400 ppm 2000 ppm.

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Comparative Toxicologic Study with Polychlorinated Biphenyls in Chickens with Special Reference to Porphyria, Edema Formation, Liver Necrosis, and Tissue Residues

J. G. Vos and J. H. Koeman

Institute of Veterinary Pathology and the Institute of Veterinary Pharmacology and Toxicology, University of Utrecht, Utrecht, The Netherlands

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Comparative Toxicologic Study with Polychlorinated Biphenyls in Chickens with Special Reference to Porphyria, Edema Formation, Liver Necrosis, and Tissue Residues. Vos, J. G. and Koeman, J. H. (1970). *Toxicol. Appl. Pharmacol.* 17, 656–668. In a comparative 60-day oral toxicity test (400 ppm) in chickens, three 60% chlorinated commercial polychlorinated biphenyl (PCB) preparations were used: compound I (Phenoclor DP 6), compound II (Clophen A60), and compound III (Aroclor 1260). Using mortality, mean survival time, mean weight, and pathological observations (hydropericardium, abdominal, and subcutaneous edema and centrolobular liver necrosis) as parameters, a significant difference in toxicity was found between the compounds: compounds I and II showed the highest, compound III the lowest, toxicity. Microscopically centrolobular liver necrosis was found in chicks fed compounds I and II. Atrophy of the spleen was found in all test groups. Chemical porphyria was found as a general PCB effect: increased fecal excretion of coproporphyrin and protoporphyrin and fluorescence of tissues occurred in all test groups. Additional experiments with compound I (2000 ppm) in Japanese quail and rats confirmed the porphyrogenic action. Gas chromatographic analyses of liver and brain of dead chicks gave PCB levels that varied between 120 and 2900 ppm. The relationship of hydropericardium (chick edema) and liver necrosis to the differences in toxicity observed between the technical PCB mixtures is discussed.

In recent years the presence of polychlorinated biphenyls (PCB) has been exhibited in fish and wildlife in many countries, including the United States, Great Britain, Sweden, and The Netherlands (Jensen, 1966; Holmes *et al.*, 1967; Holden and Marsden, 1967; Koeman *et al.*, 1967; Risebrough *et al.*, 1968; Koeman *et al.*, 1969).

Commercial PCB preparations are oily fluids consisting of a mixture of different chlorinated biphenyls. These chemicals are extremely stable with very low aqueous solubility. They are used as lubricants, as fluids for heat transfer and dielectric media, in protective coatings for wood, metal, and concrete, and for many other applications. Which of these applications has contributed to the present widespread environmental contamination has not been elucidated. The occupational hazards in the use of PCB have been known for years; normal handling of these compounds has not given rise to great difficulties (Irish, 1963).

Animal experiments with rats and guinea pigs have shown that the ingestion of PCB

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Dermal Toxicity Studies of Technical Polychlorinated Biphenyls and Fractions Thereof in Rabbits

J. G. Vos AND R. B. Beems

Institute of Veterinary Pathology and Institute of Veterinary Pharmacology and Toxicology, University of Utrecht, Biltstraat 172, Utrecht, The Netherlands

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Dermal Toxicity Studies of Technical Polychlorinated Biphenyls and Fractions Thereof in Rabbits. Vos, J. G., and Beems, R. B. (1971). *Toxicol. Appl. Pharmacol.* 19, 617–633. A significant difference in toxicity between 3 polychlorinated biphenyl (PCB) preparations was found in a prior study: Clophen A 60 and Phenoclor DP6 showing the highest, Arocior 1260 the lowest, toxicity (Vos and Koeman, 1970). A subsequent study revealed the presence of tetra- and pentachlorodibenzofuran in Phenoclor and Clophen (Vos *et al.*, 1970). In the present study, application of 118 mg of the 3 PCB's (5 times per wk, for 38 days) on the back skin of rabbits also resulted in differences in toxicity.

PCB-induced skin lesions were hyperplasia and hyperkeratosis of the epidermal and follicular epithelium. Histopathology of the liver included centrolobular degeneration, centrolobular liver cell atrophy, focal necrosis, and cytoplasmic hyalin degeneration. Definite hyperplasia and hyperkeratosis of the follicular epithelium of the ear skin were seen after the topical application of fractions of Phenoclor and Clophen eluted from chromatographic columns with 25% diethylether in hexane. The fraction from Arocior caused a minimal hyperplasia and hyperkeratosis of the follicular epithelium. PCB-induced kidney lesions were hydropic degeneration of the convoluted tubules and tubular dilatation with the presence of casts. This dilatation was demonstrated also by a significantly increased relative percentage of the diameter which corresponds to the space of Bowman. Moreover, thymus atrophy and lymphopenia were found. Fecal coproporphyrin and protoporphyrin excretion was increased.

Polychlorinated biphenyls (PCB) have been identified in tissues of fish and wildlife in many countries (Jensen, 1966; Holmes *et al.*, 1967; Holden and Marsden, 1967; Koeman *et al.*, 1967; Risebrough *et al.*, 1968; Koeman *et al.*, 1969; Jensen *et al.*, 1969; Duke *et al.*, 1970; Prestt *et al.*, 1970).

PCB preparations are extremely stable, oily fluids with very low aqueous solubility. They are used as lubricants, as heat transfer media, in protective coatings for wood, metal, and concrete, and for many other applications. Which of these applications has contributed to the present environmental contamination has not yet been established.

Inhalation and feeding experiments in rats with 65% chlorinated PCB resulted in liver injury (Drinker *et al.*, 1937; Bennett *et al.*, 1938). Liver damage and skin lesions have been described after inhalation, ingestion, and application to the skin using rabbits, guinea pigs, and mice (von Wedel *et al.*, 1943). Hydropericardium occasionally accompanied by abdominal edema was found in chicks fed PCB (McCune *et al.*, 1962; Flick

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