among the study population in the last three months from the time of clinical examination (which was carried out during the period Nov. 1994, to March 1995) were recorded. From each work plant, air samples were collected and urine samples were taken from all participants. Total chromium concentration were performed as no facility to measure the hexavalent chromium concentration. For the purpose of this study, the WW were classified, once according to the type of ventilation present at work plants and another time according to the frequency of using the protective equipment. Also the WW were classified into two group; those who work in plants in which the Cr-air was below $50\mu\text{g}/\text{m}^3$ & those above $50\mu\text{g}/\text{m}^3$ (The TLV of Cr-air is $50\mu\text{g}/\text{m}^3$).

RESULTS:

Table 1 shows the relation between WW & RG with respect to Cr-air and Cr-urine. Table 2 shows the prevalence rates (PR) of various health disorders among the study population, while table 3 shows the PR of health disorder among WW according to the level of chromium in the air of workplace. Table 4 shows the relation of Cr-air, Cr-urine for WW in relation to the type of ventilation & the frequency of using protective equipment.

DISCUSSION:

The results of the study shows that the mean level of Cr-air for the working places were above ($84.99\mu\text{g}/\text{m}^3$) the accepted level of TLV among WW but within the range of other study⁽⁹⁾, while the mean level of Cr-urine among WW was $3.62\mu\text{g}/\text{L}$ which is within the accepted level (Table 1). Both (Cr-air & Cr-urine) were much higher than that in the RG. The PR of certain health disorders were high among WW in comparison to RG (Table 2), in particular among WW who were exposed to Cr-air above accepted level of TLV (Table 3). This indicates the importance of environmental monitoring as well as periodic medical examination of the workers. However, nose disorders show high PR of nasal irritation (57.6%), this is in agreement with other study⁽¹⁰⁾; on the other hand 39.3% of these disorders were exposed to Cr-air above the accepted level of TLV. Also the PR of acute and chronic respiratory disorders among WW was higher in comparison to RG (36.4% Vs 2% respectively). These findings are consistent with that of other studies⁽¹¹⁾. The PR of skin dis-

orders and eye disorders was 15.2% and 78.8%, respectively, among WW while no skin or eye disorder were found among RG; this finding is in agreement with other studies^(6,12), it also shows the importance of using the protective equipment because the workers shows health disorders when they were working below the accepted level of TLV. The PR of abnormal LFTs among WW was higher than that among RG (42.4% Vs 16% respectively); these results were much higher than that found by Rastoglet. al⁽¹³⁾ which was 23% Vs 6.1% respectively. Also the results show a significant relation between the type of ventilation at workplace and Cr-air among WW (Table 4); this is in agreement with that of other study⁽¹⁴⁾. These findings indicate the necessity of using the artificial ventila-

tion type, especially the local exhaust ventilation, in welding process rather than to rely on natural ventilation type. On the other hand no such significance was found in relation to the frequency of using protective equipment by WW, but still the level of Cr-air was above the accepted level of TLV which indicates the importance of permanent using of protective equipment. Also the results shows a high significantly relation between WW and RG with respect to Cr-air or Cr-urine irrespective whether the workers were smokers or not (Table 1); these findings are in agreement with other studies^(14,8). The study recommends environmental monitoring and periodic medical examination of WW to prevent the health disorders.

Table 1: Relation between Welding Workers (WW) and reference group (RG) with respect to Cr-air and Cr-urine ($\mu\text{g/L}$).

Variable	WW		RG		Total	t-	DF	P
	No.	X $\pm$ SD	No.	X $\pm$ SD	No.	value		
Cr-air	33	84.9 $\pm$ 55.8	50	0.05 $\pm$ 0.01	83	9.2	81	Sig.
Smokers	13	98.6 $\pm$ 63.6	25	0.05 $\pm$ 0.001	38	6.63	36	Sig.
non-smokers	20	64.0 $\pm$ 64.6	25	0.05 $\pm$ 0.01	45	3.8	43	Sig.
Cr-urine	33	3.6 $\pm$ 4.7	50	1.02 $\pm$ 0.65	83	3.8	81	Sig.
Smokers	13	4.4 $\pm$ 5.4	25	1.25 $\pm$ 0.59	38	2.8	36	Sig.
non-smokers	20	2.4 $\pm$ 2.7	25	0.80 $\pm$ 0.64	45	1.78	43	Sig.

Sig = P < 0.001, Sig = P < 0.05

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Table 2: The prevalence rates of various health disorders among study population

Variable		WW		RG	
		No.	%	No.	%
Eye disorders:	Normal	7	21.2	50	100
	Abnormal	26	78.8	-	-
Nose disorders:	Normal	14	42.4	49	98
	Abnormal	19	57.6	1	2
Skin disorders:	Normal	28	84.8	50	100
	Abnormal	5	15.2	-	-
Respiratory disorders:	Normal	21	63.6	49	98
	Abnormal	12	36.4	1	2
Type of LFT:	Normal	19	57.6	42	84
	Abnormal	14	42.4	8	16

Table 3: The prevalence rates of various health disorders among 33 WW according to the TLV for Cr-air ($\mu\text{g}/\text{m}^3$)

Variable	TLV less than $50\mu\text{g}/\text{m}^3$				TLV more than $50\mu\text{g}/\text{m}^3$			
	cases				cases			
	Normal No.	%	Abnormal No.	%	Normal No.	%	Abnormal No.	%
eye disorders	6	18.2	5	15.2	1	3.0	21	63.6
nose disorders	5	15.2	6	18.2	9	27.3	13	39.3
skin disorders	9	27.3	2	6.1	19	57.6	3	9.0
respiratory disorders	6	18.2	5	15.2	15	45.4	7	21.2
type of LFT	7	21.2	4	12.1	12	36.4	10	30.3

Table 4: Relation between type of ventilation system, frequency of using the protective equipments and Cr-air ($\mu\text{g}/\text{m}^3$), Cr-urine ($\mu\text{g}/\text{L}$) among 33 WW

Variable	No. of workers	Cr-air $\mu\text{g}/\text{m}^3$ $\bar{X} \pm \text{SD}$	Cr-urine $\mu\text{g}/\text{L}$ $\bar{X} \pm \text{SD}$
Type of Ventilation			
Natural	28	98.7 $\pm$ 61.6	3.99 $\pm$ 4.99
Artificial	5	8.39 $\pm$ 5.08	1.57 $\pm$ 2.2
t-test	33	3.23	1.05
P		< 0.001	> 0.5
Using protective equipment			
Permanent	26	80.6 $\pm$ 63.3	3.31 $\pm$ 5.04
Intermittent	7	101.3 $\pm$ 76.2	4.76 $\pm$ 4.2
t-test		0.74	0.74
P		> 0.5	> 0.5

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REFERENCES:

- 1- Stern, R.M., Berlin, A., Fletcher, A.C. and Jarvisalo, J. eds. Health hazards and Biological effects of welding fumes & cases. Amsterdam. Excerpta Medica. Quoted by IARC (1990), 1986.
- 2- National Institute for Occupational Safety and Health. (NIOSH) recommendation for occupational safety & health standards. Morbid. Mortal, wkly Rep, 1988, 37 (Suppl, 7), 9.
- 3- Industrial Accident Prevention Association. Safety & health in welding. Oxy-acetylene & electric arc. Quoted by OSHI, Amman, Jordan 1989.
- 4- Jelmert, O., Hansteen, I.L., Langaard, S. Chromosome damage in lymphocytes of stainless steel welders elated to past & current exposure to manual metal arc welding fumes. Mutat Res. 1994, 320(3): 223-33.
- 5- Zober, A. Possible dangers to the respiratory tract from welding fumes: methods of approach in an industrial health care contest and results. Schweissen Schneiden, 1982, 34(2): 77-81.
- 6- Fregert, S. Occupational dermatitis in a 10 - year material. Contact dermatitis. 1975, 1(2): 96-107.
- 7- Abdel-Khaleq, A.S.M.A. A study of biological monitoring among workers exposed to chromium. Msc thesis. Dept. of Comm. Med. Coll. of Med. Univ. of Baghdad, 1995.
- 8- Bonde, J.P., and Christensen, J.M. Chromium in biological samples from low-level exposed stainless steel and mild steel welders. Arch. Environ. Health. 1991, 46(4): 225-9.
- 9- International Agency for Research on Cancer. Monographs of the evaluation of carcinogenic risks to Humans. Chromium, Nickel and welding, Lyon, 1990, Vol 49.
- 10- Jindrichova, J. Harmful effects caused by chromium in electric welders. Z. ges. Hyg. 1988, 24, 86-88.
- 11- Borghetti, A., Mutti, A., Cavatorta, A., Falzoi, M., Cigala, F & Franchini, J. Indices renaux exposition aigue et impregnation chronique par Le chrome Med. Lav. 1977, 68(5): 355-363 Quoted by WHO 1988.
- 12- Rudzki, E., Kozlowska, A. Causes of chromate dermatitis in Poland. Contact dermatitis. 1980, 6(3): 191-6.
- 13- Rastogi, S.K., Gupta, B.N., Husain, T., Mathlur, N., Srivastava, S. Spirometric abnormalities among welders. Environ. Res. 1991, 56(1): 15-24.
- 14- Kalliomaki, P.L., Rahkonen, E., Vaaranen, V. Kalliomaki, K. & Alftoniemi, K. lung-retained contaminants urinary chromium and nickle among stainless steel welders. Int. Arch. Occup. environ. Health. 1981, 49, 67-75.