

respectively. In terms of immune functions, respiratory burst and complement activities, total serum protein, peroxidase activity and catalase activity, one phosphate supplement could not prove significant relative advantage over others. However, fish fed dietary group MSP showed significantly higher lysozyme activity and it was not significantly different with MKP and MAP diet groups. MCP diet showed significantly lower lysozyme activity. The results of different immune gene expressions will be discussed in the conference.

**Keywords:** Monophosphates, Post-prandial absorption, macro minerals, immunity, rainbow trout

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### O-095.

#### Searching integrated strategies for the evaluation of the physiological status in fish fed functional diets: The example of SDPP in gilthead sea bream (*Sparus aurata*)

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#### Abstract

The sustained development and intensification of production systems may negatively affect the health of fish, compromising the industry productivity. One of the most used strategies for the sustained improvement in production efficiency is the generation of functional diets. In this study, we evaluated the effect of spray-dried porcine plasma (SDPP) as dietary supplement and its impact upon the physiological and defense status in the skin-associated lymphoid tissue (SALT) of gilthead sea bream. To do it, fish were fed a high-content fish meal diet supplemented with 3% SDPP. After 95 days of feeding, the SDPP-supplemented diet showed a higher somatic growth performance compared to those fish fed basal diet. A higher viscerosomatic index and lower perivisceral fat index were also registered in SDPPfed fish. Fillet proximate composition showed no changes in the fatty acid profile neither the lipid peroxidation nor the activity of oxidative stress enzymes. The skin transcriptomics showed differential expression of 194 genes (DEGs) involved in different processes including cell metabolism, gene expression, protein transport, and protein localization to membrane. The skin mucus proteome identified 35 differential synthesized proteins associated to different processes including epidermis & skin development, epidermal cell differentiation, and metabolism. Importantly, when an integrated multi-omics analysis was carried out, other biological processes were identified, including innate immune response and response to stimuli (organic substances, external stimuli). Taken together, our results suggest that (1) the SDPP is a promising feed additive for sea bream giving a beneficial impact on its growth performance; and (2) the multi-omics analysis is an interesting initial strategy for aquatic organisms that greatly helps to understand the biological processes in an integrated physiological context.

**Keywords:** Animal nutrition, dietary supplements, mucosal-associated lymphoid tissue (MALT), innate immunity.

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### O-096.

#### Feeding stress due to soy bean meal as a model for the development of molecular immune markers in rainbow trout

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#### Abstract

The increasing intensification of aquaculture practices has led to public debate about the welfare status of cultured fish.

In order to verify the immune status of trout in context of husbandry stress and to investigate the relationship between chronic stress, immunosuppression, husbandry and feeding we established molecular stress markers using a feeding stress experiment with soybean meal. The welfare status of trout was verified by investigation of mRNA expression of different potential stress regulated genes in whole blood to establish a minimal invasive method. A 56-day feeding experiment was carried out. The triplicate fish groups were fed isoenergetic and isonitrogenic feed mixtures in which the fish meal (50 % of the total diet) was replaced by 0 %, 33 %, 66 % and 100 % soybean meal. EDTA blood was collected from the caudal vein of immobilized trout. In total 88 different genes were tested for their suitability in stress detection using a Fluidigm Biomark HD and a Light Cycler System. Specific primers were designed. Regulated genes belonging to the superior signal transduction pathways such as SERPIN G superfamily, intracellular PI3K/actin, Toll-like receptor, NF-κB, MAP kinase and JAK-STAT signal transduction or intracellular pathogen recognition receptors were tested. The mRNA expression of blood cells was tested for different pro- and anti-inflammatory cytokines, chemokines, substances involved in the acute phase reaction, complement cascade or inflammatory reactions, and heat shock proteins. Finally, different marker genes for specific cell populations were investigated. The housekeeping genes β-Actin, EF1 and RPS5 served as internal standards.

Different genes (e.g. SAA, MPO, NOS2, UCP2) emerged as suitable stress and immune markers and therefore as welfare indicators on a molecular level, while some genes (e.g. IL10, IFN, HSP47) revealed no correlation to feeding stress.

The results represent an important basis for a better assessment of animal welfare in trout farming. They are an important first step towards making well-founded, early assessments of chronic feeding stress of trout in the future, which are minimally invasive. So far, the parameters have often been based on observations such as behavior, color changes and such aspects that are difficult to standardize. These results provide a basis for the development of practical detection systems - comparable to a diabetes test.

**Keywords:** Stress, inflammation, soy bean meal, feeding stress, molecular marker

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### O-097.

#### Modulation of the immune condition in European seabass (*Dicentrarchus labrax*) juveniles through long-term methionine supplementation

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