

# Aquaculture America 2020



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## INSECT MEAL AND POULTRY BY-PRODUCT MEAL BASED DIETS DURING RAINBOW TROUT *Onchorynchus mykiss* CULTURE. FTIR IMAGING AND HISTOLOGICAL CORRELATIVE STUDY TO INVESTIGATE INTESTINE AND LIVER WELFARE

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Fish meal (FM) and fish oil (FO) represent the ideal ingredients for carnivorous fish diets due to their excellent nutritive properties, including high-protein content and adequate amino acid and fatty acid (FA) profile. Over the last decades, research has focused on testing different alternative and sustainable ingredients to be used in aquafeed, including insect meal (IM) and poultry by-products meal (PBM).

IM and PBM show several advantages such as a low environmental impact, high protein content and an adequate amino acidic profile.

The present study investigated the effects on intestine and liver welfare of IM (*Hermetia illucens*) and PBM based diets during rainbow trout (*Onchorynchus mykiss*) culture.

Specifically, six different dietary treatments were formulated: one control diet based on vegetable ingredients (C Veg); one fish meal based diet (C Fish); one diet with a 30% substitution of vegetable proteins with IM (IM130); one with 60% of substitution with IM (IM160); one with 60% of substitution with PBM (PBM160) and one diet combined with 50% PBM and 10% IM (PBM150+HM110). Feeding trials lasted until fish triplicated their initial weight. At the end of the feeding trial intestine and liver samples were collected and processed for histological and spectroscopic analyses. Fourier transform infrared (FTIR) spectroscopy is a fast, label-free analytical technique, which analyses the vibrational transitions induced on matter by the interaction with the electromagnetic radiation and is able to give detailed information on the macromolecular composition of non-homogeneous biological samples. Results showed that intestine did not show inflammatory events in medium and hind traits in none of the experimental groups apart a slight increase of mucous cell in medium intestine of trout fed diets including IM (IM130 and IM160). Liver histology showed differences among the experimental groups with a variable lipid accumulation in response to the different diets.

FTIR imaging analysis allowed to detect difference in gut mucosal layer composition and to characterize the distribution and quality of lipid in liver parenchyma. Moreover, to achieve more information, specific areas on the gut mucosa and liver parenchyma were carefully selected and the IR spectra extracted and analyzed. This procedure allowed to detect differences in the relative abundance of total lipids (LIP), fatty acids (FA), saturated (CH<sub>2</sub>) and unsaturated (CH) lipid alkyl chains, phospholipids (CO), glycogen (GLY), proteins (PRT), glutamate (GLU) and mucin (MUCIN). Finally the respective ratios in which each macromolecular class was represented were compared to the overall tissue biomass (TBM).

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