Vaccination of rainbow trout against enteric redmouth disease (ERM) induces an early balanced expression of cytokines in the spleen but a heightened expression of acute phase proteins and antimicrobial peptides in both spleen and gills

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Enteric red mouth disease (ERM or yersiniosis) is an important disease of salmonids and leads to significant economic losses. It is caused by the Gram-negative bacterium *Yersinia ruckeri* and can be controlled by vaccination. Although ERM vaccination provides complete protection, little is known about the molecular mechanisms of protection elicited. In this report, we analysed the expression in spleen and gills of a large set of genes encoding for cytokines, acute phase proteins (APPs) and antimicrobial peptides (AMPs) in response to ERM vaccination in rainbow trout, *Oncorhynchus mykiss*. The expression of APPs (eg. serum amyloid A protein and serum amyloid protein P), AMPs (eg. cathelicidins and hepcidin), and pro- and anti-inflammatory cytokines (eg. IL-1β, TNF-α, IL-6, IL-8 and IL-10 etc.) was immediately activated in the spleen of vaccinated fish, with the expression of APPs and AMPs also activated in the gills, suggesting a successful innate immune response. The expression of all the alpha-chains but only one beta chain (p40B) of the IL-12 family cytokines was induced in the spleen, indicating that specific IL-12 and IL-23 isoforms may be induced to direct specific T-helper (Th)1 and Th17 type responses after ERM vaccination. Furthermore, an early induction of Th1 cytokines (IFN-γ1 and 2) and Th17 cytokines (IL-17A/F1-3) at day 1, but a late induction of Th2 cytokines (IL-4/13B1 and 2) at day 3 was also observed. Interestingly, the induction of APPs, AMPs, pro- and anti-inflammatory cytokines, Th1 cytokines and Th17 cytokines was positively correlated. This gene expression pattern suggests that ERM vaccination activates a successful innate immune response that directs an early Th1 and Th17 type response. The late induction of Th2 cytokines may have a homeostatic role.

Key words: Vaccination, rainbow trout, enteric redmouth disease, immune response, cytokines

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