



Super Additive Leading the Way To More Sustainable Aquaculture Feed

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Fish farmers are always looking for sustainable feed that can make fish strong and healthy. A new study led by the CSIC in Spain concludes that marine feed ingredients in aquaculture can potentially be replaced by plant ingredients without detrimental effects, when appropriate feed additives are added.

The team of researchers of the Nutrigenomics and Pathology Groups of the Institute of Aquaculture Torre de la Sal (IATS-CSIC), in collaboration with scientific (Norwegian University of Life Sciences, Centro de Ciências do Mar) and industrial (BIOMAR, NOREL) partners, found that **butyrate** supplementation helps to preserve intestinal function in gilthead sea bream that are fed plant-based diets. The research was conducted within the European Union funded projects AQUAEXCEL, AQUAEXCEL²⁰²⁰ and ARRAINA.

Plant-based fish food is seen as more sustainable than that containing other marine products, such as fish meal. Research shows that some farmed fish species can survive without any or with a very limited supply (< 7%) of marine feed ingredients but they can then suffer from decreased efficiency to digest food and increased susceptibility to diseases and stress.

Sodium **butyrate** is one of the most promising feed additives to be used in aquaculture to prevent these adverse effects. It is a salt of short-chain fatty acid produced by bacterial fermentation of undigested carbohydrates.

Two Transnational Access (TNA) studies, which allow scientists to use research infrastructures in different locations, were conducted to define the most effective **butyrate** dose for gilthead sea bream based on growth performance and measures of intestinal function, architecture and permeability.

Fish given the **butyrate** supplement showed fewer intestinal problems normally associated with a plant-based diet. This finding was supported by several different approaches by the research team.

“For example, looking at 80 intestinal genetic markers we could show changes in the expression of genes involved in antioxidant defence, epithelial permeability and mucus production when fish were fed with plant-based diets alone. Most of these were returned to normal when adding sodium **butyrate** to the diet,” said senior author, Dr Jaume Pérez-Sánchez (CSIC).

Co-author of the publication, Dr Ariadna Sitjà-Bobadilla (CSIC) said the Transnational Access programme was vital in completing the studies: “It would have not been possible to finalise this research and publish the current paper without the programme. Thanks to the two TNA projects we collaborated with two European research groups with complementary expertise to ours.”

Dr Pérez-Sánchez said the facilities the team had access to were an excellent asset: “One of the most difficult steps was to maintain the fish for such a long feeding trial - up to 38 months- without having any technical problems, or mortalities in the experimental fish, thanks to the good conditions of IATS installations. We achieved a record for key performance indicators at the end of the trial.”. The research was published in the scientific journal PlosOne, *doi:10.1371/journal.pone.0166564*.

The current TNA programme is part of the AQUAEXCEL²⁰²⁰ project, a continuation of AQUAEXCEL, enabling access to top facilities of participating aquaculture research infrastructures (More information under: www.aquaexcel2020.eu).

The team’s next steps will be to investigate if the benefits of the **butyrate** supplement can also be found in the protein and bacteria composition found in the digestive system: “It is a big challenge to understand how these functional features are modified by genetic and epigenetic factors and an important step towards establishing gilthead sea bream as a powerful model for the development of sustainable and healthy fish feeds,” says Dr Pérez-Sánchez.

Notes for Editors

AQUAEXCEL²⁰²⁰ is a research and innovation action funded under the EU’s Framework Programme for Research and Innovation, Horizon 2020. The project will run for five years from 2015 to 2020, with a total budget of €9.7 million funded by the European Union.

The AQUAEXCEL²⁰²⁰ consortium includes 22 partner organisations offering 39 top level aquaculture facilities in 12 European countries. The project is coordinated by the Institut National de la Recherche Agronomique (INRA) in France. AquaTT is the project dissemination partner.

The AQUAEXCEL²⁰²⁰ project unites major aquaculture experimental facilities who have the capacity to undertake experimental trials on a selection of commercially important aquaculture fish species and system types. These installations are made available to the research community for Transnational Access (TNA) with the support of the European Union’s Horizon 2020 Research and Innovation Programme.

This research was made possible through combining long term research efforts in AQUAEXCEL and ARRINA with short-term studies through the Transnational Access (TNA) program in AQUAEXCEL and AQUAEXCEL²⁰²⁰. In ARRINA, fish diets with a high replacement of marine ingredients by plant raw materials were investigated as alternatives to the traditional fish meal as aquaculture feed. The conjunction with the two TNA projects allowed this study’s integrative approach investigating the impact of such ARRINA based diets on the fish’s intestinal health and integrity.

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Sea bream at the Institute of Aquaculture Torre la Sal (IATS-CSIC) ©Jaume Pérez-Sánchez (IATS-CSIC)



In the lab at the Institute of Aquaculture Torre la Sal (IATS-CSIC) during the TNA project of AQUAEXCEL²⁰²⁰ ©Jaume Pérez-Sánchez (IATS-CSIC)