STUDI PENAMBATAN MOLEKUL SENYAWA KAEMPFEROL GLIKOSIDA SEBAGAI INHIBITOR α-GLUKOSIDASE

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ABSTRAK

Kaempferol glikosida adalah salah satu metabolit sekunder yang banyak memberikan manfaat kesehatan terutama untuk diabetes mellitus. Namun, senyawa ini belum banyak diteliti potensinya sebagai penghambat enzim α-glukosidase. Tujuan penelitian yaitu mengetahui potensi senyawa kaempferol glikosida dan toksisitasnya sebagai inhibitor α-glukosidase yang dikaji secara *in silico* dibandingkan dengan *acarbose*. Penelitian ini merupakan penelitian eksperimental komputasi yang mengkaji potensi aktivitas dan toksisitas dari 19 senyawa kaempferol glikosida. Validasi reseptor dilakukan dengan metode *re-docking* menggunakan PLANTS dari *native ligand acarbose* terhadap enzim α-glukosidase (3TOP), dilanjutkan dengan penghitungkan RMSD. Uji *in silico* dilakukan dengan *docking* menggunakan PLANT. Visualisasi *docking* dilakukan dengan pymol dan Ligplot+. Uji toksisitas senyawa dilakukan dengan ProTox-II. Validasi menghasilkan nilai RMSD < 2Å. Terdapat 4 senyawa yang memiliki skor *docking* yang lebih baik dari *acarbose* ($p < 0,05$) yaitu kaempferol-3-rutinoside, kaempferol-7-galactoside-3-rutinoside, kaempferol-3-4'-diglucoside-7-rhamnoside, dan kaempferol-3-4'-7-triglucoside. Senyawa-senyawa tersebut berikatan kuat dengan asam amino penting pada reseptor α-Glukosidase (3TOP). Semua senyawa yang diuji diketahui memiliki sifat nefrotoksik namun tidak memiliki sifat hepatotoksik, neurotoksik, sitotoksik dan karsinogenik, kecuali afzelin yang bersifat karsinogenik. Senyawa kaempferol-3-rutinoside, kaempferol-7-galactoside-3-rutinoside, kaempferol-3-4'-diglucoside-7-rhamnoside, dan kaempferol-3-4'-7-triglucoside adalah senyawa yang berpotensi dikembangkan sebagai inhibitor α-glukosidase secara *in silico*. Namun, perlu dilakukan kajian lebih lanjut terkait potensi nefrotoksisitas senyawa.

Kata Kunci : *diabetes melitus, α-glukosidase, kaempferol glikosida, in silico.*

MOLECULAR DOCKING STUDY OF KAEMPFEROL GLYCOSIDE COMPOUNDS as α-GLUCOSIDASE INHIBITORS

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ABSTRACT

Kaempferol glycosides are secondary metabolites that have various health benefits, particularly for diabetes mellitus. However, the potential of these compounds as α-glucosidase enzyme inhibitors has not been extensively studied. The aims experience to assess kaempferol glycosides activity and their toxicity as α-glucosidase inhibitors through *in silico* analysis, compared with *acarbose*. This research is a computational experimental study aimed in evaluating the activity and toxicity of 19 kaempferol glycoside compounds. Receptor validation was performed using re-docking of *native ligand acarbose* with PLANTS against α-glucosidase enzyme (3TOP), followed by RMSD calculation. In silico docking was conducted using PLANTS, and visualization was performed using PyMOL and LigPlot+. Toxicity testing was carried out using ProTox-II. The results are validation produces RMSD values < 2 Å. Four compounds have a better docking score than acarbose ($p < 0.05$), namely kaempferol-3-rutinoside, kaempferol-7-galactoside-3-rutinoside, kaempferol-3-4'-diglucoside-7rhamnoside, and kaempferol-3-4'-7-triglucoside. These compounds exhibit strong interactions with important amino acids in the α-glucosidase receptor (3TOP). All tested compounds were found to be nephrotoxic, but not hepatotoxic, neurotoxic, cytotoxic, and carcinogenic, with exception of afzelin, which has been identified as carcinogenic. The conclusion is kaempferol-3-rutinoside, kaempferol-7-galactoside-3-rutinoside, kaempferol-3-4'-diglucoside-7-rhamnoside, and kaempferol-3-4'-7-triglucoside are promising compounds that could be developed as α-glucosidase inhibitors based on in silico approach. However, further studies are required to explore the potential nephrotoxicity of these compounds.

Keywords: *diabetes mellitus, α-glucosidase, kaempferol glycosides, in silico.*