AEROBIC EXERCISE TO IMPROVE CARDIAC CAPACITY AND DISEASE RESISTANCE IN ATLANTIC SALMON

Harald Takle[1], Gerrit Timmerhaus[1], Aleksei Krasnov[1], Katja Anttila[2], Anthony P. Farrell[3], Sven Martin Jørgensen[1]

[1]Nofima AS, Aas, Norway, [2]Laboratory of Animal Physiology, Department of Biology, University of Turku, Turku, Finland, [3]Department of Zoology & Faculty of Land and Food System, University of British Columbia, Vancouver, British Columbia, Canada

Email: harald.takle@nofima.no

Introduction

Despite steady improvements in the efficiency of Atlantic salmon aquaculture production during the last decades, infectious diseases and reduced survival of smolt following seawater transfer is currently hampering further growth. Aerobic exercise by swimming has been suggested to be an effective strategy to improve robustness of farmed fish (Castro et al., 2011, Takle and Castro, 2013). This presentation will first of all give a review of several published and unpublished data from exercise experiments with Atlantic salmon at different life-stages. The backbone of the presentation will be a recent study where the objective was to examine the capacity of fry to exercise at different intensities after start-feeding and to investigate if exercise of juveniles allows more intensive exercise throughout smoltification (see below). The main focus is related to cardiac capacity and disease resistance, but effect on growth, bone development and flesh quality will also be included (Castro et al., 2013a, b; Ytteborg et al., 2013).

Methods

Experimental overview of exercise experiment of Atlantic salmon from end of start-feeding (2 g) until sea water transfer (80 g). In the first period (2-20g), salmon fry were kept at three different swimming regimes: 0.3 BL/s (non-exercise), 1.0 BL/s and 1.5 BL/s. During smoltification (20-80g), fish were split into three new regimes: 0.2, 0.8, and 2 BL/s. After smoltification, all groups were evaluated for swimming endurance capacity, temperature dependent heart rate, morphometric, biochemical and molecular responses as well as growth performance and skeletal muscle composition. Further, the impact of exercise intensity and duration on resistance to pancreas disease (PD) were evaluated in an infection challenge test with salmonid alphavirus.

Results and discussion

Results showed that both duration and intensity of exercise had an additive impact on swimming endurance capacity, where fish exercised at the highest intensity from 2-80g performed best while non-exercised performed poorest. Exercised smolts had larger relative ventricle mass and higher haemoglobin concentrations than non-exercised fish. Further, they had lower heart rate at increasing temperatures, but higher maximum rate compared to non-exercised smolts. Fish with higher exercise intensities grew faster and the condition factor were lower than for the non-exercised smolts. The PD challenge test revealed that high intensity exercise during smoltification strengthens survival independent of the first exercise period. These results supports that aerobic exercise

increases the cardiac capacity of Atlantic salmon and improves the resistance against viral diseases. Thus, exercise seems to be an efficient strategy for aquaculture to strengthen fish robustness.

Acknowledgements

This study was funded by the Fishery and Aquaculture Industry Research Fund (FHF) and the Research Council of Norway (Grant number: 225219/E40).

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