

Identifikasi Gen Penanda Resisten Antibiotik pada *Lactiplantibacillus plantarum* Kita-3 melalui Analisa *Whole-Genome Sequencing*

INTISARI

Lactobacillus telah banyak digunakan sebagai kultur starter atau probiotik dalam keju, kefir, yogurt, dan makanan yang diawetkan serta dianggap dalam status aman. Namun, studi sebelumnya menemukan bahwa beberapa strain bakteri asam laktat membawa gen resistensi antibiotik dan resisten terhadap antibiotik. Beberapa dari bakteri tersebut bahkan dapat mentransfer gen resistensi antibiotik ke bakteri asam laktat lain atau patogen melalui transfer gen horizontal, sehingga mengancam kesehatan manusia. Dalam penelitian ini, kami menggunakan *Lactiplantibacillus plantarum* Kita-3 dari keju Halloumi. Bakteri diremajakan di *de Man Rogosa dan Sharpe* pada suhu 37 °C selama 24 jam. *Minimum inhibitor concentration* diuji menggunakan *ELISA microplate reader*. *Rapid Annotation using Subsystem Technology* untuk memprediksi gen resistensi antibiotik pada kromosom dan plasmid. Konfirmasi gen resistensi antibiotik menggunakan *Comprehensive Antibiotic Resistance Database*. Secara fenotip *L. plantarum* Kita-3 resisten terhadap klindamisin (8 µg/mL), streptomisin (128 µg/mL), kloramfenikol (32 µg/mL), dan rentan terhadap tetrasiklin (0,5 µg/mL), ampicilin (0,5 µg/mL), kanamisin (16 µg/mL), eritromisin (0,25 µg/mL), siprofloksasin (0,5 µg/mL). Hasil dari analisis *Whole-genome Sequencing* kami memiliki gen resistensi terhadap tetrasiklin, fluorokuinolon, β-laktamase, dan pompa efluks multidrug yang masing-masing membawa *gen tetT, otr(A), gyrA, gyrB, parC, parE, ampC1, ampH, blaF, EXO-1, tetR, mepA, cdeA, dan mdtG*. Tidak terjadi transfer gen resistensi antibiotik pada probiotik yang dianalisis karena tidak memiliki unsur transposabel dan plasmid. Secara keseluruhan, penelitian ini menghasilkan profil resistensi antibiotik *L. plantarum* Kita-3 untuk menilai risiko transfer gen antibiotik ke bakteri lainnya. Studi ini dapat memberikan data penting tentang penggunaan probiotik yang aman.

Kata kunci: *Lactiplantibacillus plantarum*; resistensi antibiotik; transfer gen; *minimum inhibitory concentration*; *Whole-genome sequencing*.

Identification of Antibiotic Resistance Genes in *Lactiplantibacillus plantarum* Kita-3 through Whole-Genome Sequencing Analysis

ABSTRACT

Lactobacillus has been widely used as a starter culture or probiotic in cheese, kefir, yogurt, and preserved foods and is considered safe. However, previous studies found that some strains of lactic acid bacteria carry antibiotic resistance genes and are resistant to antibiotics. Some bacteria can even transfer antibiotic resistance genes to other lactic acid bacteria or pathogens through horizontal gene transfer, thus threatening human health. In this study, we used *Lactiplantibacillus plantarum* Kita-3 from Halloumi cheese. Bacteria were rejuvenated in de Man Rogosa and Sharpe at 37 °C for 24 hours. The minimum inhibitory concentration was tested using an ELISA microplate reader. Rapid Annotation using Subsystem Technology to predict antibiotic resistance genes on chromosomes and plasmids. Confirmation of antibiotic resistance genes using the Comprehensive Antibiotic Resistance Database. Phenotypically *L. plantarum* Kita-3 is resistant to clindamycin (8 µg/mL), streptomycin (128 µg/mL), chloramphenicol (32 µg/mL), and susceptible to tetracycline (0.5 µg/mL), ampicillin (0.5 µg/mL), kanamycin (16 µg/mL), erythromycin (0.25 µg/mL), ciprofloxacin (0.5 µg/mL). Results from our Whole-genome sequencing analysis have resistance genes to tetracyclines, fluoroquinolones, β-lactamases, and multidrug efflux pumps carrying the genes respectively, *tetT*, *otr(A)*, *gyrA*, *gyrB*, *parC*, *parE*, *ampC1*, *ampH*, *blaF*, *EXO-1*, *tetR*, *mepA*, *cdeA*, and *mdtG*. There was no transfer of antibiotic resistance genes in probiotics analyzed because they did not have transposable elements and plasmids. Overall, this study resulted in an antibiotic resistance profile of *L. plantarum* Kita-3 to assess the risk of antibiotic gene transfer to other bacteria. This study can provide important data on the safe use of probiotics.

Keywords: *Lactiplantibacillus plantarum*; antibiotic resistance; gene transfer; minimum inhibitory concentration; Whole-genome sequencing.