Effects of Composite Lactic Acid Bacteria on the Growth, intestinal physiology and Nonspecific immunity of Sea cucumber(*Apostichopus japonicus*)

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Background

Sea cucumber (*Apostichopus japonicas*), a member of the phylum Echinodermata, and class Holothuroidea, is highly valued by consumers and holds a prominent position in China's aquaculture industry due to its exceptional nutritional and medicinal properties. In recent years, driven by increased consumer demand, the sea cucumber aquaculture industry has experienced significant expansion. However, this expansion has been accompanied by various challenges ,including slow growth rates and recurring disease outbreaks, which have severely impeded the sector's further advancement.

People have largely addressed disease issues by extensively using antibiotics to ensure sufficient yields. This practice has led to significant problems related to resistance and drug residues, posing potential threats to human health. In recent years, various probiotics have played an important role in promoting growth and development, enhancing immune system function, preventing and treating diseases, and reducing the use of antibiotics.

Introduction

In this experiment, the addition of composite lactic acid bacteria to sea cucumber feed was implemented to investigate its positive impact on growth performance, intestinal physiology, and immune indicators of sea cucumbers. This study aims to provide a reference for the development and utilization of composite lactic acid bacteria in aquaculture.

Methods

Result

The intestinal digestive enzyme activity indicators are presented in Fig. 1

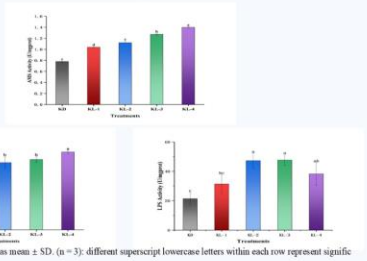

Fig.1. Values were expressed as mean ± SD. (n = 3): different superscript lowercase letters within each row represent significant differences ($P < 0.05$).

The immune and antioxidant enzyme activity indicators are presented in Fig. 2

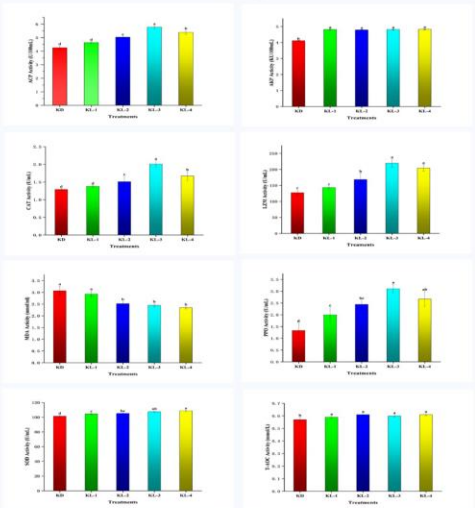

Fig.2. Values were expressed as mean ± SD. (n = 3): different superscript lowercase letters within each row represent significant differences ($P < 0.05$).

The morphological parameters of the intestine and HE staining of midgut villi of sea cucumber fed with experimental diets are presented in Fig.3 and Fig.4.

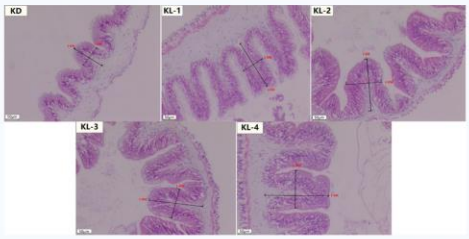

Fig.3. Intestinal morphology of sea cucumber fed the experimental diets for 8 weeks (×40). Scale bar =50μm. I-VH, intestinal villus height; I-VW, intestinal villus width to ensure clarity and conciseness, each group was annotated with only one figure and the rest were similar.

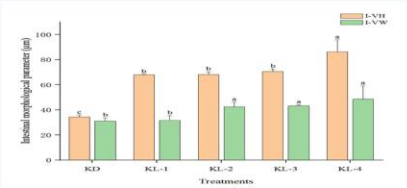

Fig.4. Values were expressed as mean ± SD. (n = 3): I-VH, intestinal villus height; I-VW, intestinal villus width. Different superscript lowercase letters within each row represent significant differences ($P < 0.05$).

The gene expression levels of Lys, Hsp70, MAPK, and FGFR-1 in the sea cucumber intestine are depicted in Fig.5.

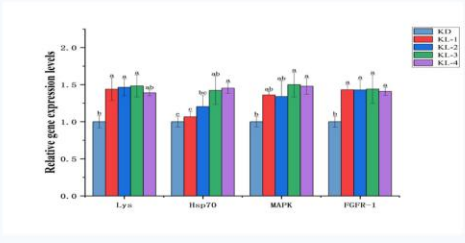

Fig.5. Values were expressed as mean ± SD. (n = 3): different superscript lowercase letters within each row represent significant differences ($P < 0.05$).

Conclusion

The experimental results demonstrated that the addition of a specific quantity of composite LAB to feed significantly enhanced sea cucumber growth, improved their antioxidant and immune capabilities, enzyme activity, and exerted a positive influence on st results occur when intestinal physiology. Furthermore, it upregulated the expression of genes associated with growth and immunity. When using weight gain rate as an evaluation metric, the bethe addition ratio of composite LAB is 1.5%. This study provides valuable insights for the potential application of composite LAB in aquaculture.