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Editorial: Fish Nutrition, Metabolism and Physiology

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Editorial on the Research Topic

Fish Nutrition, Metabolism and Physiology

Aquatic foods from marine and freshwater play a significant role in nutrition of billions of people globally, particularly during the COVID-19 pandemic which has jeopardized the global food security (Tigchelaar et al., 2021). Moreover, aquatic foods are considered as unique and rich sources of n-3 long-chain polyunsaturated fatty acids (LC-PUFA) such as EPA and DHA with beneficial impacts in a range of human pathologies particularly cardiovascular diseases (Golden et al., 2021). Aquatic foods include fish, crustaceans, and other aquatic animals/plants which can be cultured or wild-caught. Traditional fisheries may no longer be the world's most important provider of food fish. According to FAO (2020), global fish production in 2018 reached about 179 million tons, and the world aquaculture production was 114.5 million tons (valued USD 250 billion) accounting for 63.7% of the total production.

In the recent years, the rapid development of aquaculture has been overwhelmed due to the shortage of marine resources for aquafeeds production (Bruni et al., 2021). Currently, fish meal (FM) and soybean meal are the main sources of protein in aquafeeds. It has been estimated that 68.2% of the total fish meal and 88.5% of fish oil are utilized for aquafeeds production (Ghamkhar and Hicks, 2020). FM is not environmentally and economically sustainable, so the replacement of FM and research needs have been focused strongly. Soybean meal has been widely used in aquafeeds to cope with the dwindling supply of fish meal. Substituting plant proteins for fish meal at low levels has been relatively easy but their inclusion at higher levels compromises fish health through inducing enteritis. Accordingly, promoting intestinal health of fish fed high soybean meal diets through supplementation of bioactive compounds has also drawn increasing attention. Besides, the animal origin proteins (e.g., poultry by-product meal) fermented with various microorganisms have advantageous nutritional status compared to plant proteins due to their higher protein and lower fiber contents.

The interaction between nutrients and physiological responses have gained much attention. During the recent two decades, the limited supply and soaring price of fish oil have urged the replacement of fish oil with the cheaper plant oil sources (Turchini et al., 2011). However, the increased inclusion level of plant oils in aquafeeds has coupled with decreasing n-3 LC-PUFA contents in farmed fish particularly in marine species. Also, the inclusion of higher plant are often associated with research challenges for fish health and welfare. Thus, identifying LC-PUFA biosynthesis in fish fed plant oils has pivotal implication for aquafeeds formulation. Fatty acyl desaturases 2 (Fads2) and elongases of very-long-chain fatty acid 5 (Elovl5) are the two key enzymes involved in biosynthesis of LC-PUFA, and their activities determine the ability of LC-PUFA biosynthesis in

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teleosts (Xie et al.). Thus, selection efforts focused on adaptation to plant-based diets, particularly the ability to synthesize LC-PUFA, are now emerging in aquaculture. Studies have also confirmed that there is a genetic basis behind the potential for more efficient utilization of fish oil-free diets in some strains of salmon (Colombo et al.).

In intensive aquaculture, using high-fat diets is an ongoing trend due to the protein-sparing and growth-promoting effects of lipids (Zhou et al., 2019). However, high-fat diets often trigger fatty liver which retards growth and feed utilization, suppresses immune function, and reduces stress tolerance (Jia et al.). Studies on the molecular mechanism of fatty liver in high-fat diet fed tilapia revealed the relationship between fat accumulation and endoplasmic reticulum (ER) stress (Jia et al.). Accordingly, some researchers suggested that therapies aiming ER could be novel strategies for the prevention of fatty liver and protection against excessive fat deposition. Quercetin, a flavonoid, is widely present in various plants, such as tea, fruitage, and vegetables. Many studies have evidenced its regulatory effects on ER under metabolic disorders. Moreover, quercetin can attenuate excessive fat deposition in fish through regulating ER (Dong et al.).

In summary, this Research Topic delivers new ideas for future research in fish nutrition, metabolism, and physiology accomplished up to date and provides insights into the future pathways and directions of this discipline.

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KL and SR was responsible for the idea of this special volume, wrote, and reviewed this editorial topic. CZ and BF reviewed this editorial topic. All authors contributed to the article and approved the submitted version.

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