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The dietary replacement of marine ingredients by terrestrial animal and plant alternatives modulates the antiviral immune response of Atlantic salmon (*Salmo salar*)

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Abstract

The effects of replacing marine ingredients by terrestrial ingredients on the health of Atlantic salmon (*Salmo salar*) are poorly understood. During a 14-week trial, Atlantic salmon fed a fish meal-fish oil based diet (MAR) showed similar growth rates to others fed a plant protein/vegetable oil based diet (VEG), whereas poorer performance was observed in those fed an animal by-product meal/vegetable oil based diet (ABP). At the end of the trial, salmon were injected with either phosphate-buffered saline (PBS) or the viral mimic polyriboinosinic polyribocytidylic acid (pIC) and sampled for head kidney RNA after 24 h. The levels of 27 immune-related transcripts, and of 5 others involved in eicosanoid synthesis (including paralogues in both cases) were measured in the head kidney of the salmon using qPCR. All of the assayed immune-related genes and *cox2* were pIC-induced, while the other eicosanoid synthesis-related genes were pIC-repressed. Linear regression was used to establish correlations between different immune transcripts, elucidating the cascade of responses to pIC and specialization among paralogues. Regarding the effect of diet on the antiviral immune response, fish fed diets ABP and VEG showed a stronger pIC-induction of *tlr3*, *irf1b*, *stat1a*, *isg15b*, and *gig1* compared to those fed diet MAR. We infer that the observed dietary immunomodulation could be due to the lower proportion of arachidonic acid (ARA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA) in diets ABP and VEG. Furthermore, our results suggest a major role of dietary ARA in Atlantic salmon immunity, as low ARA proportion in diet VEG coincided with the highest pIC-induction of some immune transcripts (*tlr7*, *stat1c*, and *mxb*) and the lowest levels of transcripts encoding eicosanoid-synthesizing enzymes (*5loxa*, *5loxb*, and *pgds*). In contrast, the high ARA/EPA ratio of diet ABP appeared to favor increased expression