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Modulation of innate immune response, mucosal parameters and disease resistance in rainbow trout (*Oncorhynchus mykiss*) upon synbiotic feeding



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ABSTRACT

The present study investigates the effects of dietary supplements of galactooligosaccharides (GOS), *Pediococcus acidilactici* and *P. acidilactici* + GOS on innate immune response, skin mucus as well as disease resistance of rainbow trout (*Oncorhynchus mykiss*) fingerlings (15.04 ± 0.52 g). After 8 weeks of feeding, several innate immune (lysozyme, alternative complement and respiratory burst activities) and skin mucus parameters (bactericidal activity against *Streptococcus faecium*, *Streptococcus iniae*, *Serratia marcescens*, *Staphylococcus aureus* and *Escherichia coli* and mucus protein content) were studied. The results indicated that the three supplemented diet significantly increased innate immune response and skin mucus parameters in rainbow trout. The highest innate immune response, skin mucus activity as well as protein level was observed in synbiotic fed fish. Furthermore, at the end of the feeding experiment, some fish were intraperitoneally injected with *Streptococcus iniae* to determine the disease resistance. The mortality of fingerlings fed supplemented diet was significantly lower than fish from control group being the lowest mortality recorded in synbiotic fed fish group.

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1. Introduction

Aquaculture is the fastest growing food producer sector for mankind, and one of the most important fish species is rainbow trout that commercially farmed in many countries throughout the world [1]. Despite rapid expansion, the industry is faced with many problems raised by disease outbreaks, especially in modern aquaculture, which crowding stress impairs the immune response of fish. Several approaches have been suggested for resolving the problem, including traditional use of antibiotics for disease prevention [2]. Nowadays, it is well known that administration of antibiotics caused practical difficulties and undesirable consequences like development of resistant pathogens [3]. Dietary

administration of pro-, pre- and synbiotic has been suggested as the alternative strategy for traditional use of antibiotics [2,4–6]. Considering the promising results obtained, there is a growing interest for understanding the proper route of pro, pre and synbiotic administration in aquaculture, in order to treat pathogen-related diseases or to be used as preventive treatments [7–10].

Pediococcus acidilactici is Gram-positive cocci that can grow in a wide pH, temperature and osmotic pressure range, and can adhere and colonize the digestive tract of fish [11]. The beneficial effects of *P. acidilactici* on fish and shellfish health status and immune response have been reported in previous studies [11–16]. Despite the attempts for elevation of favourable bacterial groups in the gut microbiota of fish through dietary administration of probiotics, the probiotic strains could not remain as the dominant species in the gut after treatment cessation [17,18]. To resolve this issue, the administration of synbiotics (co-administration of probiotic with appropriate prebiotic as substrates) has been suggested [19].

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