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

A. Siwicki et al., Allenstein, Poland 2008

The effects of environmental and husbandry-related stress on health and performance of fish in intensive aquaculture is becoming increasingly important. Stressors like inadequate stocking densities, suboptimal or poor water quality as well as environmental contamination with toxins, pollutants and pathogens negatively affect the immune status of fish.

These factors compromise the immune competence of fish, subsequently promoting outbreaks of infectious diseases. Immune modulators which activate the innate immunity can contribute to improve immune status and animal performance. Aim of the present study therefore was to examine the effects of a dietary supplementation with Leiber® Beta-S on immune competence and disease resistance of rainbow trout and carp.

Experimental design:

The experiments were conducted by Prof. Siwicki (Inland Fisheries Institute Allenstein, Poland). The rainbow trout tests were carried out at the department of Salmonid Culture in Rutki, and the carp tests were performed at the department of Pond Fisheries in Zabieniec.

Over a period of 4 weeks the fish were fed a standard diet supplemented with 0% (control) or 0.02% Leiber®Beta-S. In further infection studies, supplementation levels of 0.01%, 0.02%, 0.05% and 0.1% Leiber® Beta-S were tested for their effects on survival rates after challenging rainbow trout with *Aeromonas salmonicida* and carp with *Aeromonas hydrophila*. The feeding of the diets started 4 weeks prior to the challenges. In both the rainbow trout and the carp studies, respectively, the experimental animals were full siblings.

Results:

Prior to the experimental start the base levels of the various parameters in the blood serum of the experimental fish were examined. Those base levels were similar for both groups and remained almost unchanged for the control group at day 28 of the experiment.

In contrast, 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 significantly increased at day 28 in fish fed the Leiber® Beta-S supplemented diets. These values improved by 41–67% in rainbow trout and 45–143% in carp (Tab. 1).

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Table 1: Effects of a dietary Leiber® Beta-S supplementation on selected immune parameters in the serum of rainbow trout and carp after 4 weeks of feeding *(n = 20)*

	Control day 28	Beta-S day 0	Beta-S day 28	Difference %
Number of animals (n)	**20**	**20**	**20**	
Leiber® Beta-S (%)	0	0	0.02	
Rainbow trout:				
Phagocytes – oxidative burst	0.35^{b}	0.33^{b}	0.52^{a}	+ 49
Phagocytes – killing activity	0.34^{b}	0.32^{b}	0.48^{a}	+ 41
T-Lymphocyte activity	0.42^{b}	0.44^{b}	0.63^{a}	+ 50
B-Lymphocyte activity	0.30^{b}	0.30^{b}	0.50^{a}	+ 67
Lysozyme (mg/L)	23.4^{b}	24.1^{b}	37.0^{a}	+ 58
Total immunoglobulin (g/L)	18.9^{b}	18.7^{b}	$28,9^{a.}$	+ 53
Carp:				
Phagocytes – oxidative burst	0.31^{b}	0.30^{b}	0.52^{a}	+ 68
Phagocytes – killing activity	0.30^{b}	0.31^{b}	0.49^{a}	+ 63
T-Lymphocyte activity	0.40^{b}	0.41^{b}	0.58^{a}	+ 45
B-Lymphocyte activity	0.27^{b}	0.27^{b}	0.47^{a}	+ 74
Lysozyme (mg/L)	1.4^{b}	1.4^{b}	3.4^{a}	+ 143
Total immunoglobulin (g/L)	10.5^{b}	10.7^{b}	18.5^{a}	+ 76

^{a,b} *= values with different superscripts in a row indicate a significant difference ($p < 0.05$)*

After challenging rainbow trout with *Aeromonas salmonicida* the survival rates increased from 3% in the control group to 31% after continuous administration of Leiber® Beta-S. An infection of carp with *Aeromonas hydrophila* led to comparable results with 13% survival in the control group and up to 39% survival in the experimental groups (Fig. 1). An optimum dosage of 200g Leiber® Beta-S per ton of feed is recommended for both species.

Conclusions Leiber® Beta-S:

- significant increase of the innate immunity
- even high dosages activate immune competent cells without detrimental effects
- support during bacterial infection
- significant increase of the survival rates after bacterial infection

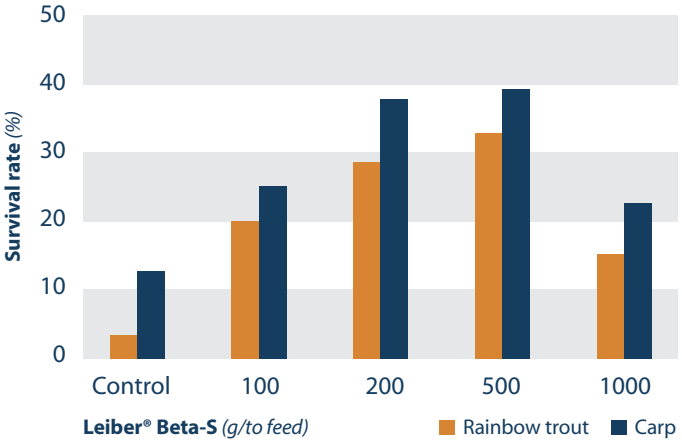

Figure 1: Effects of a dietary Leiber®Beta-S supplementation on survival rates of rainbow trout and carp after a challenge with *Aeromonas salmonicida* and *Aeromonas hydrophila*, respectively, if the experimental diets were fed for 4 week prior to infection *(n = 50)*

For more information:

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