# AKTIVITAS EKSTRAK KOLAGEN DARI KULIT IKAN SALMON (*SALMO SALAR*) SEBAGAI KANDIDAT ANTIDIABETES TIPE 2 SECARA *IN VITRO* DAN *IN SILICO*

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Sains
Program Studi Kimia

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UNIVERSITAS PENDIDIKAN INDONESIA

BANDUNG

2022

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# ABSTRAK

Pengembangan inhibitor peptida banyak menarik perhatian karena spesifitasnya yang tinggi. Terdeteksinya kandungan protein kolagen yang cukup tinggi pada limbah kulit ikan memberikan alternatif sumber inhibitor alami. Pada penelitian ini dilakukan analisis aktivitas kolagen yang diekstrak dari kulit ikan Salmon (*Salmo salar*) sebagai inhibitor enzim yang berperan dalam regulasi karbohidrat untuk dijadikan kandidat antidiabetes tipe-2 secara *in vitro* maupun *in silico*. Aktivitas inhibisi ekstrak kolagen Salmon ditentukan dengan mengukur persen inhibisi relative ekstrak terhadap enzim α-amilase dan enzim DPP-IV menggunakan spektrofotometer dan *microplate reader*. Ekstrak kolagen dikarakterisasi menggunakan beberapa parameter seperti FTIR, UV-Vis, XRD dan SDS-PAGE dan menunjukkan hasil ekstrak yang diperoleh merupakan ekstrak kolagen Salmon. Hasil penelitian menunjukkan inhibisi tertinggi terhadap α-amilase menggunakan saliva non-diabetes sebesar 72,38% dan pada α-amilase saliva diabetes sebesar 76,48%. Persentase inhibisi tertinggi terhadap enzim DPP-IV diperoleh sebesar 63,45% pada konsentrasi kolagen 1000 ppm. Kajian *in silico* menunjukkan adanya interaksi antara kolagen dengan enzim α-amilase maupun enzim DPP-IV dengan afinitas pengikatan secara berturut-turut -300,38 kkal/mol, -225.67 kkal/mol dan melibatkan 113 serta 79 interaksi residu asam amino. Analisis *in silico* potensi peptida aktif dari kolagen menunjukkan bahwa afinitas pengikatan terrendah dari α-amilase dihasilkan dari ligan peptida HVWFG (His-Val-Trp-Phe-Gly), WF (Trp-Phe), YW (Tyr-Trp) sebesar -9,6 kkal/mol, -9,3 kkal/mol, -9,3 kkal/mol dan kontrol positif akarbosa sebesar -9,3 kkal/mol. Afinitas pengikatan terrendah dari enzim DPP-IV dihasilkan dari ligan peptida YW (Tyr-Trp), WF (Trp-Phe) sebesar -8,4 kkal/mol, -8,3 kkal/mol dan kontrol positif linagliptin sebesar -7,8 kkal/mol. Enzim α-amilase dan enzim DPP-IV memiliki jenis inhibisi kompetitif. Kolagen kulit ikan salmon dan peptida dari kolagen kulit ikan salmon memiliki potensi sebagai kandidat antidiabetes tipe 2.

**Kata kunci**: Antidiabetes, inhibisi, kolagen, peptida aktif, *Salmo salar*

## *ABSTRACT*

*The development of peptide inhibitors has attracted a lot of attention because of their high specificity. The high content of collagen protein in skin fish waste provides alternative sources of natural inhibitors. In this study, an analysis of the activity of collagen extracted from the skin of Salmon (Salmo salar) was carried out as an inhibitor of carbohydrate-regulating enzymes which further used as a candidate for type-2 antidiabetic by using in vitro and in silico approach. The inhibitory activity of Salmon collagen extract was determined by measuring the percent inhibition of the extract relative to the α-amylase and DPP-IV enzymes using a spectrophotometer and a microplate reader. The collagen extract was characterized using several parameters such as FTIR, UV-Vis, XRD and SDS-PAGE and showed that the extract was Salmon collagen extract. The results showed the highest inhibition of α-amylase using non-diabetic saliva was 72.38% and diabetic -amylase was 76.48%. The highest percentage of inhibition of the DPP-IV enzyme was obtained at 63.45% at a concentration of 1000 ppm collagen. The in silico study showed an interaction between collagen and α-amylase and DPP-IV enzymes with binding affinities -300.38 kcal/mol, -225.67 kcal/mol, and involving 113 and 79 amino acid residue interactions, respectively. In silico analysis of the active peptide potential of collagen showed that the highest binding affinity of α-amylase produced from HVWFG (His-Val-Trp-Phe-Gly), WF (Trp-Phe), YW (Tyr-Trp) peptide ligands was -9 ,6 kcal/mol, -9,3 kcal/mol, -9,3 kcal/mol and positive control acarbose -9,3 kcal/mol. The highest binding affinity of the DPP-IV enzyme produced from the peptide ligand YW (Tyr-Trp), WF (Trp-Phe) -8.4 kcal/mol, -8.3 kcal/mol and positive control linagliptin -7.8 kcal/mol. The α-amylase and DPP-IV enzymes have competitive inhibition types. Salmon skin collagen and peptides from salmon skin collagen have potential as candidates for type 2 antidiabetic.*



***Keywords**: Antidiabetic, active peptide, collagen , inhibition, Salmo salar*

**DAFTAR ISI**

## DAFTAR TABEL

## DAFTAR GAMBAR

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