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Comparison of the Toxicokinetics between perfluorocarboxylic acids with Different Carbon Chain Length

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Toxicokinetics was compared between perfluoroheptanoic acid (PFHA), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA) and perfluorodecanoic acid (PFDA) in male and female rats. Half lives ($t_{1/2}$) in male and female rats were calculated to be 0.10 and 0.05 days, respectively, for PFHA and 5.63 and 0.08 days for PFOA, 29.5 and 2.44 days for PFNA and 39.9 and 58.6 days for PFDA. CL_{tot} of PFHA was higher than those of other perfluorocarboxylic acids (PFCAs) in both male and female rats. By contrast, CL_{tot} of PFDA was extremely low in both sexes. PFCAs having shorter carbon chain length showed higher CL_{tot} . There was a significant sex-related difference in CL_{tot} of PFOA and PFNA. Distribution volumes in steady state (V_{ss}) were not much different between PFCAs and between sexes. To estimate the role of urinary excretion in plasma clearance of PFCA, renal clearance (CL_R) was determined for PFCAs. CL_R of PFCAs were in the order of PFHA>PFOA>PFNA~PFDA and PFHA~PFOA>PDNA>PFDA in male and female rats, respectively. There was a close relationship between CL_{tot} and CL_R ($r^2=0.981$). Plasma protein binding, estimated in vitro, was over 98% for all PFCAs tested. The results indicate that CL_R is responsible for the difference in CL_{tot} between PFCAs having different carbon chain length and between sexes.