CHANGES IN NEUROTRANSMITTERS LEVELS IN RAIBOW TROUT BRAIN AFTER EXPOSURE TO NAPHTHALENE

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INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) are a very important group of chemical pollutants in the aquatic environment. Their main sources are anthropogenic: domestic and industrial discharges, atmospheric deposition, fossil fuels spillages. It has been shown that many PAHs have mutagenic, carcinogenic or genotoxic properties. Some of them may also act as endocrine disruptors due to their chemical structure, altering the levels and the functionality of various hormones. These effects could be mediated by an action of PAHs on the neural centres regulating hormone secretion. However, studies of the effects of PAHs on brain neurotransmission are almost non-existent. We tested here the capacity of naphthalene (a two ring PAH) exposure to influence the neurotransmitters systems in the brain of the rainbow trout.

MATERIALS AND METHODS

In this work, immature rainbow trouts (*Oncorhynchus mykiss*) of about 100 g body weight were treated with naphthalene.

First experiment: fish were intraperitoneally injected (0, 10 and 50 mg naphthalene/kg body weight), using sunflower oil as vehicle, and sacrified 1, 3 and 6 hours later.

Second experiment: fish were again intraperitoneally injected (identical doses) but using coconut oil as vehicle to form slow-release implants. Fish were sacrified 1, 3 and 5 days later.

After sacrifice, trout brains were immediately dissected into telencephalon, hypothalamus, pituitary gland, preoptic area and medulla oblongata. The levels of noradrenaline, dopamine, serotonin and related catabolites were measured in each region by high-performance liquid chromatography.

RESULTS AND DISCUSSION

In short term treatments (hours) significant increases in the levels of dopamine (DA), serotonin (5HT) and 5-hydroxyindole-3-acetic acid (5 HIAA), a serotonin catabolite, were observed in the hypothalamus. Similarly, increases of 5HIAA and serotonin levels were observed in telencephalon, besides a decrease of 5-hydroxytryptophan (5HTP), the precursor of serotonin synthesis. The other brain regions displayed minor modifications.

Mid-term treatments (5 days) with the higher dose of naphthalene tested induced significant decreases of noradrenaline (NA), DA, 5HIAA and 5HT levels in the hypothalamus, while a decrease of 5HIAA took place after a three-day exposure. In the telencephalon, decreases in the levels of 5HTP and DOPAC, the main DA oxidative catabolite, together with an increase of NA after one day exposure, were observed.

CONCLUSIONS

Naphthalene exposure is able to modify the levels of amine neurotransmitters in the brain of rainbow trout. The effects of naphthalene on each neurotransmitter differ with the dose, the brain region and the time of exposure.

Brain regions with high density of aminergic neuronal terminals (i.e., hypothalamus, telencephalon) are more sensitive to the pollutant than low-density regions.

Results suggest that some endocrine effects induced by naphthalene might be mediated through the brain aminergic systems.