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Variation of Polybrominated Biphenyl Homolog Peaks in Blood of Rats Following Treatment with Firemaster FF-1

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The predominance of higher PCB homologs in blood and tissues of rats following treatment with Aroclor 1254 or 1260 has been widely documented. BRAUNBERG et al. (1976), for example, found after four weeks adipose tissue residues consisted of three major PCB peaks, probably with four components: a pentachloro-, a pentachloro- +2,4,5,2'4',5'-hexachloro-, and 2,3,4,2',4',5'-hexachloro-biphenyls. After 30 weeks the two hexachlorobiphenyl peaks were by far the most prominent components in adipose tissue with the 2,4,5,2',4',5' -hexachlorobiphenyl the larger.

With polybrominated biphenyls (PBB), homolog distribution has not been widely studied. FRIES et al. (1975) reported that the hepta component of Firemaster disappeared more rapidly in milk of cows than did the major hexabromobiphenyl component, since identified as 2,4,5,2',4',5'- hexabromobiphenyl (SUNDSTROM et al. 1976). WOLFF et al. (1978a) reported varying concentrations of two pentabromobiphenyl peaks and the absence of the heptabromo-biphenyl in serum of persons exposed to PBB in Michigan. We report here the decrease over 42 days post-exposure of five PBB homolog peaks in blood of rats.

MATERIALS AND METHODS

Twenty-three male Sprague-Dawley rats (body weight 250-300 g) were given an 80 mg/kg dose of the polybrominated biphenyl Firemaster FF-1 in corn oil by gavage. The PBB was a sample of the lot which was inadvertently mixed with farm feed in Michigan in 1973, resulting in wide contamination of that State's food supply (KAY 1976). Animals were sacrificed serially by decapita-tion on days 7, 12, 20, 28 and 42 after dosing. Blood and tissues were frozen until analyzed. Blood was analyzed according to methods of WOLFF et al. (1978b). Fat was analyzed essentially according to the method of Dr. H.A. Price of the Michigan Depart-ment of Public Health (personal communication). Tissue was ground in a Duall 23 grinder with hexane and sodium sulfate, filtered through sodium sulfate, and chromatographed on Florisil as described for serum analysis (WOLFF et al. 1978b). Half of the lipid extract was evaporated for lipid weight determination, and PBB concentration expressed as μg per gram of lipid (ppm). Recoveries were 80-96%, and replicate determinations were within 10%.

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RESULTS AND DISCUSSION

Blood concentration of PBB, expressed as the major peak, diminished from 2.7 ppm the first week to 0.4 ppm after 42 days recovery.

TABLE 1
Blood and fat concentration of PBB in rats following an oral dose of Firemaster FF-1

Day*	7	12	20	28	42
Blood concentration, ppm	2.66 ±1.47	1.14 ±0.30	1.19 ±0.22	1.06 ±0.28	0.38 ±0.07
Fat concentration, ppm					295± 69

*Mean and standard deviation of measurements on 3,4,4,4,5 animals, days following 80 mg/kg ig dose in corn oil

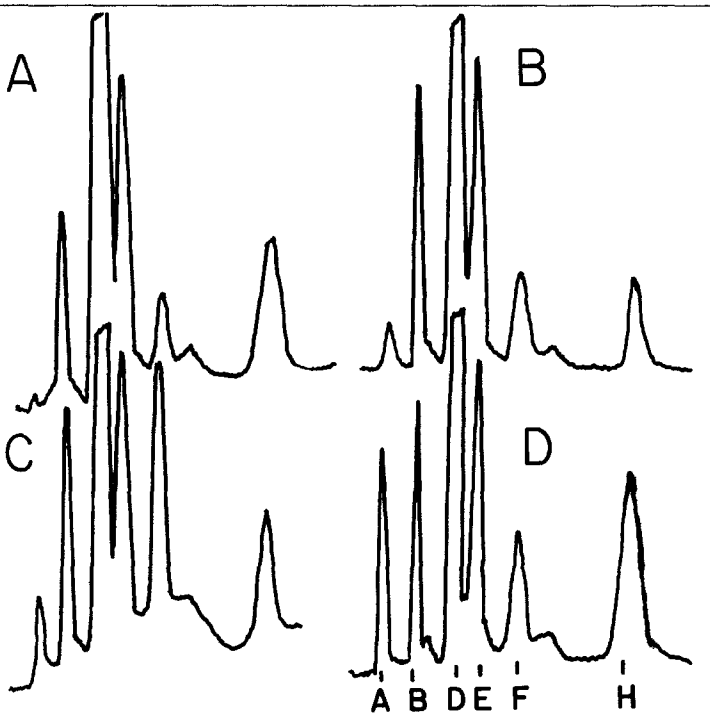

Figure 1: PBB in blood(A) and fat(B) of a rat 42 days after oral administration of Firemaster FF-1 (80 mg/kg); in blood(C) 7 days after treatment; Firemaster BP-6 Standard(D).

Adipose tissue concentration after 42 days was 295+69 ppm. Gas chromatographic traces showed similar homolog distribution in blood and adipose tissue at this time point (Fig. 1).

Calculation of homolog peaks A,B,E,F, and H as area percent of the peak D (2,4,5,2',4',5'-hexabromobiphenyl) showed different rates of decrease over the 42 day period (Fig. 2). Peaks A and F disappeared the most rapidly; peaks B and H (2,3,4,5,2',4',5'-heptabromobiphenyl; HASS, personal communication) disappeared at a similar rate; and peak E, a hexabromobiphenyl peak (WOLFF et al. 1978a) remained fairly constant over 42 days. The proportions of the two pentabromobiphenyl peaks are similar to

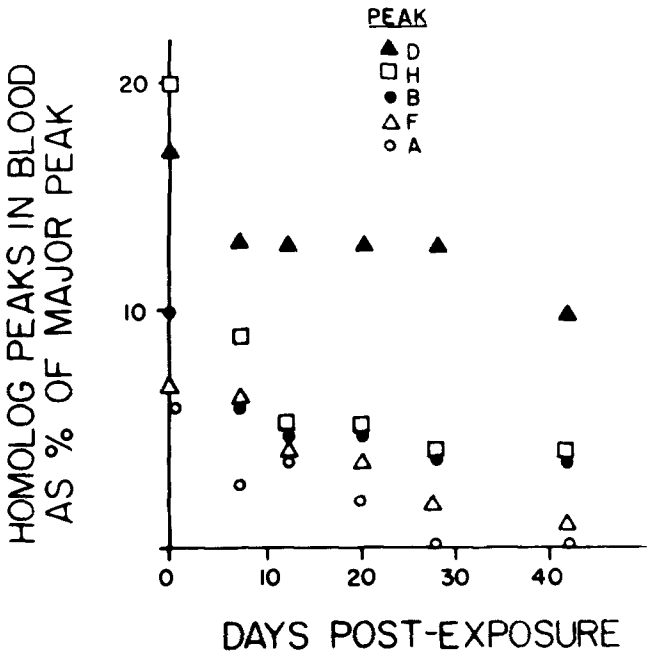

Figure 2: Relative concentrations of PBB homologs in blood of rats following an oral dose of PBB (80 mg/kg). Points at the origin indicate concentrations in Firemaster FF-1. Peak designations refer to Fig. 1.

that observed in chemical workers (WOLFF et al. 1978a). However, in blood and fat of chemical workers and in milk cows, practically no heptabromobiphenyl (peak H) was observed, whereas it was retained in significant proportions in rats after 42 days. This difference may be due in part to the length of the observational period and to species absorption-elimination variations. We have suggested earlier (WOLFF et al. 1978a) that differential excretion of PBB components may contribute to toxic response, analgous to the findings with PCBs where individual compounds have been shown to possess very different toxic potential (McKINNEY et al. 1976). Also, it may be expected that the 2,4,5, 2',4',5' hexa-bromobiphenyl, like the PCB analog observed by BRAUNBERG et al. (1976), will be the most persistent. The data of MATHEWS et al. (1977) strongly support this projection.

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