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Organic Mercury Levels in Human Hair with and without Storage for Eleven Years

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To confirm the apparent continuing trend of human uptake of methylmercury, hair samples which were cut in former times seem to be useful. Methylmercury in human hair is supposedly bound to hair keratins and is extractable with thiol-containing solutions (YAMAMOTO & SUZUKI 1978). During storage of hair samples, diagenetic changes of hair chemical composition may occur. If methylmercury decomposes to elemental inorganic mercury, the loss of mercury may be significant. To test the possible breakdown of methylmercury in human hair, samples which were analyzed for organic mercury content in 1970 and had been stored in our laboratory were reanalyzed.

MATERIALS AND METHODS

Hair samples. Hair samples were collected in 1970 from inhabitants of a small island with elevated fish consumption. This island, called Kuchinoshima, belongs to Tokara Islands, Kagoshima Prefecture. Organic mercury levels in hair compared with blood mercury levels and fish consumption frequencies were analyzed and previously reported (SUZUKI et al. 1976). Remains of finely cut hair samples were wrapped with paraffin paper and individually put in an envelope. From 135 (male, 47; female, 88) samples, 15 samples each from males and females were randomly selected and sent to one of the authors (R.Y.) without information as to the mercury value determined in 1970.

Mercury Measurement. In 1970, the finely cut hair samples were not washed and directly subjected to 1N HCl solution for extraction of organic mercury. The HCl-extract was analyzed for mercury by the method of MAGOS & CERNIK (1969) after oxidation with acid-permanganate solution. In 1981, the samples were washed 5 times with 10 mL of distilled water, then once with ethanol and once with acetone. Thereafter, they were dried in warm air (ca. 40°C). According to the method of MAGOS (1971), the dried samples were homogenized with 45% NaOH solution containing cysteine HCl and subjected to mercury analysis.

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Table 1. Mercury Content of Hair Measured Twice at an Interval of Eleven Years[a)]

Sex & Age	Hg values in 1981 measurement			1970
	Total	Inorganic	Organic	Organic
Male				
2	18.4	7.9	10.5	9.0
7	20.1	2.0	18.1	17.0
9	40.7	3.4	37.3	24.0
9	16.9	1.7	15.2	41.5
11	47.4	16.3	31.1	18.0
12	30.4	2.9	27.5	25.5
13	18.0	1.4	16.6	17.0
13	14.8	0.9	13.9	14.5
13	60.6	5.2	55.4	35.0
38	65.3	5.5	59.8	62.0
40	81.1	6.3	74.8	52.5
46	48.3	3.7	44.6	42.0
46	76.3	5.3	71.0	45.0
49	154.6	10.7	143.9	127.5
61	38.9	3.5	35.4	37.0
Female				
2	99.6	9.2	90.4	48.5
7	35.4	5.4	30.0	19.5
10	12.1	1.1	11.0	17.0
11	42.7	3.3	39.4	15.0
12	42.2	2.6	39.6	23.0
13	54.9	4.4	49.5	41.5
26	23.4	4.2	19.2	18.0
30	14.1	3.1	11.0	11.0
35	79.0	6.6	72.4	55.5
40	74.9	5.9	67.0	51.5
41	58.9	9.8	49.1	50.5
44	27.3	15.0	12.3	13.5
45	20.2	3.6	16.6	21.5
50	48.4	6.0	42.4	38.0
57	25.1	2.7	22.4	43.0

a) Values in the table denote nmol/g of hair; age of subjects is for 1970; organic Hg values in 1981 were obtained by subtraction of Inorganic Hg from Total Hg. Correlation coefficient is 0.890 ($p<0.01$ and regression equation is Y (values in 1981) = 1.13X (values in 1970) + 2.1 between the Organic Hg values in 1970 and in 1981.

RESULTS AND DISCUSSION

Table 1 shows the results indicating a good correlation between values measured in 1981 with those in 1970. However, the average of 1981 values is significantly higher than that of 1970 values ($p<0.05$ by t-test) and a regression coefficient is 1.13 (Y as 1981 values, X as 1970 values).

The reproducibility of mercury determination varies with the amount of mercury to be measured. When the amount of mercury in the reaction vessel, from which the elemental mercury is released for cold atomic absorption spectrometry, is over 50 pmoles, the reproducibility is less than 10% as relative standard deviation in both measurements concerned. The amount of hair samples contained in a reaction vessel is usually 10-20 mg. Assuming the mercury amount in a vessel is 50 pmols, the mercury content in hair will be 2.5-5.0 nmol/g. In this study, the mercury measurement was repeated twice. Therefore, the correlation coefficient, 0.890, between two measurements indicates a good accord with error variation.

The different levels of mercury in hair between two measurements seem to be explained by the different treatment of samples: In 1970, hair samples were not washed, while the samples were washed and dried in 1981. Hair samples washed and dried similar to the 1981 treatments showed an increase of about 10% in mercury content when compared to the value for unwashed samples (YAMAMOTO & SUZUKI 1978). The regression coefficient, 1.13, is reasonably explained by this fact.

Thus, we conclude that the organic mercury in human hair has been preserved for 11 years.

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