



TACKLING ROLE OF INTESTINAL TRYPTOPHAN METABOLITES IN FISH GUT HEALTH

SUMMARY:

Tryptophan (TRP) is an essential amino acid with key functions in the immune and neuroendocrine regulation of fish, showing therapeutic potential when added to diets. In mammals, gut microbes metabolize TRP to sustain intestinal balance and host-microbe communication. Drawing from this concept, this project explores whether TRP supplementation can alleviate intestinal inflammation (enteritis), focusing on the influence of microbial TRP metabolites in this process. Rainbow trout (RT, *Oncorhynchus mykiss*) serves as the model species to examine TRP's impact on gut microbiota composition, immune gene activity, and TRP metabolic pathways. In vitro experiments will be conducted where a RT gut cell line will be cultured in a TRP-supplemented medium and challenged with LPS. This will render samples for gene expression analysis and epithelial cells protein profile, targeting TRP-related enzymes. In vivo trials targeting a gut inflammation model where tryptophan is added to a dextran sodium sulfate diet (DSS) and fed to juvenile rainbow trout will be carried out. Fish will be for two and four weeks and samplings will be undertaken to obtain gut tissue, blood, and feces for molecular and biochemical evaluations. Collected samples will enable: (i) assessment of systemic immune and neuroendocrine responses using blood markers such as leukocyte counts, lysozyme activity, and cortisol; (ii) characterization of local intestinal responses through microbiome (16S rRNA sequencing) and gene expression (RNA-seq) analyses; and (iii) quantification of microbial TRP metabolites, particularly indole derivatives, in feces using LC-MS/MS. The project expects to demonstrate TRP's immunomodulatory and intestinal protective effects, reveal microbial community shifts associated with inflammation and supplementation, and pinpoint specific taxa and metabolites linked to these changes. Ultimately, the study seeks to clarify fish gut-host-microbe dynamics under inflammatory stress and develop nutritional strategies that enhance intestinal health and resilience in aquaculture.

MAIN METODOLOGIES:

To achieve the proposed goals, the project requires both in vitro and in vivo fish trials. For the evaluation of TRP in vitro or dietary supplementation, the following methodological approaches will be adopted: gene expression (rtPCR), western blot analysis, microbiome and transcriptome analysis, LC-MS/MS and humoral immune parameters.

REFERENCES:

(1) Zelante et al. 2013: 10.1016/j.immuni.2013.08.003; (2) Wang et al. 2019: 10.3389/fimmu.2019.00152; (3) Zhang et al. 2022: 10.3389/fnut.2022.1014502; (4) Bender et al. 2023: 10.1016/j.cell.2023.03.011; (5) Wang et al 2023: 10.2147/jir.S432747

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PLACE OF WORK

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WILL THE PROPOSAL RESEARCH IDEA BE FUNDED BY A SPECIFIC PROJECT?

Yes, by COMPETE2030-FEDER-00824200

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