Dietary LC-PUFA deficiency early in ontogeny induces behavioural changes in pike perch (Sander lucioperca) larvae and fry

This study examined whether dietary supply of DHA and phospholipids during early ontogeny affected the outcome of behavioural challenges in pike perch larvae and fry, and whether the history of lipid nutrition carried over in long-term effects on learning ability. Pike perch larvae were fed Artemia enriched with either refined olive oil high in oleic acid (A); refined olive oil supplemented with a low (B) or a high (C) level of DHA; or refined olive oil acid supplemented with fish oil with a high content of phospholipids (PL) and DHA (D). The enriched live diets were provided until 28 days post hatch (dph), at which time larval behavioural responses to visual and mechano-sensory stimuli were assessed. All dietary groups were subsequently fed an identical enriched live feed (diet D) and gradually weaned to an extruded dry feed, on which they were maintained for 112 days. At the end of this period, assessment of fry avoidance behaviour was repeated and individuals were tested for spatial learning ability in a maze. At the larval stage, individuals maintained on Artemia rich in DHA showed a 5–8 fold increase in swimming speed when subjected to a visually simulated predator test, a response that was not observed for larvae on diets low in DHA content. Independent of the predator simulation, larvae deficient or low in DHA exhibited significantly more time swimming along the edge of a test arena and had overall higher locomotor activities compared to larvae fed a diet with a high DHA content. Larvae on DHA rich diets showed an ability to achieve significantly higher peak acceleration rates during the escape response, which was maintained at 112 dph. Time spent locating the exit of a maze decreased with repetitious training sessions, although fish fed diets low in DHA spent longer time in the maze, caused by extended periods of inactivity or “freezing” behaviour (time lag) prior to the onset of active searching behaviour. The consistency of behavioural responses to mechano-sensory stimuli in larvae and fry suggests long-term effects on the neuromuscular path-way involved in escape responses. A longer period of freezing in the learning test may reflect a more anxious and fragile behaviour profile in fish fed low levels of DHA. Further studies should aim at verifying whether this affects performance related traits, such as immune competence and robustness.