INTISARI

Ikan patin merupakan salah satu komoditas maritim Indonesia yang sering dikonsumsi oleh masyarakat di Indonesia. Pengolahan ikan patin menghasilkan limbah berupa kepala dan daging bagian perut (*belly flap*) yang diketahui kaya kandungan asam lemak yang berpotensi sebagai nefroprotektif pada penyakit diabetes melitus. Penelitian ini bertujuan untuk mengetahui senyawa asam lemak dalam minyak ikan patin (MIP) yang memiliki aktivitas nefroprotektif terhadap penyakit diabetes nefropati (DN) dan prediksi mekanisme aksinya melalui pendekatan studi *network pharmacology* dan *molecular docking.*

Identifikasi senyawa pada minyak ikan patin menggunakan *gas cromatography* untuk menganalisis senyawa asam lemak minyak ikan patin. Senyawa hasil identifikasi selanjutnya dilakukan analisis *network pharmacology* menggunakan database (*Swiss Target Prediction, SuperPred, SEA Database)* untuk memprediksi senyawa yang berpotensi aktif, protein target potensial diabetes nefropati menggunakan database (*Swiss Target Prediction, Disgenet, Therapeutic Target Database dan OMIM*). Gen yang beririsan akan dianalisis interaksi protein-protein (PPI) menggunakan database (STRING dan perangkat lunak Cytoscape), serta analisis fungsional (GO dan jalur KEGG) menggunakan *online tools* SRplot. *Molecular docking* dilakukan untuk melihat interaksi senyawa dengan targetnya dengan hasil berupa *binding affinity* dan RMSD.

Hasil pembacaan pada kromatografi gas untuk penentuan profil asam lemak menghasilkan 12 asam lemak yang berpotensial sebagai nefroprotektif pada diabetes nefropati dan 36 irisan target potensial MIP pada DN. Hasil PPI berdasarkan nilai tengah *degree, betweenness, dan closeness centrality* menghasilkan 9 target inti yakni IL6, ALB, APOE, MMP9, ACE, PPARGC1A, APOA1, PPARG, dan PPARA. Analisis GO dan jalur KEGG menghasilkan proses biologis yang sesuai dengan nefroprotektif yakni proses regulasi respon inflamasi, *AGE-RAGE signaling pathway, TNF signaling pathway,* dan *RAS signaling system.* Studi *molecular docking* menghasilkan afinitas DHA terhadap MMP9, ACE, dan PPARG yang paling baik diantara asam lemak lainnya (-6,34, -7,03 dan -8,04 kkal/mol). DHA diprediksi memiliki aktivitas farmakologi dan ikatan pada protein target penyakit diabetes nefropati dengan protein target MMP9, ACE dan PPARG yang berperan sebagai antiinflamasi dan antifibrosis berdasarkan hasil *network pharmacology* dan *molecular docking.* Hasil ini menunjukkan MIP sebagai kandidat terapi pendamping berbasis bahan alam.

Kata kunci: minyak ikan patin, asam lemak, *network pharmacology, molecular docking*.

ABSTRACT

Patin fish is one of Indonesia's maritime commodities that is frequently consumed by the Indonesian people. The processing of patin fish produces waste in the form of heads and belly flaps, which are known to be rich in fatty acids that have the potential to be nephroprotective in diabetes mellitus. This study aims to identify the fatty acid compounds in catfish oil (MIP) that exhibit nephroprotective activity against diabetic nephropathy (DN) and predict their mechanism of action through network pharmacology and molecular docking approaches.

Compound identification in catfish oil was performed using gas chromatography to analyze the fatty acid compounds in catfish oil. The identified compounds were then analyzed using network pharmacology with databases (Swiss Target Prediction, SuperPred, SEA Database) to predict potentially active compounds and potential target proteins for diabetic nephropathy using databases (Swiss Target Prediction, Disgenet, Therapeutic Target Database, and OMIM). Overlapping genes were analyzed for protein-protein interactions (PPI) using databases (STRING and Cytoscape software), as well as functional analysis (GO and KEGG pathways) using online tools SRplot. Molecular docking was performed to assess compound interactions with their targets, yielding binding affinity and RMSD results.

Gas chromatography analysis for determining fatty acid profiles identified 12 fatty acids with potential nephroprotective effects in diabetic nephropathy and 36 overlapping potential MIP targets in DN. PPI results based on mean degree, betweenness, and closeness centrality values identified 9 core targets: IL6, ALB, APOE, MMP9, ACE, PPARGC1A, APOA1, PPARG, and PPARA. GO analysis and KEGG pathway analysis identified biological processes consistent with nephroprotective effects, including the regulation of inflammatory response, AGE-RAGE signaling pathway, TNF signaling pathway, and RAS signaling system. Molecular docking studies revealed the highest affinity of DHA toward MMP9, ACE, and PPARG compared to other fatty acids (-6.34, -7.03, and -8.04 kcal/mol). DHA is predicted to have pharmacological activity and binding to disease-target proteins in diabetic nephropathy, specifically MMP9, ACE, and PPARG, which act as anti-inflammatory and anti-fibrotic agents based on network pharmacology and molecular docking results. These findings suggest MIP as a candidate for natural-based adjunct therapy.

Keywords: catfish oil, fatty acids, network pharmacology, molecular docking.