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Mercury Content of Head Hair from Residents on the Coast of Jakarta Bay

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Minamata disease was the world's first experience with widespread methyl-mercury poisoning caused by man-made environmental pollution. A quarter of a century has passed since Minamata disease was first noticed in 1956, and its cause was identified by 1959 (Harada 1982). However, subsequent events in Iraq in 1971 (Bakir et al. 1973), in Venezuela in 1974 (Harada et al. 1980), and in Canada in 1975 (Harada et al. 1977) have shown that Minamata disease is still a serious worldwide problem. Moreover, an indication of mercury accumulation in some regions of Jakarta Bay was recently reported by Surtipanti and dan Erwansyah (1979). The average mercury concentrations were 8.8-20.0 $\mu g \cdot l^{-1}$, which greatly exceed the normal level of mercury in sea water (Fitzgerald 1979). Clearly, further works needs to be done. The present paper describes the mercury content of hair from residents on the coast of Jakarta Bay in order to examine whether or not the environmental pollution has already exerted a deleterious effect on the human body.

MATERIALS AND METHODS

Forty-nine residents on the coast of Jakarta Bay provided material for this study. Nineteen residents were male and 30 female, with a mean (± S.E.) age of 25.2 (± 4.5) and 19.9 (± 2.6) yr, respectively. None of them developed typical neurological symptoms of Minamata disease such as Hunter-Russell syndrome (Hunter et al. 1940). Head hair was collected from July through August in 1982. As a control, head hair collected from healthy volunteers living in Japan, U.S.A., Switzerland, and Scotland in 1975 was used. Total mercury contents were determined using a Toshiba Beckmann model MV 253 mercury vapor meter (Tokyo). Only hair roots and their vicinities were used for mercury assay because the amount of mercury in new growth reflects the blood mercury concentration or body burden of mercury during

the time of hair growth (Sexton et al. 1978). Student's t-test has been employed in the statistical analyses.

RESULTS AND DISCUSSION

Table 1 shows the total mercury contents of head hair from normal controls living in 4 countries and from people living in Indonesia. The methyl-mercury content of the hair was not determined, because total mercury content was low. Mercury contents of male donors in Indonesia significantly exceeded those of donors in Switzerland and Scotland ($p < 0.01$). Mercury contents of female donors in Indonesia also exceeded those of donors in Switzerland ($p < 0.05$). On the other hand, mercury levels in both male and female donors in Indonesia tended to be lower than those in donors in Japan; however, this trend was not statistically significant.

Hair was chosen for this study because its mercury content changes slowly and therefore provides a more reliable index than urine or blood mercury levels, which change rapidly (Harada et al. 1977). It is also painlessly removed and does not require refrigerated storage facilities.

TABLE 1. Total mercury content in head hair.

Subjects		N	Age (year)	Total mercury (ppm)
Normal controls:				
Japan	M.	20	20.4±0.2	4.6±0.5 (2.3-11.2)
	F.	20	18.5±0.1	2.7±0.1 (1.5- 4.0)
U.S.A.	M.	10	15.8±0.3	3.5±1.2 (0.8-11.3)
	F.	12	15.8±0.5	2.5±0.9 (0.9-11.8)
Switzerland	M.	8	18.4±0.5	0.8±0.1 (0.4- 1.5)
	F.	10	17.8±0.5	0.9±0.1 (0.4- 2.0)
Scotland	M.	10	36.7±3.6	0.7±0.1 (0.2- 1.2)
Residents on the coast of Jakarta Bay:				
	M.	19	25.2±4.5	2.9±0.7 (0.2-13.7)
	F.	30	19.9±2.6	1.9±0.4(trace-7.8)

Values are expressed as mean ± S.E.
The lowest and highest mercury contents in each group are given in parentheses.
M, male ; F, female ; N, Number of cases.

People accumulate mercury in their bodies mainly by absorption of mercury from their diets, especially from fish (Airey 1983). Consequently, in the present study the differences in hair mercury contents between donors living in 5 countries were attributed to differences in fish eating habits. Namely, each group ate fish at the following rate: Japan: 5 times and less a week; U.S.A.: 3 times and less a week; Switzerland: once and less a week; Scotland: once and less a week; Indonesia: 3 times and less a week. Approximately 100 g of fish were eaten at a meal. It is generally recognized that the minimum level of total mercury in the hair at which the development of Minamata disease symptoms is seen is approximately 50 ppm, but a person with a level of more than 20 ppm should be required to obtain a thorough medical examination (Doi & Ui 1975; Harada et al. 1977). At all events, the hair mercury contents of residents on the coast of Jakarta Bay were considered to be within normal limits.

Fish mercury concentrations have been seen to correlate with water mercury concentrations (Gardner 1978). The mercury concentrations in the sea waters of Jakarta Bay reported by Surtipanti and dan Erwansyah (1979) were surprisingly high, and were over those in Minamata Bay in 1961 (1.6-3.6 $\mu g \cdot l^{-1}$)(Fitzgerald 1979). According to the study of Fitzgerald (1979), mercury concentrations greater than 20 $ng \cdot l^{-1}$ in non-impacted coastal regions are rare. However, most Indonesians in this study have made it a habit to eat marine products caught in Jakarta Bay, although an undetermined amount. Accordingly, the discrepancy between mercury levels in the sea waters of Jakarta Bay and in the hair from the residents of the area remains to be explained. Hereafter, the environmental pollution in Jakarta Bay should be kept under close observation.

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