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Chronic exposure to the synthetic cathinone 3,4-methylenedioxypyrovalerone (MDPV) reveals enantioselective effects in *Daphnia* reproduction

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Abstract

Background: The abuse of synthetic cathinones (SC) is popular among young consumers for recreational purposes and has increased dramatically in the last years. Consequently, SC have been found in the aquatic environment at low concentrations [1]. Since SC are designed to change nervous system function, they may pose unpredictable harmful effects on non-target organisms, such as aquatic invertebrates [2]. Many SC, like 3,4-methylenedioxypyrovalerone (MDPV), are chiral, and therefore may exhibit enantioselectivity including in ecotoxicity [2,3]. Considering the limited information available on MDPV ecotoxicity and enantioselectivity, it is vital to assess its potentially enantioselective effects on aquatic organisms. **Objective:** This work aimed to assess the adverse effects of (*R*,*S*)-MDPV, (*R*)-MDPV, and (*S*)-MDPV on the survival, body size and reproduction of *Daphnia magna* after 21 days of chronic exposure. **Methods:** *Daphnia* neonates (< 24 hours) were individually exposed to concentrations ranging between 0.10 to 1.79 µg L^{-1} of (*R*,*S*)-MDPV, (*R*)-MDPV and (*S*)-MDPV for 21 days, using 10 organisms per concentration. Survival and reproduction data were recorded every day until day 21, whereas body size was determined at day 7 in a random subsample of 5 individuals per concentration (using microphotography analysis with ImageJ). **Results:** Chronic assays showed significant inhibition of the population rate of increase at 1.79 µg L^{-1} and reproductive output (number of offspring per female) at 1.00 and 1.79 µg L^{-1}, only for (*R*)-MDPV. Although (*R*,*S*)-MDPV and both enantiomers did not cause significant effects in mortality, it should be noted that organisms exposed to (*R*)-MDPV showed a slight decrease in survival at 1.00 and 1.79 µg L^{-1} when compared to the control. **Conclusions:** The present study demonstrated that chronic exposure to MDPV can impair *D. magna* reproduction, with (*R*)-MDPV causing adverse chronic effects at the tested concentrations, unlike the (*S*)-enantiomer and (*R*,*S*)-MDPV.

Keywords: chiral psychoactive drugs; synthetic cathinone; enantiotoxicity; aquatic pollution; microcrustacean

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