

Modulation of growth performances, survival, digestive enzyme activities and intestinal microbiota in common carp (*Cyprinus carpio*) larvae using short chain fructooligosaccharide

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Abstract

This study investigates the effects of inclusion of low levels of dietary short chain fructooligosaccharide (sc-FOS) on physiological response and intestinal microbiota of carp (*Cyprinus carpio*) larvae. After acclimation, fish (550 ± 20 mg) were allocated into nine tanks (40 fish per tank) and triplicate groups were fed a control diet (0%) or diets containing 0.5% and 1% sc-FOS for 7 weeks. At the end of the experiment, the growth performance parameters (final weight, weight gain, specific growth rate (SGR), food conversion ratio (FCR) and condition factor (CF), survival rate as well as digestive enzyme activities (amylase, lipase and protease), total viable counts of heterotrophic aerobic bacteria (TVC) and lactic acid bacteria (LAB) level in intestinal microbiota were measured. Our results revealed no significant ($P > 0.05$) effects of sc-FOS on growth performance and TVC when compared with the control group. However, administration of low levels of dietary sc-FOS significantly increased digestive enzyme activities (lipase and amylase) and LAB levels ($P < 0.05$). Also, survival rate was significantly elevated in sc-FOS fed carp. These results revealed that administration of low levels of sc-FOS can be considered as a beneficial dietary supplement for larval stage of common carp.

Keywords: sc-FOS, prebiotic, growth, intestinal microbiota, digestive enzyme activities, *Cyprinus carpio*

Introduction

Administration of antibiotics in aquaculture, especially in intensive systems was an important concern and resulted in ban or restriction of antibiotic usage in many countries (Cabello 2004). To resolve this issue, several researches performed to investigate dietary supplements as an alternative of antibiotics in aquaculture (Merrifield, Dimitroglou, Foey, Davies, Baker, Bøgwald, Castex & Ringø 2010; Ringø, Dimitroglou, Hoseinifar & Davies 2014). Prebiotics, non-digestible dietary ingredient which can beneficially affect intestinal microbiota, has the potential to be used as an alternative of antibiotics. It has been reported that prebiotics can increase growth performance and improve health status of fish and shellfish through modulation of gastrointestinal tract microbiom towards potentially beneficial communities like lactic acid bacteria (LAB) (Gatesoupe 2008; Hoseinifar, Ringø, Shenavar Masouleh & Esteban 2014; Merrifield, Balcázar, Daniels, Zhou, Carnevali, Sun, Hoseinifar & Ringø 2014; Ringø *et al.* 2014). LAB have been considered as beneficial residents of the fish intestinal ecosystem and frequently isolated from the gut of several fish species (Dimitroglou, Merrifield, Carnevali, Picchiatti, Avella, Daniels, Guroy & Davies