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Bacteriocins as the Alternatives to Antibiotics

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The antibiotic therapy was found and developed in the twentieth century and resulted in decreasing human morbidity and mortality; therefore, it is considered as the most notable scientific achievement of that time. However, as a result of several problems associated with antibiotic therapy such as emerging of single- or multiple-antibiotics resistance in pathogens, scarcity of new families of antibiotics to replace the ineffective existing antibiotics, the high costs, and possible risks related to development and using such new antibiotics has limited the primary advantages of antibiotics and decreased confidence about their usefulness in the twenty-first century (1, 2). Consequently, based on several studies, it has been demonstrated that the human commensal microbiota can be influenced or damaged by administrating broad-spectrum antibiotics. In addition, there is particularly a concern about the potential association between the rising incidence of allergic and autoimmune diseases and the broad-spectrum antibiotics intake (3). Considering the abovementioned problem, development of usable novel antimicrobial agents is required. With this purpose, several alternatives including bacteriophages and phage lysins, RNA-based therapeutics, probiotics, plant derived compounds, and antimicrobial peptides from various sources have been investigated. The bacteriocins, a subgroup of antimicrobial peptides, are good alternatives. Bacteriocins have some favorable characteristics; they are small peptides that are synthesized in a ribosome of a bacteria against other bacteria while the producing bacteria has a specific immunity against it. Most of the genetic information of bacteriocin is transferred by plasmids, which makes genetic and molecular analysis possible. In fact, activity of bacteriocin is killing or inhibiting the closely related species or even different strains of the same species. The bacteriocin-producing bacteria and some other bacteria have *imm* gene encoding immunity proteins that enable the bacteria to resist against the produced bacteriocin and thereby ensure cell survival (4, 5). Bacteriocins are a heterogeneous group. Two typically classes of bacteriocins have been identified, ie, class I and II. Bacteriocins belonging to the class I undergo posttranslational modifications and those of belonging to the class II are unmodified peptides.

In comparison to present chemotherapeutic products, most of bacteriocins have a high specific activity against different clinical targets such as antibiotic-resistant strains as well as distinctive mechanisms. In addition, they can be genetically engineered for gene-based peptide due to their proteinaceous characteristic. Both the broad-spectrum bacteriocins (for targeting infections with unknown etiology) and potent narrow-spectrum bacteriocins (for targeting determined pathogens without any negative effect on normal flora) have been identified (6).

It has been demonstrated that minimum inhibitory concentration varies extensively among bacteriocins and sensitive strains. Bacteriocins have antimicrobial activity against gram-positive spore-forming species. Besides, the produced bacteriocins by gram-positive bacteria are inactive against gram-negative bacteria. Although production of bacteriocins is related to growth, several factors such as media, producing strain, fermentation conditions (ie, temperature, agitation, pH, the dilution rate, and aeration) affect the yield of bacteriocin per unit biomass. Due to the potentials for engineering bacteriocins such as modifying their activity and specificity, bacteriocins can be used for food preservation.

References

1. White AR, Bsac Working Party on The Urgent Need: Regenerating Antibacterial Drug Discovery , Development.. Effective antibacterials: at what cost? The economics of antibacterial resistance and its control. *J Antimicrob Chemother.* 2011;**66**(9):1948–53.
2. Cooper MA, Shlaes D. Fix the antibiotics pipeline. *Nature.* 2011;**472**(7341):32.
3. Blaser M. Antibiotic overuse: Stop the killing of beneficial bacteria. *Nature.* 2011;**476**(7361):393–4.
4. Willing BP, Russell SL, Finlay BB. Shifting the balance: antibiotic effects on host-microbiota mutualism. *Nat Rev Microbiol.* 2011;**9**(4):233–43.
5. Nishie M, Nagao J, Sonomoto K. Antibacterial peptides "bacteriocins": an overview of their diverse characteristics and applications. *Biocontrol Sci.* 2012;**17**(1):1–16.
6. Riley MA, Wertz JE. Bacteriocins: evolution, ecology, and application. *Annu Rev Microbiol.* 2002;**56**:117–37.