Extended Abstract Journal of Clinical Developmental Biology 2019
Vol.4 No.3

Nutrition Congress 2019: Evaluating the effects of low molecular weight sodium alginate as an immune-stimulator, also as a novel prebiotic combined with Bactocell® (a probiotic) on humoral and mucosal immune responses of Asian seabass juveniles

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During the past decade, aquaculture has been considered as one of the fastest-growing industries of food production. 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. Following the 2006 EU ban on antimicrobial growth promoters, to reduce use of antibiotics chemical compounds in agri-business products have arisen. Therefore, application of bioactive substances, such as probiotics and prebiotics as an alternative to antibiotics has been considered as environmentally friendly tool for aquaculture. Interest in the use of prebiotics and probiotics in aquaculture increased considerably over the past several years due to the beneficial effects reported for these diet additives in humans and terrestrial animals, including enhanced production efficiency, increased nutrient utilization, .and improved disease resistance. Using immune stimulants as bio-friendly and environmentally safe agents is an alternative approach to combat diseases in aquaculture. Therefore, present study performed to evaluate the potential effect of individual or combined administration of dietary low molecular weight sodium alginate (LMWSA) and Bactocell® on haematological, humoral and skin mucosal immune responses of *L. calcarifer* juveniles.

A 42-day study was conducted to determine the effect of incorporating dietary low molecular weight sodium alginate (LMWSA), extracted from the brown algae, Undaria pinnatifida and Macrocystis pyritera, and Pediococcus acidilactici MA 18/5 M (PA), Lallemand Animal Nutrition S.A., Blagnac, France, on growth performance, antioxidant defense activity, intestinal lysozyme gene (LYZ) expression, histo-morphology, microbiota, and digestive enzymes activity of Asian sea bass (*Lates calcarifer*) juveniles. Six experimental diets were formulated including: Diet (1) a basal diet (Control), Diet (2) 5 g LMWSA kg^{-1} diet, Diet (3) 10 g LMWSA kg^{-1} diet, Diet (4) 0.9 × 10^7 CFU PA g^{-1} diet, Diet (5) 5 g LMWSA kg^{-1} diet + 0.9 × 10^7 CFU PA g^{-1} diet, and Diet (6) 10 g LMWSA kg^{-1} diet + 0.9 × 10^7 CFU PA g^{-1} diet were fed to Asian sea bass, *L. calcarifer* (12.0 ± 0.2 g). The results showed that fish fed PA alone (Diet 4) and the combination of both supplements (Diet 5) had the greatest weight gain. Fish fed Diet 6 and those fed Diet 1 (Control) had the highest and lowest villus height, apparent villus surface and crypt depth, respectively. Fish fed diets administered with PA (Diet 4) or synbiotics (Diets 5 and 6) showed higher total viable and lactic acid bacteria counts than all the other groups. The evaluated digestive enzymes activities including total protease, trypsin, lipase, and α-amylase remarkably increased by administration of LMWSA or its combination with PA. Moreover, liver antioxidant enzymes activities including superoxide dismutase, catalase, and Glutathione S-transferase pronouncedly enhanced following the administration of LMWSA or its combination with PA. Supplementing diet with blends of 10 g kg^{-1} of LMWSA and PA (Diet 6) more pronouncedly enhanced c-type and g-types LYZ expression in comparison with those fed 5 g kg^{-1} of LMWSA and PA (Diet 5). Based on the results obtained, it can be claimed incorporating diet with LMWSA and PA separately or in symbiotic form had promising results as functional feed additives in juvenile Asian sea bass L. calcarifer. © 2019 Elsevier B.V.

Methodology and Theoretical Orientation: In this study six weeks of feeding trial was conducted to examine the effect of dietary administration of low molecular weight sodium alginate (LMWSA) and Pediococcus acidilactici MA 18/5M (PA) on growth performance, digestive enzymes, and intestinal histology of *Lates calcarifer* juveniles. Fish (12.0 ± 0.2 g) were fed experimental diets as follows: Control (diet 1, basal diet), 5 g kg-1 LMWSA (diet 2), 10 g kg-1 LMWSA (diet 3), 0.9 × 107 CFU g-1 PA (diet 4), 5 g kg-1 LMWSA + 0.9 × 107 CFU g-1 PA (Diet 5), and 10 g kg-1 LMWSA + 0.9 × 107 CFU g-1 PA (Diet 6). At the end of the trial, blood samples from the caudal vein and skin mucus were collected for evaluation of immunological parameters.

Findings: Results indicated a significant ($P < 0.05$) increase in innate immune parameters including serum lysozyme, bactericidal, hemolytic and respiratory burst activities as well as mucosal immune responses including lysozyme and bactericidal activities when diet was supplemented with immunostimulants. Moreover, the combined effects of LMWSA with Bactocell® resulted in more pronounced immunological responses compared to the control and singular administration. Red and white blood cell counts significantly increased with either singular or combined administration of LMWSA and Bactocell® compared with the control group ($P < 0.05$).

This work is partly presented at Joint Event on 26th World Nutrition Congress & 15th Euro Obesity and Endocrinology Congress, June 17-18, 2019 London, UK.

Conclusion and Significance: These results indicated that combined administration of LMWSA and Bactocell® can be considered as a beneficial feed additive and immunostimulant in *L. calcarifer* juveniles.

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