Distribution and Elimination of a Polychlorinated Biphenyl After Acute Dietary Exposure in Yellow Perch and Rainbow Trout

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Abstract. Distribution and elimination of a single polychlorinated biphenyl isomer (2,5,2',5'-tetrachloro[14C]biphenyl, 4-CB) were compared in a nonfatty fish (yellow perch) and a fatty fish (rainbow trout). Adult fish were exposed acutely to 4-CB (0.8 μg/fish) by the oral or intraperitoneal route and were killed at designated times thereafter for one month. Whole body elimination of 4-CB was similar in both species with 20 to 30% of the radioactive 4-CB being eliminated in the first 3 to 4 days after treatment, but very little thereafter. Also, the same extent of elimination was seen when the compound was given orally or intraperitoneally. Tissue distribution of 4-CB residues was different in the two species. Perch relied on viscera and carcass as main 4-CB distribution sites and skeletal muscle, skin and scales as minor sites. In rainbow trout, on the other hand, skeletal muscle and carcass were major distribution sites, whereas viscera and skin were minor sites. This species difference in 4-CB distribution was not due to a difference in sexual maturity of the perch and trout, because a build-up of eggs or sperm was not present in the peritoneal cavity of either species.

Fish, as a major human food source, are among the most frequently cited polychlorinated biphenyl (PCB) contamination problems (Peakall 1975). Monitoring studies in Lake Michigan have shown that lake trout and rainbow trout have a greater PCB residue concentration on a whole fish basis than yellow perch (Veith 1975). While the complete explanation for this species difference is not known, the greater lipid content of trout than perch (Veith 1975) may be partly involved. A species difference in lipid content, however, cannot be the entire answer, because in the same study the PCB residue concentration in chinook and coho salmon was twice as great as yellow perch while
lipid content of these species was similar (Veith 1975). Thus, it may also be that
tROUT and salmon take up PCBs from food and/or water at a greater rate than
yellow perch and/or metabolize and eliminate the compounds at a slower rate.

The objective of the present study was to compare tissue distribution and
whole body elimination of a single, radioactive PCB isomer, 2,5,2',5'-tetra-
chlorobiphenyl (4-CB) in adult rainbow trout and yellow perch after acute oral
and intraperitoneal exposure. The PCB isomer, 4-CB, was chosen for study
because (1) it is one of the major PCB isomers found in Lake Michigan fish in
nature (Veith 1975) and (2) metabolism and elimination of this isomer in fish
exposed to 4-CB in water has been investigated by others (Peterson and Guiney
1979).

Methods

Chemicals

2,5,2',5'-Tetrachloro[14C]biphenyl (4-CB) with a specific activity of 4.2 mCi/mmol (California
Bionuclear, Sun Valley, CA) was diluted with unlabeled 4-CB (Analabs, New Haven, CT) to a final
specific activity of 0.198 μCi/μg. Before dilution, [14C] 4-CB was purified by thin layer chromatogra-
phy to greater than 99% purity using silica gel plates and hexane as the solvent.

Fish

Adult male and female rainbow trout (Salmo gairdneri, 80 to 110 g) and yellow perch (Perca
flavescens, 70 to 120 g) with no visually detectable build-up of eggs or sperm in the peritoneal cavity
were used. The trout were obtained from the Kettle Moraine Springs Trout Hatchery, Adell, WI
and perch from the Peterson Trout Farm, Peterson, MN. Both species were acclimated for three
weeks to laboratory conditions before they were exposed to 4-CB. During the acclimation period
and throughout the study, the two species were kept in separated 1,500-L tanks supplied with
flowing, aerated, dechlorinated water (100 L/hr). Water temperature was maintained at 12°C for
both species and a 12 hr light-dark cycle was used. Every other day yellow perch were fed Oregon
Moist Pellets while rainbow trout received dry fish meal pellets, the composition of which was
described previously (Guiney et al. 1979).

Acute Oral and Intraperitoneal Exposure to 4-CB

Both species were exposed to 0.8 μg of [14C] 4-CB per fish by the oral or intraperitoneal route. For
oral exposure, individual fish were placed in a separate tank and fed a single #5 gelatin capsule that