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

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16

17 **Abstract**

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

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