

Comparison of Hair Mercury Levels between Occupational and Non Occupational Exposed Populations in Benghazi City

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Abstract—The mean level of total mercury in hair samples of dentists (occupational exposed population) and non occupational exposed population (control group) in Benghazi city were carried out. The level of total mercury (mean \pm standard deviation) in hair samples of dentist was 5.99 ± 2.64 mg/kg in the range of 3.44 – 776 mg/kg. For control group, the mean level of total mercury (mean \pm standard deviation) was 0.81 mg/kg in range of LOD-3.6 mg/kg. In comparison, our results indicated that, the level of mercury in dentist is significantly higher than those of control group. The effect of age, gender and fish consumption were also carried out.

Keywords— Benghazi, dentist, exposure, occupational and mercury.

I. INTRODUCTION

OCCUPATIONAL exposure to mercury and consumption of fish are the major source of mercury contamination[1]. Dentists and their assistances who work with amalgam are chronically exposed to mercury vapor, which accumulates in their bodies to much higher levels than for most non-occupationally exposed[2-6].

Urine, blood and hair have been used as an index of mercury exposure. However, hair sample has advantages over urine and blood sample. These advantages are: easy to collect, a physician is not required to obtain the sample, easy to transport and store, the level of mercury has been reported to be stable for long periods and hair reflects the concentration of mercury in blood at the moment of growth.

In this study, hair samples were collected from dentists and non occupational exposed donors live in Benghazi. The samples were analysed for mercury levels and the results were compared.

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II. MATERIALS AND METHODS

A. Sample collection

Thirty two dentists and fifty non occupational exposed donors were included in this study. The dentists were randomly selected from 4 dental clinics (2 private, 2 public) in Benghazi, Libya. For unexposed individuals, the hair samples were collected randomly from inhabitants of Benghazi city. During collection of the hair samples, each individual was asked to complete a questionnaire detailing name, sex, age, occupation and dietary habits.

B. Preparation of hair samples

Hair samples were collected from donors by single cutting from the occipital region with a pair of clean stainless steel scissors in accordance with the IAEA protocols. The hair samples were cut to lengths of about 2-5 mm. The hair samples were then washed according to the standard procedure recommended by the IAEA: wash hair in acetone, thrice in water and once more in acetone. The samples were then dried overnight in an oven at 60°C.

C. Hair analysis

Samples were analysed by neutron activation analysis with the kayzero standardization methods. About 0.1 gram of each hair sample and Al-Au wire and Zr monitors were irradiated in a neutron flux of 2.1×10^6 n cm⁻²s⁻¹ in the PUSPATI TRIGA MKII Reactor for about 6 hours. After a decay period of three days activated samples were analysed by a gamma spectroscopy system consisting of a HPGe detector and the associated electronics. Detail of the analysis has been reported earlier [7-10].

III. RESULTS AND DISCUSSION

A. Description of the studied populations

The total sample was made up of 32 dentists and 50 non occupational exposed individuals live in Benghazi city. Details description of the population studied are summarized in Table 1.

TABLE I
DESCRIPTION OF THE STUDIED POPULATIONS

	Dentist		Control group	
	Male	Female	Male	Female
N	16	16	24	26
Percent	50%	50%	48	52
Age in years (mean ± stdv)	32.06 ±4.06	28.14 ±2.21	28.66 ±14.68	24.35 ±11.71
range	25 – 38	24 - 32	5-68	10-52

The mean (\pm standard deviation) of total mercury levels in hair samples for whole participating dentists was 5.99 ± 2.64 mg/kg in the range of 3.44 – 776 mg/kg. For male, the mean (\pm standard deviation) of the total mercury in their hair samples was 6.22 ± 1.32 mg/kg in the range of 3.82 – 12.40 mg/kg. For female, the mean level was 6.60 ± 4.46 mg/kg in the range of 3.44 – 776 mg/kg. The frequency distribution of mercury concentration for the participating dentists is shown in Fig 1.

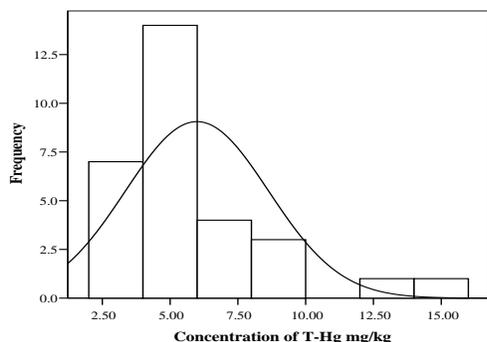


Fig.1 Frequency distribution of total mercury concentration for the participating dentists

For control group, the mean (\pm standard deviation) of total mercury level in their hair samples was 0.81 ± 0.09 mg/kg in the range of LOD – 3.6 mg/kg. For the males and the females, the mean of the total mercury were 0.63 ± 0.07 mg/kg (range LOD – 0.98 mg/kg) and 0.84 ± 0.11 mg/kg (range LOD – 3.6 mg/kg), respectively. The frequency distribution of the total mercury in this population is given in Fig 2.

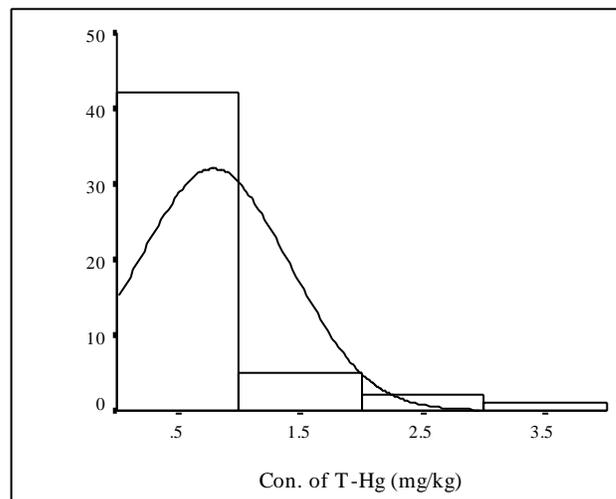


Fig. 2 The frequency distribution of the total mercury in hair samples of control group

Our results indicated that, there was a significant difference between hair mercury concentration of dentists and controls. In this study, 65% of the participating dentists had level of mercury in their hair exceeded the level of mercury of 5mg/kg which sets by the WHO[1].

Age was found to be correlated to hair mercury level of dentists at 0.01 level ($r=0.531$, $p=0.001$). This finding contrast to that of Ott et al. [11] who found no correlation between mercury level in hair samples of dentists and their age. Tabatabaei et al. [12]. found a positive relation between urine mercury and age ($p=0.008$). For control group, age was positively correlated ($r = 0.28$, $P = 0.048 < 0.05$) to level of the total mercury in their hair indicating that, the level of the mercury in hair tend to increase over the time.

The mean mercury level in hair samples of male dentists was higher than that for female. However, the difference was not significant. For control group, the level of the total mercury in the hair samples of the females was significantly higher than that in the males ($r = 0.28$, $P = 0.048 < 0.05$). The difference between gender groups might be due to the using of hair care products (the highest level of the total mercury were found in the females who use hair care cosmetic more often).

Although fish consumption is a major source mercury exposure, in this study fish consumption had no effect on the level of mercury in dentists or control group hair and this finding accords with Harakeh [2]. A significant correlation between hair mercury level and fish consumption have been reported in our previous study in other nation[7]. The absence of correlation between hair mercury level and fish consumption may be due to the very low frequency of fish consumption in the city.

IV. CONCLUSION

This study showed that the occupational exposure to mercury in dentists poses a potential risk of increasing

systematic mercury level. There is a need for further investigation including environment monitoring of Hg, evaluation and test for neuro-behavior to detect early effects of mercury poisoning. It is important to enforce personnel safety measures to control the exposure.

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