

Hair Cadmium Level of Smoker and Non-Smoker Human Volunteers In and Around Calcutta City

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In recent years considerable interest has arisen concerning cadmium accumulation in man (Friberg et al. 1974; Bernard Lauwerys 1984). In general, the body burden of cadmium of an urban population is due to occupational exposure, as well as non-occupational contamination (Lagerwerff and Specht 1970; Khandekar et al. 1980). Several reports indicate that cadmium body burden of cigarette smokers or tobacco users is more than of non-smokers (Ellis et al. 1979; Nordberg 1974; Lewis et al. 1972). Measurement of cadmium in human hair has been suggested as an indicator of body burden (Shaikh and Smith 1984; Shrestha and Schrauzer 1987).

Most industrialized countries have regular monitoring programs for measuring cadmium accumulation in humans (Shigematsu et al. 1979; Kjellstrom 1979; EPA 1979; Lauwerys et al. 1979). There has been little or no work done thus far in India regarding the level of cadmium in humans. The objective of this investigation was to survey the levels of cadmium in hair of random samples of human volunteers. The influences of smoking habits, urban or rural life and age of the volunteers on the level of cadmium in hair were examined.

MATERIALS AND METHODS

Hair samples of male volunteers residing in Calcutta proper and rural areas 30 to 50 Km away from Calcutta were collected at random and stored in separate clean polyethylene bags until used. Food habit, smoking habit, nature of the job, living environment and age of each volunteer were recorded. Hair samples were washed with acetone, rinsed with deionized water and again with acetone and then dried for 3 days at 60°C. For digestion, 6.5 ml of an acid mixture (Conc. HNO₃; Conc. HClO₄: Conc. H₂SO₄ :: 10:2:1) was added to 1 gm. of hair sample and heated under refluxing until brown vapors disappeared. The clear solution was cooled, made up to a 50

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ml volume and filtered through washed whatman No.41 filter paper. Cadmium in aliquots of the digested samples was determined by a SP 2900 Pye Unicam Atomic Absorption Spectrophotometer coupled with a SP 9 computer using air-acetylene flame at a wavelength 228 nm. Reagent blanks prepared similarly served as controls. Results are expressed as μg cadmium/g of hair.

RESULTS AND DISCUSSION

Cadmium content of washed hair of urban and rural male volunteers in and around Calcutta was determined. The urban volunteers were doctors, Lawyears, students, cloth merchants and office-workers who were not occupationally exposed to cadmium. All rural volunteers were cultivators or landless field labours and the villages were free from industrial pollution. All volunteers examined were nonvegetarian and the principal foods were rice, bread, pulses, vegetables and fish.

It is apparent from the results (Table 1) that the range of cadmium levels of hair of urban volunteers was significantly ($P = 0.05$) higher than those of volunteers from rural areas. The mean cadmium level of hair of urban volunteers ($1.4 \mu\text{g/g}$) was twice that of rural volunteers ($0.8 \mu\text{g/g}$).

The hair cadmium level of non-smoker and smoker volunteers of Calcutta and rural areas were analysed separately and compared. The data indicate (Table 1) that the mean cadmium levels of the smoker group of both urban and rural area (1.8 ± 0.8 and $0.89 \pm 0.5 \mu\text{g/g}$ respectively) were significantly ($P=0.05$) higher than the non-smoker (0.67 ± 0.4 and $0.51 \pm 0.2 \mu\text{g/g}$ respectively).

The mean cadmium level of smokers of Calcutta ($1.8 \pm 0.8 \mu\text{g/g}$) and rural area ($0.89 \pm 0.5 \mu\text{g/g}$) was significantly ($P=0.05$) different. The smoking-index data indicate that urban smoker volunteers sampled in this study generally smoked more cigarettes (approximately two times) per year than the rural volunteers. The mean cadmium level of non-smokers of urban and rural volunteers were not significantly different.

The data indicate that industrially non-exposed urban and rural volunteers had comparable levels of cadmium in hair, although there are fewer automobiles in rural area. The smokers residing in Calcutta or in rural areas had more cadmium in their hairs than non-smokers of the area. The smoker of Calcutta sampled in this study had more cadmium than smokers of rural areas because they smoked more cigarettes than the later group. The results suggest that analysis of cadmium in hair provides a useful tool for the evaluation of the status of this metal in smoker and non-smoker population of industrially non-exposed urban and rural areas.

Table 1. Comparison of level of cadmium in hair of non-smoker and smokers of Calcutta and surrounding rural areas

Parameters	All volunteers		Non-smoker		Smoker	
	Rural (N=27)	Urban (N=44)	Rural (N=8)	Urban (N=14)	Rural (N=19)	Urban (N=30)
Range of Age (Yrs)	18 - 45	21 - 53	19 - 38	21 - 53	18 - 45	22 - 52
Mean Age (Yrs)	28 ± 7	32 ± 7	27 ± 6	33 ± 8	29 ± 8	31 ± 7
Range of cadmium level of hair (µg/g)	0.13-2.3	0.2-3.3	0.3-0.83	0.2-1.5	0.13-2.3	0.45-3.3
Mean cadmium level of hair (µg/g)	0.8±0.4	1.4±0.8	0.51±0.2	0.67±0.4	0.89±0.5	1.8±0.8
*Smoking index (Pack/Yr.) :						
Range					34.2-163.2	50.4-168
Mean					75.4± 30.7	124.9 ± 40.5
	t = 3.56 with DF = 69; significant at P=0.05		t = 1 with DF = 20 Not significant at P = 0.05		t = 4.35 with DF = 47 significant at P = 0.05	

*20 cigarettes were considered as one pack and number of packets per year for the smoker volunteers considered.

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