DOCTORAL THESIS

Risk assessment of perfluorinated compound (PFC) contamination and their effects on animal reproductive health

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Risk Assessment of Perfluorinated Compound (PFC) Contamination and their Effects on Animal Reproductive Health

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Abstract

Perfluorinated compounds (PFCs) are man-made fluoro-surfactants that are identified as global pollutants and can pose health risks to humans and wildlife. People can exposure to these chemicals through inhalation, food consumption, as well as dust digestion and so on. Fish consumption is one of the major sources of pollutants exposure to people living in coastal environment. In the first part of the present study (chapters 2 and 3), the concentrations of perfluorinated compounds (PFCs) were measured in 20 common fish species purchased from the Hong Kong and Xiamen markets, and oyster and mussel samples were collected from 12 field sampling sites distributed in Pearl River Delta (PRD) and Hong Kong. Concentrations of total PFCs in fish ranged from 0.27–8.4 ng/g to 0.37–8.7 ng/g in Hong Kong and Xiamen, respectively. The average daily PFCs intake per person were ranged from 42-1362 ng/day in Hong Kong and 60-1434 ng/day in Xiamen. While the total PFCs concentrations in oyster and mussel samples were 0.461-1.960 and 0.663-3.430 ng/g wet weight, respectively. In the consumption of these shellfish, the average daily PFCs intake per person were range from 75.78-322.8 ng/day for oyster and 109.14-564 ng/day for mussel. These data highlighted the risk of dietary intake of PFCs for South China coastal people. In chapter 3, surface sediment samples were also collected from 12 PRD and Hong Kong field sampling sites. Analytical results indicated that the concentrations of total PFCs were in the range of 0.151-3.106 ng/g dry weight in the sediments. In general, an increasing trend of PFC contamination with higher anthropogenic activities was observed in PRD and Hong Kong water systems.

Based on these findings, potential reproductive health risks of PFCs from sea

food consumption in our region were estimated using in vivo animal experiment. Perfluorooctanesulfonate (PFOS) was one typical PFCs that most studied for years and was reported had adverse effects on animal fertility. In chapter 4, a murine model was used to study potential effects of PFOS on testicular signaling. Serum concentrations of testosterone and epididymal sperm counts were significantly lower in the mice after 21 days of the exposure to the highest dose (10mg/kg/day) of PFOS. The expression levels of testicular receptors for gonadotropin, growth hormone, and insulin-like growth factor 1 were considerably reduced on Day 21 in mice exposed daily to 10 or 5 mg/kg PFOS. The transcript levels of the subunits of the testicular factors (i.e., inhibins and activins), Inha, Inhba, and Inhbb, were significantly lower on Day 21 of daily exposure to 10, 5, or 1 mg/kg PFOS. The mRNA expression levels of steroidogenic enzymes (i.e., StAR, CYP11A1, CYP17A1, 3beta-HSD, and 17beta-HSD) were notably reduced. Therefore, PFOS-elicited subfertility in male mice is manifested as progressive deterioration of testicular signaling. In chapter 5, we investigated the effects of PFOS on primary mice Leydig cells by measuring the effects of PFOS in dbcAMP-induced testosterone levels. In the PFOS/dbcAMP co-treated cells, our data indicated that PFOS cotreatment caused modulatory effects on the testosterone concentration. In chapter 6, we used *C. elegans* as animal model, to investigate the effects of PFOS on gonadal development and fertility. Significant decreases in P_0 the body length, number of laid egg of the P_0 generation, and the embryonic lethality of the P_1. Moreover abnormal morphology was observed in oocytes and eggs of the P_0 generation. The study illustrated the negative impact of PFOS exposure on the reproductive development and function on the hermaphrodite germ line. Collectively the present study has highlighted the risk of PFCs through sea food consumption in South China and has demonstrated the negative effects of PFOS exposure on reproductive dysfunction.

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