

European seabass response to air exposure: impact of dietary inclusion of bioactive blood hydrolysates

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Abstract (400 words maximum, Times New Roman, 10, regular, justified, multiple 1.15)

In aquaculture farms, fish are subjected to stress situations, which induce oxidative stress through an imbalance between the generation of reactive oxygen species (ROS) and the scavenging activity of antioxidants. Diet supplementation with functional ingredients to modulate oxidative stress after air exposure was investigated, using bioactive peptides from swine blood hydrolysates (BH), within a circular economy context.

Three swine BH were obtained by autohydrolysis (AH) or enzymatically. The enzymatically produced BH were further submitted to a micro- (MF) or nanofiltration (NF). Five isolipidic and isoproteic diets for European seabass were developed: a fishmeal (FM) based diet (positive control, PC), a commercial-based diet where 50% of FM was replaced by vegetable proteins (negative control, NC) and three diets where 3% of each BH was added to the NC. Diets were assigned to triplicate groups of 71 European seabass juveniles (initial weight 12.3 ± 1.4 g), and fed to apparent satiation in a recirculating saltwater system. After 12 weeks, 9 fish per treatment were either immediately sampled or air-exposed for 1 minute and let to recover for 6 hours prior to sampling, in which plasma and liver were collected.

Plasmatic cortisol and lactate were elevated for all diets after the air exposure, without differences among diets. Glucose levels were unaffected by diet or stress. Regarding liver oxidative stress markers, lipid peroxidation (LPO) tended to increase after air exposure. Considering the non-stressed fish, MF diet led to the lowest LPO, being significantly lower than the AH, and similar to the remaining diets. Protein oxidation decreased in stressed fish, but did not differ among diets. Liver catalase was significantly lower in NC, NF and AH groups compared to PC and increased after stress. Superoxide dismutase activity was lower for AH and PC diets than for the MF, and it was reduced in stressed fish.

The stress response triggered by air exposure involved increased cortisol levels, followed by an increment in plasma lactate. However, none of the BH improved plasma stress response. The stress challenge increased liver LPO through ROS accumulation under oxidative stress. Carbonyls decreased post-stress, likely due to a feedback interaction with the LPO radicals, which reduced protein oxidation. The NF, composed of smaller peptides than the other BH, may modulate European seabass antioxidant defences by lowering catalase levels without increasing LPO, suggesting it could provide exogenous antioxidants to counteract ROS-induced oxidative stress.

Keywords: Blood hydrolysates; Bioactive peptides; European seabass; oxidative stress; lipid peroxidation.

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