

# Yersinia ruckeri challenge on rainbow trout fed different diet types

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**Aim**  
To elucidate how different feed types with varying amounts of fish versus organic plant protein and oil sources affected the survival of rainbow trout in connection with an infection

## Introduction

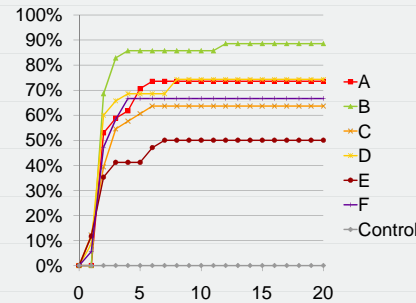
A challenge for sustainable rainbow trout production is an increasing use of plant sources in fish feed due to shortage of marine protein and oil sources. Diets with high plant content are known to cause enteritis and injury to the intestine, which will affect the absorption of nutrients, affecting the overall health status and welfare of the fish.

The result is a higher risk of disease following exposure to pathogenic microorganisms. Enteric redmouth disease (ERM) caused by *Yersinia ruckeri* (Yr) is an economically important disease which causes problems in rainbow trout.

**Conclusion**  
The lower mortalities in some groups seen in the experimental infections with *Y. ruckeri* show that fish protein and fish oil can be partly exchanged with plant protein and plant oil, but these results shall be seen in a broader perspective with other elements of rearing and production of rainbow trout

## Results

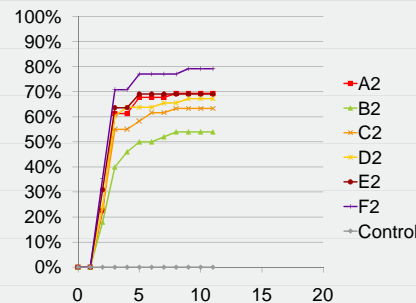
Diet code	Diet content	Mortalities due to a natural Yr-infection	Cumulative mortalities day 14 due to an experimental Yr-infection
A	Fish protein and fish oil	2 %	74 %
B	Fish + plant protein and fish oil	3 %	89 %
C	Fish + 2x plant protein and fish oil	7 %	64 %
D	Fish + 3x plant protein and fish oil	5 %	74 %
E	Fish protein and fish + linseed oil	9 %	50 %
F	Fish protein and linseed oil	6 %	67 %
Control		-	0 %



The results of experiment 1 are shown in the upper table and figure. Two weeks post challenge the mortalities in the different groups were between 50 and 89 %. The mortalities were lowest in the group fed the diet where half of the fish oil was replaced by plant oil (code E). Unfortunately, the results were blurred due to a natural infection with *Y. ruckeri* that had occurred in the diet groups two months prior to the experimental infection (mortalities between 2 and 9 % in the different groups), and the highest cumulative mortality percentage in connection with this natural infection was seen in diet group E. The fish were not treated with antibiotics.

The results of experiment 2 are shown in the lower table and figure. Eight days post challenge the mortalities in the different groups were between 52 and 77 %. All fish had been vaccinated with an oral vaccine against ERM four months prior to the experimental infection. The mortalities in group B2 fed the diet with fish + plant protein and fish oil were significant lower compared to the other diet groups.

Diet code	Diet content	Cumulative mortalities day 7 due to an experimental Yr-infection
A2	Fish protein and fish oil	68 %
B2	Fish + plant protein and fish oil	52 %
C2	Fish + plant protein and linseed oil	62 %
D2	Fish + plant protein and sunflower oil	66 %
E2	Fish + plant protein and rape seed oil	69 %
F2	Fish + plant protein and grape seed oil	77 %
Control		0 %



## Materials and methods

Groups of rainbow trout were fed six different diets (various amounts of marine versus plant protein and oil sources, see upper table ) over a two month period. Samples of 35 rainbow trout (150-200g) from the six different diet codes were kept at a temperature of 13°C in 200 l tanks with separate recirculation of water and air-supply for each tank. The fish were injected intraperitoneally (ip) with 10<sup>8</sup> cfu/fish (841107-1/1; serotype O1, biotype 1). A control with 5 fish from each code was injected ip with sterile broth. Mortalities were recorded daily. The experiment was terminated after 20 days. The experiment was repeated, this time with diet codes containing other amounts of marine versus plant protein and oil sources compared to the first experiment ( see lower table), each code in duplicate. Between 24-31 trout in each tank was injected ip with 10<sup>8</sup> cfu/fish (841107-1/1). Two tanks were used as controls and were treated as described in the first experiment.