

POTENSI PEPTIDA BIOAKTIF HIDROLISAT KOLAGEN CEKER BEBEK
HIBRIDA MELALUI SIMULASI *GASTROINTESTINAL DIGESTION*
SEBAGAI AGEN PENGHAMBAT ANGIOTENSIN
CONVERTING ENZYME

INTISARI

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Kolagen merupakan protein struktural yang paling melimpah dalam tubuh hewan dan dapat diisolasi dari kulit maupun tulang, salah satunya ceker bebek hibrida. Kolagen mengandung berbagai asam amino yang berpotensi menghasilkan peptida bioaktif dengan aktivitas fisiologis, termasuk antihipertensi. Penelitian ini bertujuan untuk mengisolasi dan mengidentifikasi biopeptida dari hidrolisat kolagen ceker bebek hibrida serta mengevaluasi aktivitas penghambatan *Angiotensin Converting Enzyme* (ACE). Sampel yang digunakan berasal dari ceker bebek hibrida umur panen 6–7 minggu. Proses penelitian meliputi tiga tahap, yaitu ekstraksi kolagen menggunakan asam asetat dan enzim bromelin, hidrolisis secara *in vitro* menggunakan enzim pepsin, pankreatin, dan pepsin-pankreatin (GID), fraksinasi hidrolisat serta uji penghambatan ACE berbasis fluoresensi dengan substrat Abz-Gly-Phe-(NO₂)-Pro. Data dianalisis secara deskriptif untuk data karakterisasi kolagen, SDS-PAGE, dan fraksinasi, serta menggunakan rancangan acak pola searah untuk data hidrolisis kolagen dan penghambatan ACE. Apabila ditemukan perbedaan yang signifikan, analisis dilanjutkan dengan uji Tukey menggunakan *software* SPSS Statistics. Hasil penelitian menunjukkan bahwa kolagen yang berhasil diisolasi memiliki rendemen sebesar 25,34% dengan pH 4,33, serta menampilkan pola berat molekul khas kolagen tipe I berupa rantai $\alpha 1$ (138,92 kDa), $\alpha 2$ (147,42 kDa), dan β (230,87 kDa). Analisis FTIR mengonfirmasi keberadaan gugus fungsional kolagen melalui serapan Amida A, B, I, II, dan III, sedangkan pengujian DSC memperlihatkan dua puncak endotermik masing-masing pada 86,12°C (Td) dan 150,86°C (Tm). Proses hidrolisis menggunakan enzim pepsin dan pankreatin menghasilkan hidrolisat kolagen dengan berat molekul rata-rata sekitar 7,4 kDa dan kadar asam amino bebas tertinggi sebesar 370,89 ± 3,17 µg/mL. Hidrolisat dengan nilai tertinggi kemudian difraksinasi menggunakan membran ultrafiltrasi menjadi empat fraksi, yaitu >30 kDa, 10–30 kDa, 3–10 kDa, dan <3 kDa. Pengujian aktivitas ACE *inhibitory* menunjukkan bahwa fraksi kurang dari 3 kDa memiliki potensi penghambatan paling tinggi, yaitu 27,11 ± 32,58%. Penelitian lebih lanjut perlu dilakukan dengan berbagai metode untuk memastikan data yang lebih valid dikarenakan kinerja ACE yang belum stabil secara *in vitro*.

Kata Kunci: Ceker bebek hibrida, Isolasi kolagen, Peptida bioaktif, ACE *inhibitor*, antihipertensi.

POTENTIAL OF BIOACTIVE PEPTIDES DERIVED FROM HYBRID DUCK FEET
COLLAGEN HYDROLYSATE THROUGH SIMULATED GASTROINTESTINAL
DIGESTION AS ANGIOTENSIN CONVERTING ENZYME INHIBITORS

ABSTRACT

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Collagen is the most abundant structural protein in the animal body and can be isolated from skin and bones, including hybrid duck feet. Collagen contains various amino acids that have the potential to produce bioactive peptides with physiological activities, including antihypertensive effects. This study aimed to isolate and identify bioactive peptides from hybrid duck feet collagen hydrolysate and to evaluate their Angiotensin Converting Enzyme (ACE) inhibitory activity. The samples were obtained from hybrid duck feet at a harvest age of 6–7 weeks. The research consisted of three main stages: collagen extraction using acetic acid and bromelain enzyme, *in vitro* hydrolysis using pepsin, pancreatin, and sequential pepsin–pancreatin (gastrointestinal digestion simulation), followed by hydrolysate fractionation and fluorescence-based ACE inhibitory activity assay using Abz-Gly-Phe-(NO₂)-Pro as the substrate. Data were analyzed descriptively for collagen characterization, SDS-PAGE, and fractionation results, while a completely randomized one-way design was applied for collagen hydrolysis and ACE inhibitory activity data. Significant differences were further analyzed using Tukey's test with SPSS Statistics software. The results showed that the isolated collagen had a yield of 25.34% with a pH of 4.33 and exhibited a typical type I collagen molecular weight pattern, consisting of α 1 (138.92 kDa), α 2 (147.42 kDa), and β chains (230.87 kDa). FTIR analysis confirmed the presence of collagen functional groups through Amide A, B, I, II, and III absorption bands, while DSC analysis showed two endothermic peaks at 86.12°C (Td) and 150.86°C (Tm). Hydrolysis using pepsin and pancreatin produced collagen hydrolysates with an average molecular weight of approximately 7.4 kDa and the highest free amino acid content of 370.89 ± 3.17 μ g/mL. The hydrolysate with the highest value was further fractionated using ultrafiltration membranes into four fractions: >30 kDa, 10–30 kDa, 3–10 kDa, and <3 kDa. The ACE inhibitory activity assay indicated that the <3 kDa fraction showed the highest inhibitory potential, with an inhibition value of $27.11 \pm 32.58\%$. Further studies using different approaches are needed to obtain more valid data due to the unstable performance of ACE under *in vitro* conditions.

Keywords: Hybrid duck feet, Collagen isolation, Bioactive peptides, ACE inhibitor, Antihypertensive.