Increasing our understanding of the impact of compounds produced by certain fish parasites

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Credit: AI-generated image (disclaimer)

European aquaculture production provides direct employment to 80 000 people and has an estimated EUR 3 billion annual turnover. But parasites can cause severe disease outbreaks leading to high economic losses in finfish aquaculture.

The EU-funded PARAFISHCONTROL project is helping to increase the sustainability and competitiveness of European Aquaculture by improving our understanding of fish-parasite interactions. The project is developing innovative solutions and tools for the prevention, control and mitigation of the major parasites affecting Atlantic salmon, rainbow trout, common carp, European sea bass, gilthead sea bream and turbot.

Researchers recently presented their latest findings, which included particularly exciting news of novel disease treatments planned for use in the near future. In a paper published in the journal 'Acta Veterinaria Scandinavica' the team explores the biological and pathological roles of the excretory/secretory (ES) compounds produced by anisakid nematodes.

The parasites in question

Human consumption of raw or under processed seafood containing third stage larvae of anisakid parasites may elicit a gastrointestinal disease (anisakidosis) and allergic responses. Unsurprisingly, the presence of larvae in fish products reduces their commercial value. The parasites are widely distributed in marine fish populations worldwide: their life-cycles include invertebrates and fish as intermediate or transport hosts and mammals or birds as final hosts. While attention is often focused on their impact on human health, the molecules are likely to play a general biological role in invertebrates and lower vertebrates as well.

ES products have several functions during infection, for example the penetration of host tissues and evasion of host immune responses, but are at the same time known to elicit immune responses (including antibody production) both in fish and mammals. It is possible that ES proteins from anisakid nematodes, in particular Anisakis simplex, may have a therapeutic potential in immune-related diseases.

Potential therapies for immune-related conditions

Ascarid nematode larvae carry genes encoding various immunoregulatory products which ensure the survival of the parasite in the host immune environment and ES products of anisakids are expected to have similar properties. In a mouse experimental model of asthma, induced by an allergen (APAS-3), it was shown that an ES protein could reduce Th2 responses, inhibit cellular migration, suppress cytokine expression and reduce chemokine production in bronchoalveolar lavage (BAL) fluid.

The team points out that an anaphylactic immune response to peanut in a mouse model has also been inhibited in part by A. simplex or A. lumbricoides, while Anisakis ES compounds have been shown to decrease the expression of genes encoding inflammatory cytokines. In addition, a recent study has demonstrated immunoregulatory effects of A. simplex ES antigens in a colitis zebrafish model. The paper explains, 'These findings suggest that by appropriate biochemical techniques the immunoregulatory potential of anisakid ES molecules may be further characterised and exploited for prevention and/or treatment of inflammatory diseases.

PARAFISHCONTROL (Advanced Tools and Research Strategies for Parasite Control in European farmed fish) is setting out to increase the sustainability and competitiveness of the European aquaculture industry. It is doing so, as evidenced in the recently published paper, by improving our understanding of fish-parasite interactions and by developing innovative solutions and tools for the prevention, control and mitigation of the most harmful parasitic species affecting the main European farmed fish species.

More information: Project website: www.parafishcontrol.eu/

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