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## Plectasin derived peptide NZ2114 ameliorates *Clostridium perfringens* infection in broilers

*Clostridium perfringens* is a prominent pathogen existing in humans and livestock. In poultry production, necrotic enteritis induced by C. perfringens and its related subclinical symptoms always is one of the most common and economically devastating enteric disease, and it is estimated a resulting in annual losses of up to US$6 billion worldwide. Multiple *in vitro* and *in vivo* effects of NZ2114, a fungal defensin plectasin derivative, against C. perfringens type A–induced necrotic enteritis are reported. NZ2114 exhibited the characteristics of low concentration (MIC=0.91μM) with a rapid killing (2 h 99.9% reduction) of C. perfringens; meanwhile, it had additive effects with virginiamycin, lincomycin, aureomycin, and bacitracin zinc (FICI=0.75–1.0). An antibacterial mechanism study found that NZ2114 permeabilized the cell membrane within five minutes. Additionally, a seriously wrinkled surface, retracting cytoplasm, membrane peeling, and leakage of cellular contents were observed by scanning electron microscopy. After membrane penetration, NZ2114 bound specifically to the DNA, disrupted the DNA conformation, and arrested the cell cycle at the I-phases. NZ2114-protected broilers challenged with C. perfringens exhibited significantly reduced levels of interleukin-6 (IL-6), IL-1β, and tumor necrosis factor alpha (TNF-α) in serum ($P<0.05$), as well as markedly increased antibody levels of immunoglobulins (Ig) A, IgG, IgM, and sIgA ($P<0.05$), in addition to mildly regulated small intestine morphology. Moreover, Illumina sequencing analysis showed that NZ2114 supplementation affected the caecum intestinal bacterial diversity and community, such as increasing the ratio of Firmicutes to Bacteroidetes and Ruminococcaceae content, which was closely related with the improvement of average daily gain (ADG) and average daily feed intake (ADFI) that were with supplemented at 20 and 40 mg/L NZ2114 ($P<0.05$). These outcomes indicate the potential of NZ2114 as a new alternative to antibiotic (ATA) agent for the treatment of C. perfringens-induced necrotic enteritis infection.

### Recent Publications

1. Wang X, Wang X M, Teng D, Mao R Y, Hao Y, et al. (2018) Increased intracellular activity of MP1102 and NZ2114 against *Staphylococcus aureus in vitro* and in vivo. Scientific Reports 8(1):4204.
2. Zheng X L, Wang X M, Teng D, Mao R Y, Hao Y, et al. (2017) Mode of action of plectasin-derived peptides against gas gangrene-associated *Clostridium perfringens* type A. PLoS One 12(9): e0185215.
3. Li Z, Wang X, Teng D, Mao R Y, Hao Y, et al. (2017) Improved antibacterial activity of a marine peptide-N2 against intracellular *Salmonella typhimurium*, by conjugating with cell-penetrating peptides-bLFcin 6 Tat 11. European Journal of Medicinal Chemistry 145:263.
4. Wang X M, Teng D, Mao R Y, Yang N, Hao Y, et al. (2017) Combined systems approaches reveal a multistage mode of action of a marine antimicrobial peptide against pathogenic *Escherichia coli* and its protective effect against endotoxemia. Antimicrobial Agents and Chemotherapy 61(1): e01056–16.
5. Zhang Y, Teng D, Wang X M, Mao R Y, Cao X T, et al. (2015) *In vitro* and *in vivo* characterization of a new recombinant antimicrobial peptide MP1102 against methicillin-resistant Staphylococcus aureus. Applied Microbiology and Biotechnology 99(15):6255–6266.

### Biography

Da Teng is the Associate Professor of Gene Engineering Laboratory of Feed Research Institute of Chinese Academy of Agricultural Sciences. She is mainly engaged in the research and development of antimicrobial peptide (AMP) and alternatives to antibiotic (ATA) over seventeen years. She is the Key Member of AMP and ATA Direction of National Innovation Program of Agricultural Science and Technology in Chinese Academy of Agricultural Sciences. She has presided and participated in over 10 national research projects and funds and published more than 50 papers in reputed journals and was a winner of Beijing S&T Award, 1st class (2017).

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