

Effects of (1,3)-(1,6)- β -glucan from brewers' yeast (Leiber® Beta-S) on feed conversion, immune competence and disease resistance of rainbow trout (*Oncorhynchus mykiss*)

A. Siwicki et al., Allenstein, Poland 2009

Environmental and husbandry conditions in intensive aquaculture have strong effects on health and performance of fish. Stressors like pathogens, inadequate stocking densities, handling and transport as well as suboptimal or poor water quality negatively affect the immune status. A previous study has already demonstrated that (1,3)-(1,6)- β -D-glucans from brewers' yeast improve the immune status of rainbow trout and carp. The present study examined the effects of both different dosages and administration periods of Leiber® Beta-S on performance, immune parameters and disease resistance of rainbow trout.

Experimental design:

The experiments were conducted by Prof. Siwicki (Inland Fisheries Institute Allenstein, Poland) at the department of Salmonid Culture in Rutki. Over a period of 4 weeks the rainbow trout were fed a standard diet supplemented with 0% (control), 0.02% or 0.05% Leiber® Beta-S.

In a further infection study the same dosages of Leiber® Beta-S were tested for their effect on the survival rates after challenging rainbow trout with *Aeromonas salmonicida*, *Yersinia ruckeri* or the IPN-virus. The infection was carried out after 1, 2, 3 or 6 month of feeding with Leiber® Beta-S.

Table 1: Effects of Leiber® Beta-S (200g/to) on growth performance of rainbow trout (fingerlings: Ø 8.5-9.2g BW)

| | Control | Leiber® Beta-S |
|-------------------------------|---------|----------------|
| Number of animals (n) | 250 | 250 |
| Testing period (days) | 56 | 56 |
| Live body weight (BW): | | |
| Initial (g) | 2260 | 2220 |
| After 1 month (g) | 3890 | 4021 |
| After 2 month (g) | 5800 | 5900 |
| Daily BW gain (g/day) | 29.1 | 32.2 |
| FCR (1:) | 0.933 | 0.899 |
| Mortality (%) | 6 | 0 |

Results:

Initially, in the present studies the effect of Leiber® Beta-S on the growth performance of rainbow trout was examined. Table 1 reveals that 0.02% Leiber® Beta-S improves body weight gain and feed conversion of rainbow trout fingerlings by 10% and 3.5%, respectively. The positive influence on the mortality rate also confirms the improved health status of the juvenile fish. In a further experiment (Figure 1) at the later growth stage from 50g body weight onwards the efficacy of 0.02% and 0.05% Leiber® Beta-S could equally be demonstrated when administered over a long period of 7 months.

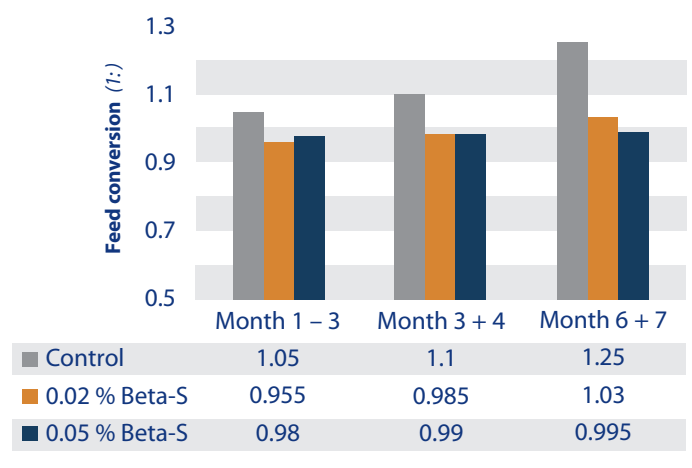


Figure 1: Effects of Leiber® Beta-S on feed conversion of rainbow trout (2 x 250 fish, initial BW 50g, 7 month)

The long-term effect of 0.02% and 0.05% Leiber® Beta-S on various immune parameters in the blood serum of the experimental fish is illustrated in Table 2. Also in this trial the oxidative burst and the killing activity of phagocytes, the activity of T- and B-lymphocytes as well as the levels of lysozyme and immunoglobulins were constantly and significantly increased in the Leiber® Beta-S test groups after 1, 3 and 6 months of feeding. After an infection challenge of rainbow trout with bacterial, pathogenic *Aeromonas salmonicida* or *Yersinia ruckeri* the survival rate was increased after regular administration of 0.02% and 0.05% Leiber® Beta-S from 20%-35% in the control group to 50%-65%. An infection with the IPN-virus enhanced the survival rate from 50% on average in the control group to up to 80% in the test groups (Figure 2). A long-term administration over 6 months did not result in any case in a depressive effect on the activation of the immunocompetence through 0.02% and 0.05% Leiber® Beta-S.

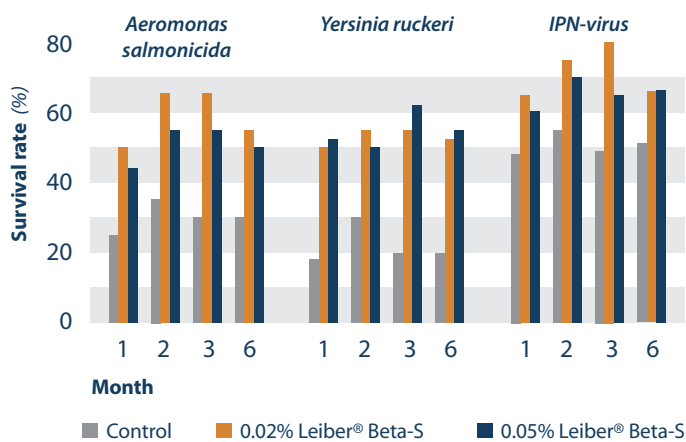


Figure 2: Effects of a dietary Leiber® Beta-S supplementation on the survival rates of rainbow trout after infection with pathogens when the experimental diets were fed for 1, 2, 3 and 6 months prior to infection ($n = 40$)

Conclusions Leiber® Beta-S:

- | stimulation of the innate immunity and protection against infectious diseases
- | enhanced the unspecific cellular and humoral defence mechanisms
- | increased protection against bacterial and viral diseases
- | improved growth performance and feed conversion of rainbow trout



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Table 2: Effects of dietary Leiber® Beta-S on selected immune parameters in blood serum of rainbow trout 1, 3 and 6 months after feeding the test diets ($n = 10$)

| | Control | Beta-S 0.02 % | Beta-S 0.05 % |
|--|-------------------|-------------------|-------------------|
| Phagocytes - oxidative burst (OD 620 nm) | | | |
| after 1 month | 0.34 ^b | 0.46 ^a | 0.47 ^a |
| after 3 months | 0.33 ^b | 0.49 ^a | 0.52 ^a |
| after 6 months | 0.32 ^b | 0.47 ^a | 0.42 ^a |
| Phagocytes – killing activity (OD 620 nm) | | | |
| after 1 month | 0.41 ^b | 0.50 ^a | 0.52 ^a |
| after 3 months | 0.39 ^b | 0.54 ^a | 0.53 ^a |
| after 6 months | 0.38 ^b | 0.51 ^a | 0.45 ^a |
| T-lymphocytes activity (OD 620 nm) | | | |
| after 1 month | 0.45 ^b | 0.55 ^a | 0.56 ^a |
| after 3 months | 0.45 ^b | 0.60 ^a | 0.58 ^a |
| after 6 months | 0.43 ^b | 0.57 ^a | 0.50 ^a |
| B- lymphocytes activity (OD 620 nm) | | | |
| after 1 month | 0.33 ^b | 0.42 ^a | 0.43 ^a |
| after 3 months | 0.34 ^b | 0.47 ^a | 0.45 ^a |
| after 6 months | 0.36 ^b | 0.45 ^a | 0.42 ^a |
| Lysozyme (mg/L) | | | |
| after 1 month | 35.5 ^b | 44.5 ^a | 43.0 ^a |
| after 3 months | 37.5 ^b | 46.5 ^a | 42.0 ^a |
| after 6 months | 36.5 ^b | 43.5 ^a | 41.0 ^a |
| Total immunoglobulins (g/L) | | | |
| after 1 month | 7.4 ^b | 8.4 ^a | 8.6 ^a |
| after 3 months | 7.5 ^b | 9.1 ^a | 8.9 ^a |
| after 6 months | 7.8 ^b | 8.9 ^a | 8.5 ^a |

^{a, b} = values with different superscripts in a row indicate a significant difference ($p < 0.5$)

For more information:

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