

Plantaricin IIA-1A5 from *Lactobacillus plantarum* IIA-1A5 displays bactericidal activity against *Staphylococcus aureus*

ABSTRACT

Plantaricin IIA-1A5 is a bacteriocin produced by *Lactobacillus plantarum* IIA-1A5 isolated from Indonesian beef. This research aimed to identify the genes involved in plantaricin IIA-1A5 production and examine its mode of action against *Staphylococcus aureus*. It has been reported that a bacteriocin structural gene, *plnW*, is present in genome of *L. plantarum* IIA-1A5. Here, we reported the presence of additional genes responsible for plantaricin precursor (*plnA* and *plnEF*) and a gene encoding the quorum sensor of histidine kinase (*plnB*). It indicates that genes involved in production of plantaricin IIA-1A5 are organized in at least two bacteriocin operons (*plnABCD*, *plnEFI*) and a structural *plnW* gene. Purified plantaricin IIA-1A5 yielded a single band in SDS-PAGE with apparent size of 6.4 kDa. Amino acid composition of purified plantaricin IIA-1A5 was mainly composed of cationic glutamic acid and cysteine that allowed the formation of disulphide bonds, suggesting plantaricin IIA-1A5 belongs to the pediocin-subclass of class II bacteriocins. Plantaricin IIA-1A5 displayed remarkable antibacterial activity against *S. aureus*, which was initiated by the adsorption of plantaricin IIA-1A5 onto the cell membrane of *S. aureus*. The adsorption is hypothesised to be facilitated by non-ionic interactions as it is reduced by the presence of organic solvents or detergents. This adsorption promoted leakage of cellular metabolites through the cell membrane of *S. aureus*, as indicated by the release of genetic and proteinaceous material of *S. aureus* observed at 260 and 280 nm, respectively. The leakage also promoted the release of divalent (Ca^{2+} , Mg^{2+}) and monovalent (K^{+}) cations. The release of these intracellular components might be due to pores formed in the cell membrane of *S. aureus* by plantaricin IIA-1A5 as shown by scanning electron microscopy. Altogether, the mode of action of plantaricin IIA-1A5 against *S. aureus* seems to be bactericidal as indicated by lysis of the cell membrane.