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Polychlorinated Biphenyls in Human Blood Samples of Bombay

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Polychlorinated biphenyls (PCBs) have received considerable attention in the last two decades, since studies have shown that these are extremely persistent environmental pollutants worldover (Risebrough et al. 1968, Olsson and Reutergardh 1986). Presence of PCBs in human blood has been reported by several investigators (Kriess 1985, Tsai 1985, Leoni et al. 1986, Nakagawa et al. 1987).

This paper reports the levels of PCBs in the blood of 60 professional and 20 voluntary blood donors.

MATERIALS AND METHODS

Hexane-double distilled (Ranbaxy), anhydrous sodium sulfate, aluminium oxide, sulphuric acid, KOH pellets from Sarabhai chemicals (A.R. grade), ethyl alcohol-double distilled, silica gel (Acme Chemicals, A.R. grade), Pyrex glass column (30 cm X 10 mm).

10 mL of blood from 60 professional and 20 voluntary donors was collected in screw cap testtubes containing 0.2 mL of heparin (200 U.S.P units).

For the extraction and clean-up of PCBs from the whole blood samples, the method of Heeshane et al (1983) with slight modifications (Vaman Rao and Savitri 1988) were used.

The gas chromatograph used was Sigma 3B model Perkin Elmer fitted with 6.0 ft X 2.) mm glass column packed with 3% SE-3) on 80-100 chromosorb WAW. The carrier gas used was nitrogen with a flow rate of 35 mL/min. Temperature parameters were 210°C(column), 250°C (injector) and 300°C(detector).

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Quantification of PCB residues was done by comparing respective total areas of PCB peaks in the sample with the total area of chromatogram of Aroclor 1260.

RESULTS AND DISCUSSION

Table. Range and mean PCB concentration in human blood samples. M = Male, F = Female

Samples from	No. of samples analysed	Sex	PCB range in ppm	Mean ± S.D in ppm	% incidence
Professional donors	60	M	0.005-3.33	0.837 ± 0.10	100
Voluntary donors	10	M	0.108-0.894	0.328 ± 0.109	100
	10	F	0.227-0.782	0.464 ± 0.150	100

From table 1 it is quite evident that male professional donors had more PCBs in their blood than the male voluntary donors as was evident by the mean PCB concentration of 0.837 ± 0.10 ppm in professional donors and 0.328 ± 0.109 ppm in the voluntary donors blood respectively. Further it was found that the female voluntary donors had higher levels of PCBs (0.464 ± as compared to male voluntary donors.

Table 2. Percent incidence of PCB contamination of blood samples of professional donors within specific concentration range.

PCB range in ppm	No. of Samples	Average Mean ± S.D in ppm	Percent incidence
0.005 - 0.5	16	0.334 ± 0.08	26.66
0.5 - 1.0	26	0.727 ± 0.14	43.33
1.0 - 1.5	12	1.282 ± 0.38	20.00
1.5 - 2.0	3	1.584 ± 1.12	5.00
2.0 - 3.5	3	1.778 ± 1.25	5.00

From table 2 it can be seen that nearly 44% of the professional blood donors blood samples had PCB levels between 0.5 - 1.0 ppm with a mean value of 0.727 ± 0.14 ppm, while 26% samples had between 0.005 - 0.5 ppm followed by 12% of 1.0 - 1.5 ppm.

Table 3. Percent incidence of PCB concentration in blood samples of voluntary donors within specific concentration range.

PCB range in ppm	No. of Samples	Average Mean ± S.D in ppm	Percent incidence
0.10 - 0.30	7	0.197 ± 0.08	35.00
0.30 - 0.60	7	0.390 ± 0.15	35.00
0.60 - 0.90	6	0.505 ± 0.22	30.00

From table 3 it is evident that 70% of the samples were in the range of 0.10 - 0.60 ppm of PCB with a mean concentration of 0.2935 ± 0.115 ppm. The remaining samples (30%) were found to contain PCB between 0.60 - 0.90 ppm.

From table 2 and 3 it is clear that the maximum number of professional donors blood samples (43%) had PCB levels between 0.5 to 1.0 ppm and the voluntary donors blood had 0.1 to 0.6 ppm. The concentration of PCB was lower in the voluntary donors, because of their lower age group (19 to 20 years of age) as compared to professional donors, whos age was 35-45 years. Kriess (1985) and Kimbrough (1985) reported that body burden of PCB increases with age and environmental exposure.

In the U.S. population groups, the mean serum levels of PCBs were found to be between 0.004 - 0.008 ppm. However, the fish eating population of Lake Michigan, Triana and New Bedford showed higher concentration of PCBs in their blood, which were 0.0025 - 0.036 ppm, 0.003 - 0.015 ppm and 0 - 0.010 ppm respectively (Kriess 1985). The higher levels of PCBs in these populations are attributed to consumption of fish from PCB contaminated lakes.

In a study conducted in Japan from 1972-83, a mean PCB concentration of 0.77 ppm was reported (Yakushiji et al 1983). Hakaru et al (1982) reported mean PCB concentration of 0.017 ppm in the blood of people from Nagasaki prefecture. The general population in Taiwan was found to contain 0.0026 ppm of PCB in their blood (Tsai 1985). The Southern population of California in America was found to have 0.004 - 0.005 ppm of PCB in the blood of non-occupationally exposed workers (Sahl et al 1985). In Italy, women who had spontaneous abortions had 0.0037 ppm PCB in their blood (Leoni et al 1986). Bercovicci et al. (1983) reported missed abortions in women who had mean PCB of 0.103 ppm in their serum. In another study conducted in Israel, premature and underweight babies were born to women who had 0.12 ppm of PCB in their serum (Wasserman et al. 1982). Nakagawa et al. (1987)

reported 0.079 ppm PCB in the blood of Japanese population.

From these reports it is evident that the PCBs in the blood of citizens of Bombay were significantly higher, whether they were professional or voluntary donors. But unfortunately, such studies of environmental PCB exposure of people of Bombay through food are not available to the best of our knowledge. Hence, it is necessary to take up further study in this aspect regarding monitoring of food substances of fish origin for the presence of PCBs.

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