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The effects of dietary Immunogen[®] on innate immune response, immune related genes expression and disease resistance of rainbow trout (*Oncorhynchus mykiss*)



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ABSTRACT

This study investigates the effects of prebiotic Immunogen[®] on lysozyme, TNF α and HSP70 gene expression in head kidney, humoral innate immune parameters and resistant to *Aeromonas hydrophila* of rainbow trout. 120 healthy rainbow trout (81.65 \pm 1.49 g) were distributed in six fiberglass tanks assigned to two groups fed control or diet supplemented with 2 g kg⁻¹ Immunogen[®] for 45 days. The results revealed that administration of Immunogen[®] significantly ($P < 0.05$) up regulated lysozyme and TNF α gene expression. HSP70 gene expression was significantly ($P < 0.05$) lower in Immunogen[®] fed fish at the end of trial. Humoral innate immune parameters (lysozyme activity, ACH50 and bactericidal activity) were significantly ($P < 0.05$) increased whether 15 or 45 days after feeding on Immunogen[®] supplemented diet. However, significant ($P < 0.05$) increase in agglutination antibody titer observed just after 45 days feeding on Immunogen[®]. Rainbow trout fed with 2 g kg⁻¹ Immunogen[®] showed remarkably higher resistance against *A. hydrophila* (64.44% survival) compared to the control group (24.44% survival). These results confirm that Immunogen[®] can up regulates immune related genes expression, stimulates immune response that per se enhances disease resistance in rainbow trout.

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1. Introduction

The release of disinfectants and drugs into the rearing water of the intensive fish production system, can affect the integrity of gastrointestinal microbiota [1], decreases growth performance and suppresses the immune responses [2,3]. Also, the administration of antibiotics may results in food and environmental pollutions and development of antibiotic resistant pathogens [4–7]. Along with tremendous growth of world aquaculture during the last years, there was increasing interests toward administration of ecological and environmental friendly approaches like immunostimulants, probiotic and prebiotic as a replacement for antibiotic therapy [8–11].

Prebiotics are “non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus

improves host health” [12]. The positive effects of prebiotics on immune response and resistance of fish and shellfish is well-documented [8,9,11,13] and previous studies demonstrated that prebiotics can stimulate both innate immune mechanisms and cells involved in the specific immune response [13–16].

Immunogen[®] is a commercial prebiotic, mainly includes β -Glucan and mannanoligosaccharides (MOS), derived from *Saccharomyces cerevisiae* yeast cell wall [17]. MOS and β -glucan have been demonstrated to show beneficial effects on specific and non-specific immune mechanism of monogastric animal [8,17–19]. Ebrahimi et al. [20], reported improved growth performance and immune response of common carp after administration of Immunogen[®] in diet. Despite recent progress in the field of prebiotic administration in aquaculture [8] there is limited information about the effects of administration of Immunogen[®] [20] as well as genetic insight into the effects of prebiotics on fish immune system. Thus, the aim of the present study was determination of dietary Immunogen[®] effects on some hematological parameters, humoral immune response, immune related genes expression (Lysozyme (lyz2), tumor necrosis factor α (TNF α), heat shock protein 70

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