

Effects of polyunsaturated fatty acid supplementation on the eicosanoid biosynthesis pathway in penaeid shrimp

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ABSTRACT:

Dietary supplementation of polyunsaturated fatty acids (PUFAs) has been shown to improve survival, growth, and reproductive maturation in crustaceans. PUFAs not only provide energy source for these biological processes, but also serve as precursors of eicosanoids, which are a group of pro- and anti-inflammatory signalling molecules that include prostaglandins and hydroxy fatty acids. In mammals, the consumption of n-3 PUFAs has been shown to reduce inflammation in the gastrointestinal tract. However, their effects on crustacean inflammatory pathway remain unknown. In this study, the juvenile Pacific white shrimp *Penaeus vannamei* were fed with feed pellets with similar proximate compositions but varying levels of PUFAs, including minimal PUFA requirement (control feed), high level of arachidonic acid (ARA feed), and high level of docosahexaenoic acid (DHA feed). After four weeks of feeding, shrimp were challenged with white spot syndrome virus (WSSV) and collected at 24 h post-infection. Fatty acid analysis of shrimp muscles and hepatopancreases revealed that muscles contained similar fatty acid profiles to feed pellets whereas the fatty acid profile of hepatopancreases differed. Moreover, WSSV infection increased the levels of PUFAs in muscles of shrimp in DHA feed group. The effects of dietary PUFAs on gastrointestinal tract were also examined by monitoring levels of two eicosanoids, namely prostaglandin E₂ (PGE₂) and prostaglandin F_{2α} (PGF_{2α}) in shrimp intestines. In shrimp fed with control feed and ARA feed, WSSV infection resulted in higher levels of PGE₂ and PGF_{2α} in intestines than uninfected shrimp. However, levels of both prostaglandins were comparable in the DHA feed group. As both PGE₂ and PGF_{2α} are proinflammatory signaling molecules whereas DHA are known for its strong inflammatory effects, we believe that DHA supplementation in shrimp feed counteracts the inflammation caused by WSSV infection in shrimp intestines. Further study is required to determine whether the reduction of prostaglandins in shrimp intestines due to DHA supplementation are beneficial shrimp health and survival.

KEYWORDS:

shrimp; eicosanoid; feed; polyunsaturated fatty acids; intestine; white spot syndrome virus.