Trophic transfer and effects of DDT in male hornyhead turbot (Pleuronichthys verticalis) from Palos Verdes Superfund site, CA (USA) and comparisons to field monitoring

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ABSTRACT

High concentrations of DDT and metabolites (ΣDDT) have been detected in sediment and the demersal flatfish hornyhead turbot (Pleuronichthys verticalis) collected from Palos Verdes (PV), California, USA, a site contaminated with over 100 metric tons of DDT throughout 1960–70s. This study was conducted to assess the transfer of ΣDDT from PV-sediment into polychaetes (Neanthes arenaceodentata) and hornyhead turbot, and to investigate if the responses in turbots from two different laboratory exposures mimic those in turbots caught in PV (PV-turbot). Turbot fed PV-sediment-contaminated polychaete for 7 days had liver concentrations of ΣDDT similar to PV-turbot. After 28 days, ΣDDT also accumulated in livers of turbot gavaged with a ΣDDT mixture. In vitro cell bioassays indicated significant increases of 17bestradiol equivalents (EEQ) in turbot bile extracts as compared to the control in the 7-day study. These responses corresponded to those measured in PV-fish. Glucocorticoid receptor (GR), anti-androgen receptor (anti-AR), estrogen receptor (ER) or aryl hydrocarbon receptor (AhR) activities were also observed in extracts of PV-sediment, and PV-sediment-exposed worm. Anti-AR, AhR and GR activities were significantly higher in PV-sediment than reference sediment (San Diego, SD). Higher transcripts of hepatic VTG, ERα and ERβ were found in PV-turbot than SD-turbot, but were unaltered in fish exposed to sediment-contaminated worms for the 7-day study. In contrast, liver extracts from the 28-day treatment of ΣDDT showed lower EEQ but similar hepatic VTG and ERβ transcripts relative to those of PV-turbot. These data indicated that trophic transfer of sediment-associated DDT in 7-day exposures corresponded to field measurements of DDT residues and in vitro ER bioactivities, but failed to mimic in vivo biological effects observed in field fish. In contrast, treatment with ΣDDT alone for 28 days mimicked in vivo biological effects of DDTs in PV fish, but did not correspond to liver concentrations or in vitro bioactivities.

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