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Editorial: Beneficial effects of functional ingredients in feed on immunity improvement and growth promotion of aquaculture animals

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low fish meal diet, additives, growth performance, antioxidant capacity, intestinal morphology, inflammatory response

Editorial on the Research Topic

[Beneficial effects of functional ingredients in feed on immunity improvement and growth promotion of aquaculture animals](#)

Aquaculture now supplies an increasing proportion of food fish, 49% (1.226 billion tons) of the total in 2020, and is the fastest growing food sector with production as the per capita food fish supply has reached 20.2 kilograms (FAO, 2022). With capture fisheries declining in worldwide and the expansion of the farming industry, fish meal, the critical protein sources in feed, is obviously inadequate to support the requirement, and use levels will still have to be declined. The application of plant protein sources and non-protein energy sources are increasingly widespread. Consequently, the poor feed palatability, decreased food intake, reduced health and growth performance of farmed animal induced by receiving low-fishmeal diets have recently gained increasing attention (Lazarotto et al., 2018; Niu et al., 2019; Wattanakul et al., 2019). On the other hand, Due to the rapid expansion of farming scale, the increased rearing densities and deteriorated aquatic environment leads to an outbreak in disease frequency (Li et al., 2020; Jahangiri et al., 2022). Given the use of antibiotics is being restricted, it is particularly important to develop safe and effective ingredients to improve both the growth and health of aquaculture animals.

Here, we inspire a Research Topic including 10 papers on dietary ingredients influencing the growth performance, meat quality, ovarian development, intestinal histology, antioxidant activity and immunity of economic aquatic animals, aiming to highlight the strategies and fundamental mechanisms for promoting the sustainable development of aquaculture based on both the experiments and theory.

To alleviate growth reduction and enteritis caused by low fish meal diets, Yao et al. evaluate the different inclusion level of *Schizochytrium limacinum* in diets, and demonstrated that 0.6% *S. Limacinum* supplementation can improve the growth performance, promote hepatopancreas lipid metabolism, reduce apoptosis, promote

autophagy and improve intestinal health of *Litopenaeus vannamei* fed low fish meal diets. The study of Yue et al. revealed that limonene, allicin and betaine supplementation in low fish meal diets had a time effect on the growth performance, and could improve antioxidant capacity, meat quality and intestinal health of largemouth bass (*Micropterus salmoides*). Meanwhile, Ke et al. reported that that dietary sodium butyrate intervention could enhance growth and feed utilization of orange-spotted grouper (*Epinephelus coioides*) with high soybean meal-induced enteritis by promoting intestinal digestive enzyme activities, reducing mucosa permeability, maintaining the integrity of intestinal morphology and attenuating the intestinal inflammatory response.

Plant-based additives have been attracting growing attention in the last two decades. Studies in *M. salmoides* demonstrated that mulberry leaf extract could improve antioxidant capacity, immune function, and glycolipid metabolism, thereby alleviating the negative effects of a high-starch diet (Tingsen et al.). An addition of 2% fermented tea residue can also improve the growth and the liver antioxidant capacity, and enhance the resistance to *Aeromonas hydrophila* in largemouth bass (Jiang et al.). Moreover, Chien et al. reported that the appropriate level (250–500 ppm) of dietary grape extract could improve the growth performance and antioxidant activity of *L. vannamei*.

Other additives were also involved in this Research Topic. An increase of growth performance and antioxidant status were observed in juvenile yellow catfish (*Pelteobagrus fulvidraco*) fed diets supplied with pyrroloquinoline quinone (Shi et al.). Additionally, SKL17-2 peptide, a 17-amino acids (aa) short peptide synthesized based on interferon-g related protein in large yellow croaker (*Larimichthys crocea*), could destroy *Pseudomonas plecoglossicida* and was considered to be a potential feed additive used for prevention and treatment of visceral white nodules disease (Lin et al.).

Beside feed supplements, several ingredients were also investigated in this Research Topic. The effects of cholesterol on ovarian development of *Eriocheir sinensis* were well studied by Guo et al., in which 0.4% of dietary cholesterol can promote ovarian maturation via improving the estradiol level of the organism.

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Moreover, the impact of the dietary inclusion of cellulose with different viscosities on the growth, nutrient digestibility, serum biochemical indices, and the hepatic and gut morphology of largemouth bass indicated that viscosity is the main anti-nutritional effect of dietary carboxymethyl cellulose and soluble non-starch polysaccharides (Liu et al.).

The Research Topic summarized some of the latest advancement on the recent development and achievement in revealing growth and immune regulation of functional dietary ingredients on aquaculture animals. We are appreciated to all authors for their innovative works and all reviewers for their helpful comments. We sincerely thank the Editorial Team of Frontiers in Marine Science for their hard work to get the publication of Research Topic.

Author contributions

XW: Writing-original draft. JS: Writing-review. All authors contributed to the article and approved the submitted version.

Conflict of interest

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