

Prebiotics and Fish Immune Response: A Review of Current Knowledge and Future Perspectives

SEYED HOSSEIN HOSEINIFAR,¹ MARIA ÁNGELES ESTEBAN,² ALBERTO CUESTA² and YUN-ZHANG SUN³

¹Department of Fisheries, Faculty of Fisheries and Environmental Sciences, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

²Fish Innate Immune System Group, Department of Cell Biology and Histology, Faculty of Biology, University of Murcia, Murcia, Spain

³Xiamen Key Laboratory for Feed Quality Testing and Safety Evaluation, Fisheries College, Jimei University, Xiamen, China

It is now a well-documented fact that there is a distinct relation between fish nutrition and health status. Intensification of aquaculture practice to meet market demand causes stress and elevates the risk of the disease outbreak. Therefore, provisions of proper diets as well as appropriate feeding regimens are of high importance in intensive aquaculture. Considering the negative impacts raised by prophylactic and therapeutic use of antibiotic in aquaculture, administration of dietary immunostimulant has been suggested as an alternative to antimicrobial agents. In this sense, functional dietary supplements, including pre-, pro- and synbiotic received increasing attention as an environment-friendly strategy for improving fish health. During the past years, administration of prebiotics in the diet of different fish species revealed promising results in immune response. In the present review article, the topic of the administration of dietary prebiotics in aquaculture is addressed with a special focus on recent findings regarding the effects of prebiotics on fish immune response and possible mode of action. Furthermore, the present study covers the gap in existing knowledge and suggests issues that merit further investigation.

Keywords prebiotic, fish, nutrition, immune response

INTRODUCTION

During the past decade, aquaculture has been considered as one of the fastest-growing industries of food production (Reverter et al., 2014). The elevation of aquatic animal production has been obtained by increasing the production per unit of area which per se results from intensification. However, the elevation of stocking density in aquaculture practices increases the stress level in the cultured organism and the risk of diseases (Pohlenz and Gatlin III, 2014). Therefore, disease outbreaks are now considered as one of the most important

constraints for development of intensive and super intensive aquaculture systems in many countries (Magnadottir, 2010).

To resolve the issues raised by intensification, antimicrobial agents have been routinely administered as a preventative means of pathogens control (Cabello, 2006). Nevertheless, as a consequence of increasing concerns about negative impacts of chemotherapy on the environment and human health includes the emergence of antibiotic-resistant bacterial strains, accumulation of residual in edible tissues as well as depression of immune system caused the establishment of strict regulation for administration of antimicrobial agents in many countries (Reverter et al., 2014). Therefore, there are increasing interests for using eco-friendly alternatives to the therapeutic use of antimicrobials such as administration of functional dietary supplements (Hoseinifar et al., 2014a). Prebiotics “*ingredient of the not digestible diet that is beneficial to the host for stimulating selectively the growth and/or the activity of one or more*

The authors equally contributed to this review article.

Address correspondence to Seyed Hossein Hoseinifar, Department of Fisheries, Faculty of Fisheries and Environmental Sciences, Gorgan University of Agricultural Sciences and Natural Resources, P.O. BOX: 45165-386, Gorgan, 49138-15739, Iran. E-mail: hoseinifar@gau.ac.ir