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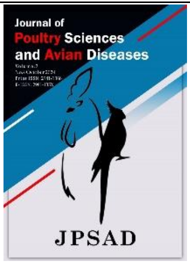

Antimicrobial peptides, their significance and challenges in veterinary medicine

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Dear Editor,

Today, many developed countries have banned the use of antibiotics in the farm animal industry due to the problem of antibiotic resistance and its consequences on human health (1). This limitation has encouraged scientists to introduce safe and effective alternatives to antibiotics. Among these candidates, antimicrobial peptides (AMPs), due to their broad spectrum activities against a wide range of pathogens, their immune-modulatory activities, and the inability of pathogens to resist them, are attractive to scientists (2). AMPs are short-chain peptides with a length of 10 to 50 amino acids with a positive charge, amphipathic properties, and unique tertiary structures. They are the first protective barrier in the animal's innate immune system (3). Many studies have shown that AMPs have antibacterial, antiviral, antifungal, and antiparasitic properties and anticancer and immune modulatory effects *in vitro* and *in vivo* (3).

The mechanisms of action proposed by AMPs consist of i) binding to the cell membrane and destroying it, ii) binding to specific receptors on the cell surface and preventing pathogens from binding and then entering into the cell, iii) entering the cell and binding to intracellular proteins, DNA and RNA and disturbance in cellular biological processes (3).

Today, computer-based tools such as protein modeling, molecular docking, and molecular dynamic (MD) simulation, as well as artificial intelligence (AI) algorithms, allow for the obtaining of engineered peptides with the best possible functions for therapeutic, agricultural, and veterinary medicine (4).

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Despite all the advantages of AMPs, we still face significant challenges in producing and industrializing these biological compounds in veterinary medicine and feed production (5). Two significant challenges in this field are 1) the cost-effective production of AMPs and 2) the short half-life of AMPs in the bodies of farm animals.

The chemical production of AMPs could be more economical due to the high cost of production. On the other hand, the small size of AMPs and their susceptibility to digestive enzymes cause dramatic drops in the half-life of AMPs in the animal blood circulation and gastrointestinal tract. Today, recombinant DNA technology helps scientists to offset significantly the cost of AMP industrial production. However, there are still difficulties due to the lethal effects of AMPs on the expression host and the low yield of peptide production (6).

According to our findings, yeast is one of the best hosts for producing AMPs (the data was not published). Researchers have also provided other solutions to reduce the cost of AMPs

, such as using the synergistic effects of peptides with antibiotics (7).

Computer-based tools, especially AI, can be suitable for predicting and engineering improved AMPs to increase their half-life. Moreover, using protective carriers for AMPs in the blood circulation and digestive system can protect AMPs from the risk of digestion by enzymes and increase their half-life (8). Some researchers use probiotics as live carriers in the digestive tract to produce AMPs. They generated bioengineered probiotics that can produce and secrete an AMP in the digestive tract (9).

At the end of this letter, it can be summarized that AMPs can be a worthy and attractive alternative to antibiotics. However, there is still a long way to go in using AMPs on a large and industrial scale in the treatment and nutrition of farm animals. Undoubtedly, future research in this field can solve these problems and achieve this important goal.

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