

ABSTRAK

Tingkat keberhasilan perawatan endodontik mencapai 86-98%. Salah satu etiologi kegagalan perawatan endodontik adalah infeksi bakteri persisten. Spesies bakteri dengan prevalensi paling tinggi yang diisolasi di dalam saluran akar yang telah dilakukan perawatan adalah *Enterococcus faecalis*. Penanganan *E.faecalis* pada infeksi saluran akar dapat dilakukan melalui mekanisme penghambatan biosintesis dinding sel bakteri. Enzim *Muramidase A* berperan penting pada tahap awal biosintesis peptidoglikan, yang merupakan komponen utama pembentuk dinding sel bakteri. Daun *Piper betle linn.* yang dikenal juga sebagai daun sirih hijau diketahui memiliki kemampuan antibakteri pada kandungannya. Senyawa bioaktif pada daun *Piper betle linn.* yang dianggap berperan dalam aktivitas antibakteri terutama terhadap *E.faecalis* adalah senyawa fenol dan turunannya, *gallic acid* dan *hydroxychavicol*. Tujuan dari penelitian ini adalah mengetahui efektivitas antibakteri fraksi metanol daun *Piper betle linn.* terhadap bakteri *E.faecalis* secara *invitro* dan mengetahui prediksi aktivitas senyawa *hydroxychavicol* dan *gallic acid* terhadap enzim *MurA* dengan metode *in silico*. Penelitian *invitro* dilakukan dengan pengukuran zona hambat dengan metode *Kirby Bauer* dan penentuan nilai *Minimum Inhibitory Concentration (MIC)* dan *Minimum Bactericidal Concentration (MBC)* dengan metode mikrodilusi. Penelitian *insilico* dilakukan dengan melakukan *molecular docking* antara ligan senyawa terhadap reseptor *MurA* menggunakan *Autodock tools 1.5.6*. Hasil pengukuran zona hambat menunjukkan tidak terbentuk zona hambat pada sampel fraksi metanol daun *Piper betle linn.* dengan konsentrasi ($\mu\text{g/mL}$) 20.000, 40.000, 60.000, dan 80.000 $\mu\text{g/mL}$, sedangkan untuk konsentrasi 100.000, 200.000, dan 400.000 $\mu\text{g/mL}$ menunjukkan zona hambat rata-rata sebesar 10,1 mm, 12,1 mm, dan 14,7 mm. Hasil penentuan *MIC* pada konsentrasi 20.000 $\mu\text{g/mL}$ dan nilai *MBC* pada konsentrasi 40.000 $\mu\text{g/mL}$. Hasil *molecular docking* menunjukkan nilai *binding affinity* terhadap reseptor *MurA* pada senyawa *gallic acid* sebesar -6,30 kcal/mol dan pada senyawa *hydroxychavicol* sebesar -5,10 kcal/mol. Kesimpulan dari penelitian ini adalah bahwa fraksi metanol daun *Piper betle linn.* memiliki efektivitas antibakteri terhadap bakteri *E.faecalis* dan senyawa *hydroxychavicol* dan *gallic acid* memiliki aktivitas terhadap enzim *MurA* dari bakteri *E.faecalis*.

Kata Kunci: *Enterococcus faecalis*, *Muramidase A*, *Gallic acid*, *Hydroxychavicol*, *Piper betle linn*, Sirih hijau, *Molecular Docking*

ABSTRACT

The success rate of endodontic treatment is 86-98%. One of the etiologies of endodontic treatment failure is persistent bacterial infection. The most prevalent bacterial species isolated in treated root canals is Enterococcus faecalis. Management of E.faecalis in root canal infections can be done through the mechanism of inhibiting bacterial cell wall biosynthesis. Muramidase A enzyme plays an important role in the early stages of peptidoglycan biosynthesis, which is the main component of bacterial cell wall formation. Piper betle linn. leaves, also known as green betel leaves, are known to have antibacterial abilities in their compounds. Bioactive compounds in Piper betle linn. leaves that are thought to play a role in antibacterial activity, especially against E. faecalis, are phenol compounds and their derivatives, gallic acid and hydroxychavicol. The purpose of this study was to determine the antibacterial efficacy of the methanol fraction of Piper betle linn. leaves against E.faecalis bacteria invitro and to predict the activity of hydroxychavicol and gallic acid compounds against the MurA enzyme using in silico methods. Invitro research was conducted by measuring the inhibition zone based on Kirby Bauer method and determining the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) values using microdilution method. Insilico research was conducted by molecular docking between compound ligands against MurA receptor using Autodock tools 1.5.6. The inhibition zone measurement results showed no inhibition zone at concentrations of 20.000, 40.000, 60.000, and 80.000, while the 100.000, 200.000, and 400.000 µg/mL concentration showed an average inhibition zone of 10.1 mm, 12.1 mm, and 14.7 mm. The results of MIC and MBC determination at concentration of 20,000 µg/mL and 40,000 µg/mL. The results of molecular docking demonstrated that the binding affinity value to the MurA receptor on gallic acid compound of -6.30 kcal/mol and on hydroxychavicol compound of -5.10 kcal/mol. The conclusion of this study is that the methanol fraction of Piper betle linn. leaves has antibacterial efficacy against E. faecalis bacteria and hydroxychavicol and gallic acid compounds have activity against the MurA enzyme of E. faecalis bacteria.

Keywords: Enterococcus faecalis, Muramidase A, Gallic acid, Hydroxychavicol, Piper betle linn, Green betel, Molecular Docking