

Alternative protein sources for fish, not competing with the human food demand evaluated by traditional and novel approaches.

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At present, most alternative feed sources in fish is since long known in terrestrial animals. However, in a longer time frame this is questionable from a food security perspective, as these sources often are of human food quality. This is an argument rapidly growing in importance. Microbes, insects and products from other forms of extractive aquaculture are of major interest considering their growth potential, nutritional profile, probiotic qualities and ability to use simple resources as substrates. However, with a transition towards a circular economy, substrates that produce such feed ingredients will to a higher degree be based on waste and by-products. This development will demand novel approach in nutrition research in order to understand non-intuitive positive and negative effects in the fish gut biota, immune response, metabolism, welfare and product quality/safety. We will present our ongoing work, concerning physiological implications of alternative protein sources using *in situ* experimental technologies, such as cannulation and repeated tissue sampling. This work also combines advanced analytic methods of metabolomics and gut microbiota using amplicon next generation sequencing that targets 16S rDNA for bacterial identification. Data on post-prandial plasma AA profile, hematological parameters and erythrocyte indices will be presented together with data concerning the interaction between diet and stress in fish where fishmeal has been replaced by yeast up to 60%. Also, data concerning changes of the microbiota of fish given fungal mycelium-, yeast-, insect- (if ready) and mussel meal will be presented, including comparison between nutrient efficiency of feed given in clear or “green” water environments. Finally, experiments concerning yeast as biological barrier to prions, i.e. food safety, will be discussed. In all, an overall picture of one possible future development in fish nutrition will be painted with a focus on the use of novel feed stuffs in circular food production systems.

Food safety

Blood variables stress, erythrocyte function

Probiotic – gut microbiota

Post prandial Metabolites and nutrient plasma levels