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ZINPRO PERFORMANCE MINERALS®

Zinpro Performance Minerals® Shown More Effective at Promoting Growth, Antioxidant Capacity, Skin and Gut Morphology of European Sea Bass

INTRODUCTION:

The role of trace minerals in hormone and enzyme function, their necessity for proper bone, nervous, and reproductive system maintenance and development, and their critical position in epithelial tissue production and maintenance affects overall fish health. This study sought to evaluate the effects of Zinpro Performance Minerals® (ZPM) supplemented at one-half the rate of inorganic minerals, or in combination with inorganic minerals, on growth performance, morphology of gut and skin, hepatic enzyme activity, and skin zinc content of European sea bass (*Dicentrarchus labrax*).

EXPERIMENTAL DESIGN:

For four months, quadruplicate groups of 15 g (initial BW) sea bass were fed 1 of 3 treatments:

1. Inorganic (Control): 100 ppm Zn as $ZnSO_4$ + 80 ppm Fe as $FeSO_4$ + 24 ppm Mn as $MnSO_4$ + 6 ppm Cu as $CuSO_4$ and 0.24 ppm Se as Na_2SeO_3
2. Inorganic + ZPM: 50/50 combination of inorganic minerals and ZPM at levels in Control diet
3. ZPM 0.5x: ZPM minerals included at one-half the dose of inorganic minerals in the Control diet

In an effort to magnify response of fish to trace mineral source and level, animals underwent a temperature challenge during the last two months of the trial. Feed was then restricted by 50% of pre-stress period intake, throughout the last month of the study.

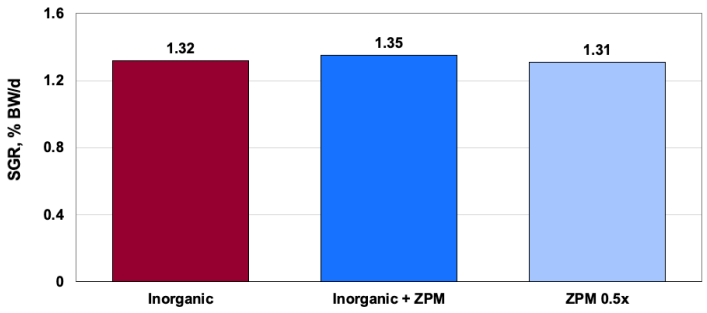
RESULTS:

- Specific growth rate (%BW/d) results showed that fish consuming a half-dose of minerals from ZPM were able to maintain growth performance
- Hepatic activity of glutathione peroxidase (GPx) was increased in fish supplemented with 0.5x ZPM, $P < 0.05$
- Inclusion of ZPM for partial or complete replacement of inorganic trace minerals positively impacted the number of goblet cells, in both intestine and skin, $P < 0.05$

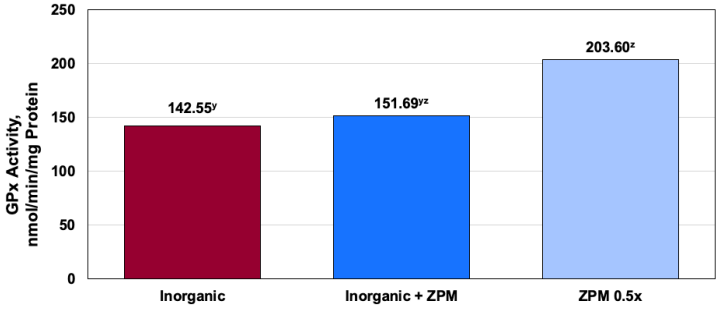
Results indicate that Zinpro Performance Minerals are more effective than inorganic mineral sources, as evident by improving the antioxidant capacity and mucosal immune status of the skin and intestine. Enhancements to these systems are expected to translate into fish that are better able to respond to disease and maintain health status when produced in commercial farming conditions.

The knowledge gained from this study should assist in the development of more efficient diets for European sea bass, which will allow them to meet performance targets and contribute to their improved welfare.

Specific Growth Rate at Feeding Study End

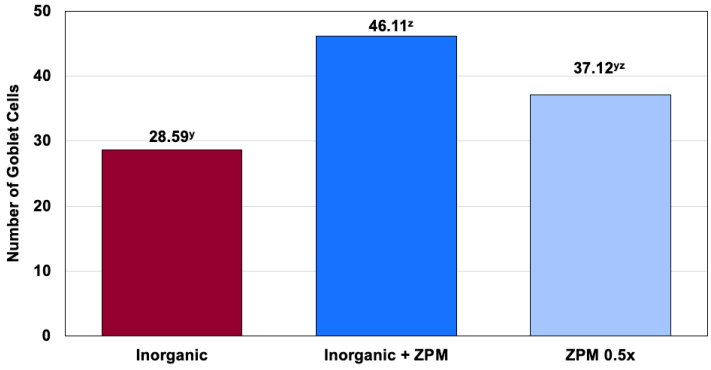


Hepatic Glutathione Peroxidase Activity at Feeding Study End



^{yz} Means lacking a common superscript letter differ, $P < 0.05$

Number of Goblet Cells in Skin at Feeding Study End



^{yz} Means lacking a common superscript letter differ, $P < 0.05$

Abstract

ZINPRO PERFORMANCE MINERALS®

Effects of complexed trace minerals at different inclusion rates in commercial sea bass (*Dicentrarchus labrax*) diets

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Introduction

Trace minerals are key elements for activation and function of hormones and hundreds of enzymes. They are essential for proper development and function of bone, nervous and reproductive systems, being critical to epithelial tissue production and maintenance and thus affect health through enhanced skin, gill, fin, scale and gastrointestinal integrity. By playing essential roles in activation and modulation of several processes involved in fish immune response, optimal trace mineral nutrition is very important in helping fight stress and disease. Among these, zinc is known to exert beneficial effects beyond growth, namely through modulating immune response and resistance to disease development of muscle and bone, reduction of cataract incidence and oxidative stress. In addition, zinc plays an essential role in wound healing, and speeds re-epithelialization processes in both humans and fish. Interestingly, metal-amino acid complexes have proven to be more efficient than inorganic minerals in reducing skin lesions of Atlantic salmon after infestation with Caligus, indicating enhanced barrier defense mechanisms against pathogens. Major objectives of this study were to evaluate effects of metal-amino acid complexes (Availa®Zn, Availa®Fe, Availa®Mn, Availa®Cu, Availa®Se), supplemented at half the level of inorganic or in combination with inorganic minerals (sulfates of Zn, Fe, Mn and Cu, and Se in the form of selenite), on growth performance, gut and skin morphology, hepatic enzyme activity and zinc content in skin of European sea bass.

Material and methods

Quadruplicate groups of European sea bass, with an initial body weight of 15 g, were daily fed one of 3 diets, formulated to vary in trace mineral source and/or level to apparent satiety, for 4 months. A Control diet was formulated to include an inorganic trace mineral premix of 100 ppm Zn ($ZnSO_4$), 80 ppm Fe ($FeSO_4$), 24 ppm ($MnSO_4$), 6 ppm Cu ($CuSO_4$) and 0.24 ppm Se from (Na_2SeO_3). A second and third diet were formulated to include metal-amino acid complexes as a 50:50 combination with inorganic minerals or at one-half the dose of inorganic minerals in the Control diet, respectively. In order to magnify response to trace mineral source and level, fish were submitted to a temperature challenge in the second- half of the feeding period (last 2 months), with feed restricted by 50%, from the pre-stress period intake, in the last month of the feeding period.

Results and discussion

Metal-amino acid complexes supplemented at one-half the level of inorganic sources maintained growth performance of European sea bass. Performance results indicate metal-amino acid complexes are a more effective or bioavailable source of trace minerals than inorganic sources in European sea bass, as demonstrated previously in Atlantic salmon and catfish. Zinc methionine complex (Zn-Met) was shown to be 3 to 5 times more bioavailable than inorganic Zn ($ZnSO_4$), in meeting growth requirements in purified and practical diets containing phytic acid, respectively. In addition, benefits of supplementing channel catfish diets with metal amino acid complexes vs. inorganic minerals were observed to go beyond growth performance, with Zn-Met being 3 to 6 times more effective than $ZnSO_4$ in protecting channel catfish against Edwardsiella ictalurid.

Increased hepatic activity of glutathione peroxidase (GPx) found in European sea bass supplemented with metal-amino acid complexes at one-half the level of inorganic trace minerals, indicate metal-amino acid complexes are more effective in promoting the antioxidant capacity of fish. Partial or complete replacement of inorganic trace minerals with metal-amino acid complexes had a clear impact on the number of goblet cells, in both intestine and skin of European sea bass. As part of the mucosal immune system, goblet cells play an important role in protecting fish against pathogens, especially in aquatic animals that are in close contact with their environment. Enhanced antioxidant capacity (i.e. GPx) and barrier defense lines (i.e. goblet cells) are expected to translate to better response of fish to disease, and thus result in healthier fish, especially when grown under commercial farmed conditions. Outcomes of this project are expected to contribute to the development of more efficient diets for European sea bass, through the supply of trace minerals that are highly available and efficiently meet sea bass performance targets, contributing toward their welfare status.

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Note: Original abstract has been slightly modified to fit spatial requirements; Figures are included on page one and removed references are available upon request