Establishing conditions for the generation of valuable furan fatty acids in fish grown in an zero discharge aquaculture system

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Background. Furan fatty acids (F-acids) are considered as health-promoting minor fatty acids in food. However, data on these valuable antioxidants is scarcely found in the literature. This is mainly due to analytical difficulties in their detection (among other the lack of reference standards). A recent study indicated that fish is the major food source for the human uptake of F-acids.
Goal. Here we explored the presence of F-acids in three species of freshwater fish in a recirculating aquaculture system operated at the Rehovot campus.
Methods. The system consisted of a fish basin (5 m^3) from which water was recirculated through aerobic and anaerobic treatment steps. By means of this treatment configuration, water usage for fish growth is extremely low as the system is operated without water exchange and water addition is limited to compensate for evaporation losses only. After having been cultured for 21 months in the system, hybrid tilapia (*Oreochromis aureus* x *O. niloticus*), common carp (*Cyprinus carpio*) and hybrid striped bass (*Morone saxatilis x M. chrysops*) were analyzed for F-acids. In addition, F- acids content was also examined in grey mullet (*Mugil cephalus*), which had been cultured in an open system. Fillet, liver and spleen were separated and analysed in Hohenheim on F-acids by means of gas chromatography with mass spectrometry (GC/MS) using isolated/synthesized standards for quantification.
Results. Concentrations of the main mineral constituent in the muscle tissue of the fish were within the acceptable range. F-acids were detected in all samples but the concentrations were lower than those reported in fish in the literature. Highest F-acid concentrations were generally found in fillet followed by liver or spleen. According to literature, the most common F-acids are three dimethyl-substituted F-acids (9D5, 11D3, 11D5) and two monomethyl-substituted F-acids (9M5, 11M5). These five F-acids represented between 17.5-89% of the F-acids in the sample (typical contribution according to the literature ~90%). In addition, we detected several peaks in the F-acid fraction of our samples which were unknown to us. Selective GC/MS methods were used for their identification. By this measure we identified seven novel F-acids in the samples. Their concentrations were highest in liver and spleen.
Outlook. More details on the occurrence of these novel F-acids will be explored in the final phase of the project.