FISH VACCINATION BASED ON THE MUCOSAL IMMUNOGLOBULIN IgT

Lluís Santamaria Piedra. Biotechnology Degree.
Professor: Lluís Tort Bardolet
Facultat de Biociències, Universitat Autònoma de Barcelona.

In fish all the pre-requisites to mount a specific immune response are present and it shares many similarities with mammals, but it is overall less developed. In comparison, fish immune system has a minor secondary response and it lacks immunoglobulin (Ig) class diversity.
Until recently IgM was thought to be the only Ig isotype responding to pathogens in fish, thus lacking a specific Ig for mucosal immunity like mammalian IgA.
However, in 2010 a new Ig isotype was discovered both in rainbow trout and zebrafish, **IgT**.
IgT is mainly expressed in gut mucus by a B cell subset involved in the response against pathogens, indicating that IgT has a specific role in mucosal immunity.

Vaccination is one of the most important methods used in the prevention of diseases in aquaculture. In fish, there are mainly three routes of vaccine administration:
-**Immersion vaccination**. It requires great amounts of antigen and it is not very effective.
-**Injection vaccination**. It elicits a strong immune response, but the laborious handling can induce stress.
-**Oral vaccination**. It is a practical method, but the protection is limited and the antigen can suffer from degradation in the stomach.
Despite being the most effective protective method, fish vaccination is very limited when compared to mammal vaccination due to their less developed Immune System.

HYPOTHESIS. Stimulation of the gut mucus through oral vaccination can elicit a strong IgT-mediated immune response.

MATERIALS

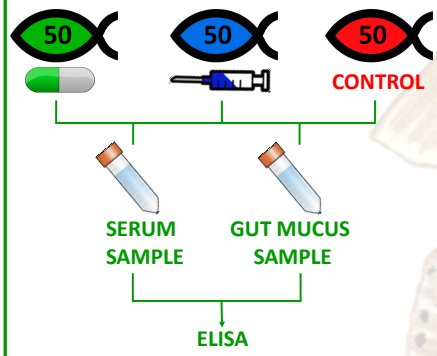
In this study, rainbow trout (*Oncorhynchus mykiss*) are **orally** and **intraperitoneally** vaccinated against vibriosis using *Listonella anguillarum* inactivated cells. The oral vaccine is microencapsulated in a bioadhesive polysaccharide based carrier to prevent its degradation.

METHODS & EXPECTED RESULTS

(Graphics displayed here are merely speculative and represent no actual data.)

IgT production

Gut mucus and serum samples are collected at different days. IgT and IgM titers are assayed by ELISA against inactivated *Listonella anguillarum*.

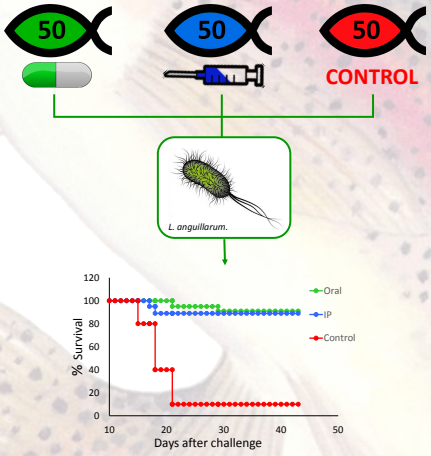


The following results are expected:

- A higher mucosal Ig response using the oral vaccine.
- A higher serum Ig response using the IP vaccine.
- A more pronounced increase of IgT compared with IgM using the oral vaccination.

Vaccine efficiency

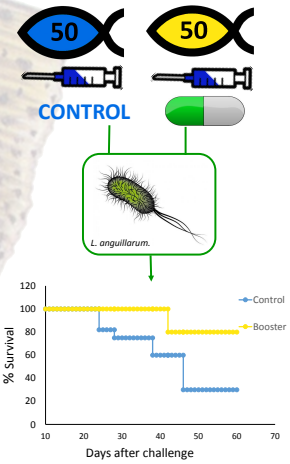
After 500 degree days post-vaccination fish are challenged with *L. anguillarum*. Their mortality is monitored on daily basis.



Both vaccines are expected to reduce the mortality. Given that the oral vaccine affects the mucosal immunity it may provide better results than the IP vaccine.

Oral vaccination as a booster

900 degree days after being vaccinated intraperitoneally fish are re-vaccinated with the oral vaccine. Then, after 600 degree days, they are challenged with *L. anguillarum.*



The oral re-vaccination is expected to enhance the immunity, thus reducing the mortality rate.

CONCLUSIONS

The use of a oral vaccine to elicit a specific mucosal response has been proposed. According to the hypothesis this response should be caused mainly due to the action of IgT and so a test to asses this point has been suggested. If this vaccine proved to be effective protecting the fish against vibriosis it would make for a practical antigen delivery method due to both its simplicity and the absence of arduous handling practices present in the currently most used vaccination processes. It could also be used to boost de immunity granted by a primary IP vaccine, being specially useful on account of the aforementioned simplicity and the additional specific mucosal protection it would confer to the fish.

- *M Watts, BL Munday, CM Burke*. **Immune responses of teleost fish.** Australian Veterinary Journal, Vol 79, No 8, August 2001, Pages 570-574
- *Yong-An Zhang, et al*. **IgT, a primitive immunoglobulin class specialized in mucosal immunity**. Nature Immunology, Volume 11, Number 9, September 2010, Pages 827-836
- *Karen P. Plant, Scott E. LaPatra*. **Advances in fish vaccine delivery**. Developmental and Comparative Immunology Vol 35, 2011, Pages 1256-1262
- *Jaime A. Tobar, et al*. **Oral vaccination of Atlantic salmon (Salmo salar) against salmonid rickettsial septicaemia**. Vaccine Vol 29, 2011, Pages 2336-2340