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Regulation and mechanism of organic selenium on quorum sensing, biofilm and antioxidant effects of Lactobacillus paracasei

Zaixiang Lou[1], Jiale Dong[1], Hongwei Tao[1], Yeexuan Tan[1], and Hongxin Wang[1]

[1]State Key Laboratory of Food Science & Technology

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Abstract

The study focused on the impact and action mechanism of different organic selenium products on the bioactivity of two strains of *Lactobacillus paracasei*. The growth, antioxidant activity, extracellular polysaccharide secretion, quorum sensing and biofilm formation of the strains before and after the addition of organic selenium crude products and three organic selenium standard were evaluated. The results showed that the addition of crude organic selenium had a promoting effect on the growth, antioxidant activity, extracellular polysaccharide, biofilm formation, and AI-2 activity of the strain. The organic selenium standards had a regulatory effect (positive and negative) on biofilm formation and the activity of the QS signal molecule AI-2 in the strain. L-selenocysteine had the strongest regulatory effect, with maximum GIM1.80 biofilm formation when it reached a critical concentration of 0.4 μg/ml; L-selenomethionine resulted in the highest activity of the signal molecule AI-2 of GDMCC1.155, when it reached a critical concentration of 0.4 μg/ml. The results of scanning electron microscopy demonstrated that organic selenium effectively improved the morphology and structure of the bacterial cells of the two strains. Molecular docking revealed that the mechanism by which organic selenium regulates quorum sensing in *Lactobacillus* was achieved by binding two crucial receptor proteins (histidine protein kinase HKP and periplasmic binding protein LuxP) from specific sites. It provides a new alternative (organic selenium) for regulating the viability and beneficial activity of *Lactobacillus paracasei*. **Significance statement:** The study found that organic selenium can both positively and negatively regulate quorum sensing and biofilm formation of *Lactobacillus,* and the critical concentrations have also been obtained. Meanwhile, it was found that organic selenium can promote the growth, antioxidant activity, and biofilm formation of *Lactobacillus* by activating quorum sensing, so as to better exert its probiotic properties. Furthermore, the regulating mechanism of organic selenium on the activity of *Lactobacillus* was revealed. This study provides a new alternative for regulating and stimulating the beneficial activity of probiotics.

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