

Importance of Fish Antimicrobial Peptides for Aquaculture and Biomedicine

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Fishes rely heavily on their innate immune defences for initial protection against pathogen agents invasion, both during the first stages of their lives, when the adaptive immunity is still not active, and when they are completely developed, as the adaptive immune system display scarce memory and short-lived secondary responses [1]. The antimicrobial peptides (AMPs) are one of the major components of the innate defences in protecting from such infections. In mammals, AMPs typically have broad-spectrum antimicrobial activity, they can often kill multiple pathogens that include bacteria, fungi, parasites and viruses. A large number of AMPs have been isolated from a wide number of fish species during last years, among which pleurocidin from winter flounder (*Pleuronectes americanus*) [2], cathelicidins from rainbow trout (*Oncorhynchus mykiss*) [3], defensins from zebrafish (*Danio rerio*) [4], piscidins from hybrid striped bass (white bass, *Morone chrysops*, female, x striped bass, *Morone saxatilis*, male) [5], dicentracin from sea bass (*Dicentrarchus labrax*) [6], and hepcidin from channel catfish (*Ictalurus punctatus*) [7], epinecidin from the grouper (*Epinephelus coioides*) [8] (for a review see [9]). The activity of fish AMPs have been tested not only against the more common fish bacterial pathogens [8,10] but either against other pathogens like nervous necrosis virus [11]. Moreover, some AMPs have shown dual functional aspects, like hepcidins that have been indicated to be involved in iron regulation [12]. Piscidins have been demonstrated to be present both in mast cells and professional phagocytic granulocytes [13] and have been detected via bug blot, Western blot, ELISA and/or immunochemistry in gill extract of different important fish species [14].

Therefore, due to their impact for fish immune system, AMPs levels could be useful to determine, maintain or improve fish health in aquaculture [15]. In fact, as an example, piscidin 2 estimated concentrations in different tissues of hybrid striped bass are lethal to different ectoparasites [16] and piscidin 4 concentrations in gills are lethal to important bacterial pathogens [17]. Different chronic stresses lead to significant down-regulation of AMPs and thus their monitoring could be useful in aquaculture to measure health status and, on the contrary, up-regulation of AMPs could be of interest to enhance disease resistance and to improve the efficacy of traditional treatments against pathogens, like it happens for immunostimulant [15]. AMPs could be of great interest even in biomedicine, as they are attractive candidates for different therapeutic approaches. In mammals, AMPs have demonstrated diverse biologic effects [18], like endotoxin neutralization, immunomodulating activity and induction of angiogenesis and, therefore, they are seen as very attractive therapeutic tools. At the moment, the increasing incidence of antibiotic-resistant bacterial infections is of great importance in medicine and AMPs could help to cope this challenge. They can combat different pathogens and exert their biologic activity in several ways due to their multifunctional properties [18] and, therefore, the research in this field is growing very fast during the last years.

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