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Probiotic, prebiotic and synbiotic supplements in sturgeon aquaculture: a review

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Abstract

This study addressed the issue of the dietary supplements; probiotic, prebiotic and synbiotics considered as functional food ingredients in sturgeon aquaculture. Developments of this strategy have been suggested and practiced as an alternative to antibiotic administration in aquaculture. Sturgeons are commercially valuable species due to their meet and roe, which is made into caviar. Aquaculture of sturgeons up to marketable size has increased during the last decade while disquieting decreases have been noticed of the natural populations. In line with the expand evaluations of microbial dietary supplements and prebiotics in finfish and shellfish aquaculture, the scientific community has also increased their interest in approaches to these issues in sturgeon aquaculture. The present review summarizes and discusses the results on intestinal microbiota of sturgeon species and the effects of probiotic, prebiotic or synbiotic administration on growth performance, gut physiology, intestinal microbiota, immune response and health. Furthermore, this study tries to cover the gaps of existing knowledge and suggest issues that merits further investigations.

Key words: gut microbiota, immune response, prebiotic, probiotic, sturgeons, synbiotic.

Introduction

Sturgeon is the common name used for fish belonging to *Acipenser*, *Huso*, *Scaphirhynchus* and *Pseudoscaphirhynchus* in the Acipenseridae family. These species are of high commercial interest in several countries due to their roe, which is made into caviar (luxury food) as well as their meat (Carmona *et al.* 2009). As sturgeons are slow-growing fish species and mature very late in natural environment (Tripp *et al.* 2009; Lu & Rasco 2014). According to International Union for Conservation of Nature, most of them are under severe threat of reduction of natural population, and more than 85% of the sturgeon species are at risk of extinction (Bronzi *et al.* 2011). Over fishing, loss of habitat and decrease of water quality (pollutions), poaching and construction of dams on rivers which demolish natural spawning ground are the main causes of aforementioned issue (Carmona *et al.* 2009). The best practised strategy for reducing pressure on natural population of sturgeon is commercial aquaculture up to marketable size to meet the increased demand for meat and caviar (Hoseinifar *et al.* 2011a).

All animal production systems have challenges; improve resistance to pathogens, increase growth performance, reduction in blood lipids, improve lipid metabolism, immunostimulation and the host health in a positive manner. The gut microbiota can metabolize numerous nutrients that the host cannot utilize and convert them to end products like short-chain fatty acids, a process that has direct impact on digestive physiology (Tellez *et al.* 2006). In this respect, modulation of the digestive tract microbiota in a positive way is of importance. Modulation of the intestinal microbiota of finfish and shellfish can be performed through administration of probiotics (Wang *et al.* 2008; Merrifield *et al.* 2010; Dimitroglou *et al.* 2011; Carnevali *et al.* 2014; Lauzon *et al.* 2014), prebiotics (Merrifield *et al.* 2010; Ringø *et al.* 2010a, 2014) or synbiotics (combination of probiotics and prebiotics) (Cerezuela *et al.* 2011; Ringø *et al.* 2014).