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A STUDY OF BIOLOGICAL MONITORING AMONG ELECTROPLATING JORDANIAN WORKERS EXPOSED TO CHROMIUM AND SOME OCCUPATIONAL HEALTH HAZARDS

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دراسة بعض القياسات الحيوية لدى العاملين في الطلاء الكهربائي بالكروم وبعض المخاطر الصحية المهنية في الأردن

الخلاصة:

تم إجراء دراسة مقطعية على الحالة الصحية للعاملين في القطاع الخاص لمدينة عمان في مهنة الطلاء الكهربائي بالكروم حيث كان عددهم 35 عاملاً وتم مقارنتهم مع 50 عاملاً يحملون نفس الصفات ولكن غير معرضين في الكروم وللفترة من تشرين الثاني 1994 ولغاية آذار 1995. لقد كان معدل تركيز أنغمة الكروم في هواء بيئة العمل لدى عمال الطلاء الكهربائي (17.9 ميكروغرام/م³) وهو أقل من الحد المسموح به صحياً في حين كان معدل تركيز الكروم في إدرار العاملين بالطلاء الكهربائي 7.45 ميكروغرام/لتر والمعدل قريب من الحد الأدنى المسموح به. ولقد وجد اختلاف معنوي بين متوسطات أنغمة الكروم في الهواء وكذلك في الإدرار بين العمال المعرضين للكروم وغير المعرضين. أظهرت الدراسة أن نسبة انتشار العلل الصحية (العيون، الأنف، الجلد، الجهاز التنفسي) عند العمال المعرضين لأنغمة الكروم كانت أعلى مقارنة بالعمال غير المعرضين. وتوصلت الدراسة إلى توصيات محددة.

SUMMARY:

A cross-sectional study on health status of electroplating workers (EPW) exposed to chromium were carried out. They were 35 workers working at private sectors in Amman City during the period, Oct. 1994 to March 1995. Other 50 workers were not functionally exposed to chromium were study as reference group (RG). The mean chromium concentration in air (Cr-air) of the work place was 17.9 µg/m³, which was below the TLV while the mean chromium concentration in urine (Cr-urine) of EPW was 7.45 µg/l which was lower

limit of TLV. There was a significant differences in the mean Cr-air, Cr-urine of EPW in comparison to RG. The prevalence rates of certain health disorders (eye, nose, skin, respiratory system) were higher in EPW than RG. Recommendation is given.

INTRODUCTION:

Chromium is an essential nutrient⁽¹⁾; it is used as a catalyst (chromic acid) in the solution of the chromium electroplating bath⁽²⁾. It may cause occupational health hazards⁽³⁾ such as nose disease⁽⁴⁾, skin disease⁽⁵⁾, impairment of lung function⁽⁶⁾.

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tests (LFT)^(6,8) and other manifestations such as acute and or chronic toxic effects^(1,9). Periodic medical examinations with environmental and biological monitoring are needed in order to detect such health hazards in industry⁽¹⁰⁾. This study is done to evaluate some of the health hazards of chromium among Jordanian workers in electroplating plants by measuring Cr-air and Cr-urine of the workers.

SUBJECTS AND METHODS⁽¹¹⁾

All the private chromium electroplating plants in Amman City were included; their total male workers was 35. Fifty workers as reference group (RG) were not exposed to chromium chosen from other plants. Each plant was visited on the 4th working day⁽¹²⁾; the workers were interviewed and examined, LFT was done, and collection of air and urine sample were carried out. Total chromium concentrations were assayed since no facilities to measure the hexavalent chromium concentration were available. Any health disorder that occurred among the study population in the last three months before the time of medical examination were recorded (Nov. 1994 till March 1995).

RESULTS:

Table 1 shows the relation between the EPW and RG in respect to the Cr-air and Cr-urine while table 2 shows the prevalence rates of some health disorders among the study population

DISCUSSION:

A cross-sectional study among EPW in the private sector at Amman City was carried out. The mean level of Cr-air for

the EPW was $17.92\mu\text{g}/\text{m}^3$ which is below the TLV (Table 1) but within the range of other study⁽⁹⁾, while the mean level of Cr-urine of EPW was $7.45\mu\text{g}/\text{L}$ which is within the accepted level⁽⁹⁾, but it was much higher than the RG; however t-test between EPW and RG shows a high significant difference in respect to Cr-air or Cr-urine (Table 1). Also a significant relation was shown between Cr-air and Cr-urine among EPW when the EPW were separated according to the TLV i.e. below and above the TLV⁽¹¹⁾. The result (Table 2) shows a high prevalence rate of eye disorders (8.6%) and nose disorders (62.9%) among EPW than RG (0% and 2% respectively); this is in agreement with other studies^(5,5). Also it show a significant association between EPW with RG respect to respiratory disorders. The prevalence rate of skin disorders was 14.3% which was much higher than that of Laubstein et al⁽⁷⁾ (which was 6.7%) and much less than that reported by Lee and Goh⁽⁵⁾ (Which was 38%). Table 2 also shows no significant association between EPW and RG in respect to the LFT; this results is not consistent with the finding of other studies^(6,8). However, the prevalence rate of abnormal LFT among EPW was higher than that among RG (37.2% Vs 16% respectively), and the restrictive type of defect was the predominant one (31.4%). This is not in agreement with Reggiani et al⁽¹³⁾ who found that the obstructive type of defect in LFT was the predominant one (13%). The study recommends an occupational health and safety programme in each plant as prevention of health disorders is possible

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Table 1: Relation between the EPW and the RG in respect to the Cr-air and Cr-urine

Study population	No	Cr-air $\mu\text{g}/\text{m}^3$ $\bar{x} \pm \text{SD}$	Cr-urine $\mu\text{g}/\text{L}$ $\bar{x} \pm \text{SD}$
EPW	35	17.92 ± 24.73	7.45 ± 9.74
RG	50	0.05 ± 0.01	1.02 ± 0.65
t-value		5.12	3.67
DF: 83			
p		< 0.001	< 0.001

Table 2: The prevalence rate (%) of various health disorders among the study population

Variable	EPW		RG	
	No	%	No	%
Eye disorders	32	91.4	50	100
normal	3	8.6		
eye irritator				
Nose disorders	13	37.1	49	98.0
normal	16	45.7	1	2.0
nasal irritation	3	8.6		
nasal ulceration	3	8.6		
nasal perforation				
Skin disorders	30	85.7	50	100
normal	5	14.3		
skin irritation				
Respiratory disorders			49	98.0
normal	19	54.3	1	2.0
acute resp. dis.	11	31.4		
chronic resp. dis.	5	14.3		
Type of LFT			42	84.0
normal	22	62.8	6	12.0
mild restrictive	11	31.4	1	2.0
mild obstructive	--	--	--	--
mixed mild	1	2.9	--	--
moderate restrictive	--	--	1	2.0
moderate obstructive	1	2.9	--	--

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