Temperature effects on vaccine induced immunity to viruses in fish

Lorenzen, Niels; Lorenzen, Ellen; Rasmussen, Jesper Skou; Christensen, Mikkel Black; Einer-Jensen, Katja; Veselý, T.; Poroková, D.

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N. Lorenzen, E. Lorenzen, J. S. Rasmussen, M. B. Christensen and K.Einer-Jensen.
National Veterinary Institute, Department of Fish, Poultry and Fur animals, DTU, Århus, Denmark

T. Veselý and D. Poroková
Veterinary Research Institute, Brno, Czech Republic

Abstract

In poikilothemic vertebrates such as teleost fishes, temperature affects all physiological processes including host-pathogen interactions like immune response and propagation of infection. Whether an infection with a pathogenic virus in fish results in development of clinical disease often depends on the balance between virus multiplication and anti viral immune reactions in the host. Water temperature is one of the most important factors influencing the balance between the fish and its environment. Usually, an optimal immune response of a particular fish species is obtained at its normal summer temperature whereas low temperatures may be immunosuppressive. Although innate and adaptive immune response mechanisms should be considered as integrated parts of the immunedefence, low temperatures appears to affect (inhibit) adaptive mechanisms more than innate mechanisms. This might represent a problem in terms of inducing a protective immune response by vaccination in aquaculture, since it is often desirable to vaccinate fish during autumn, winter, or spring. In experimental vaccination trials with rainbow trout (*Oncorhynchus mykiss*) using a DNA-vaccine encoding the viral glycoprotein of viral haemorrhagic septicaemia virus (VHSV), non-specific as well as specific immune mechanisms seemed to be delayed at low temperature. At five weeks post vaccination fish kept at 5°C had no detectable response of neutralising antibodies while two thirds of the fish kept at 15°C had sero-converted. While protective immunity was still established at both temperatures, specificity analysis suggested that protection at the lower temperature was mainly due to non-specific innate antiviral mechanisms, which appeared to last longer at low temperature. This was presumably related to a prolonged persistence of the vaccine. In DNA vaccination trials with spring viremia of carp (SVC) in common carp (*Cyprinus carpio*), protection at low temperature (10°C) appeared to require considerable longer time to develop compared to at 19°C, stressing that determination of optimal vaccination strategies in terms of temperature related effects need to be based on experimental evidence with the actual host and pathogen species rather on general principles.