

**KAJIAN SIFAT FUNGSIONAL DAN AKTIVITAS
ANTIOKSIDAN PROTEIN DAN HIDROLISAT
JEROAN SAPI SECARA *IN VITRO***

INTISARI

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Pemanfaatan jeroan sapi saat ini menuntut cara baru yang dapat meningkatkan nilai tambah dari sisi ekonomi maupun lingkungan. Salah satu upaya yang dapat dilakukan adalah dengan membuat konsentrat protein jeroan sapi dan hidrolisat protein jeroan sapi yang mempunyai aktivitas antioksidan. Penelitian ini bertujuan untuk mendapatkan sifat fisikokimia konsentrat protein dari jeroan sapi dan kemampuan antioksidannya. Materi penelitian menggunakan jeroan sapi Peranakan Ongole (PO) yaitu hati, paru-paru, jantung dan limpa, yang didapat dari rumah pemotongan hewan dan sapi dengan kisaran umur yang sama. Variabel penelitian yang diukur adalah sifat fisikokimia, sifat fungsional yang meliputi kapasitas dan stabilitas emulsi, kapasitas dan stabilitas buih, daya serap air dan minyak, kelarutan protein, pembentukan gel dan perilaku protein terhadap perubahan suhu, dan kemampuan antioksidan secara *in vitro* yang meliputi uji DPPH, FTC, TBA, daya reduksi dan aktivitas mengkelat logam besi. Hasil penelitian menunjukkan bahwa jeroan sapi memiliki kadar air sebesar 70,44 - 77,97%, protein 14,71 - 20,29%, lemak 2,15 - 4,95%, kadar abu 0,93 - 1,72%, karbohidrat 0,16 - 3,64%, dan pH 5,75 - 6,52. Konsentrat protein jeroan sapi mempunyai kandungan protein sebesar 56,54 - 76,09%, lemak 5,43 - 7,36%, 2,97 - 5,09% untuk abu dan 3,36 - 21,71% untuk karbohidratnya. Nilai pH konsentrat protein jeroan sapi berada di kisaran pH 3,59 - 5,16, dengan kadar air sebesar 11,60 - 11,76% dan nilai Aw 0,74 - 0,75. Konsentrat protein jeroan sapi menunjukkan sifat fungsional yang menyamai atau lebih baik dibandingkan dengan sumber protein komersial seperti protein whey dan kasein. Beberapa sifat fungsional yang diperoleh menunjukkan data lebih tinggi dari sifat fungsional protein komersial seperti daya buih dan stabilitas buih, daya emulsi dan pembentukan gel. Kelarutan konsentrat protein jeroan sapi berkisar antara 0,90 - 82,51% dengan titik isoelektrik mendekati pH 4. Konsentrat protein jeroan sapi memiliki suhu transisi glass dan suhu denaturasi yang berbeda. Demikian pula dengan gugus aktif yang berperan dalam interaksi atau pengikatan dengan molekul lainnya, konsentrat protein jeroan sapi mempunyai beberapa gugus aktif amina/amida berdasarkan hasil analisis FTIR. Komposisi asam amino yang lengkap dan mendukung sebagai komponen penyusun peptida antioksidan, yang didominasi oleh asam amino leusina, asam glutamat, fenilalanina dan arginina. Kadar protein terlarut hidrolisat protein jeroan sapi berkisar antara 1,54 - 3,07 mg/ml, kadar peptida sebesar 0,83 - 2,72 mg/ml, pH dalam kisaran 2,00 - 7,01 dan derajat hidrolisis sebesar 11,85 - 25,42%. Hasil penelitian pengujian antioksidan menunjukkan memiliki aktivitas mengkait radikal DPPH sebesar 6,74 - 43,34%, dengan nilai IC_{50} sebesar 2,77 - 13,62 mg/ml, aktivitas mengkelat logam sebesar 13,47 - 62,22%, dan daya reduksi sebesar 0,108 - 0,657. Hidrolisat protein jeroan sapi juga memiliki kemampuan untuk menghambat proses peroksidasi lipid, ditunjukkan oleh hasil uji antioksidan dengan metode FTC (13 - 42%) dan TBA (0,618 - 0,824). Hidrolisat protein

jantung sapi mempunyai aktivitas antioksidan yang paling tinggi dan mengandung 22 sekuen peptida bioaktif dari 5 jenis protein induk. Dua puluh dua sekuen peptida yang diperoleh adalah GTLEDQIIQANPALEAFGNAK, NLQEEISDLTEQLGSSGK, ISADAMMQALLGAR, SLQSLLKDTQIQLDDAVR, SEFKLELDDVTSNMEQIIK, AAAAPAPAPAPPPAPEPSKEPEFDPSKIK, DLEEATLQHEATAAALR, LQNEIEDLMVDVER, NLTEEMAGLDEIIAK, VAPEEHPTLLTEAPLNPK, SYELPDGQVITIGNER, AISEELD-HALNDMTSI, ILNPAAIPEGQFIDSR, AVFPSIVGRPR, NLLQAELEELRAVVEQTER, DFELNALNAR, DIDDLELTLAK, IEELEEEIEAER, NLTEEMAGLDEIIAKLTK, LEDEEEMNAELTAK, NLLQAELEELR, dan VVDSLQT-SLDAETR. Sekuen terbaik adalah DFELNALNAR. Konsentrat dan hidrolisat protein jeroan sapi berpotensi dikembangkan sebagai bahan fungsional dalam olahan pangan maupun nutrasetika.

Kata kunci: Jeroan sapi, Hidrolisat protein, Sifat fungsional, Aktivitas antioksidan dengan DPPH, *Chelating agent*

STUDY ON FUNCTIONAL PROPERTIES AND ANTIOXIDANT ACTIVITY
OF BEEF OFFAL PROTEINS AND HYDROLYSATES IN VITRO

ABSTRACT

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The utilization of beef offal now requires new ways that can increase added value from an economic and environmental perspective. One effort that can be done is to make protein concentrates of beef offal and protein hydrolysates from beef offal which have antioxidant activity. This study aims to obtain the physicochemical properties of protein concentrates from beef offal and their antioxidant abilities. The research material uses beef offal, namely the liver, lungs, heart and spleen, which are obtained from slaughterhouses and cattle with the same age range. The research variables measured were physicochemical properties, functional properties which included emulsion capacity and stability, foam capacity and stability, water and oil absorption, protein solubility, gel formation and protein behavior againsts temperature changes, and in vitro antioxidant capacity which included DPPH, FTC, TBA, reducing power and iron metal chelating activity tests. The results showed that beef viscera had a moisture content of 70.44 - 77.6%, protein 14.71 - 20.29%, fat 2.15 - 4.95%, ash 0.93 - 1.72%, carbohydrates 0,16 - 3,64%, and pH 5,75 - 6,52. The protein concentrate of beef offal has a protein content of 56.54 - 76.09%, fat 5.43 - 7.36%, 2.97 - 5.09% for ash and 3.36 - 21.71% for carbohydrates. The pH value of protein concentrates of beef offal is in the range of pH 3.59 - 5.16, with moisture content of 11.60 - 11.76% and Aw value of 0.74 - 0.75. Protein concentrates of beef offal show functional properties that are equivalent or better compared to commercial protein sources such as whey protein and casein. Some functional properties obtained show higher data than the functional properties of commercial proteins such as foam capacity and stability, emulsion capacity and gel formation. The solubility of protein concentrates of beef offal ranged from 0.90 to 82.51% with an isoelectric point close to pH 4. The protein concentrates of beef offal had different glass transition temperatures and denaturation temperatures. Likewise with active groups that play a role in the interaction or binding of other molecules, protein concentrates of beef offal have several active groups of amines / amides based on the results of FTIR analysis. Complete and supportive amino acid composition as a source of antioxidants, which is dominated by leucine, glutamic acid, phenylalanine and arginine amino acids. The soluble protein content of protein hydrolysate of beef offal ranged from 1.54 - 3.07 mg/ml, the peptide content was 0.83 - 2.72 mg/ml, the pH was in the range of 2.00 - 7.01 and the degree of hydrolysis was 11,85 - 25.42%. The results of antioxidant examination showed that protein hydrolysates had DPPH radical scavenging activity of 6.74 - 43.34%, with IC₅₀ values of 2.77 - 13.62 mg/ml, metal chelating activity was 13.47 - 62.22%, and reducing power of 0.108 - 0.657. The protein hydrolysate of beef offal also has the ability to inhibit the lipid peroxidation process, indicated by the results of antioxidant tests with the FTC method (13 - 42%) and TBA (0,618 - 0,824). Hydrolysate of beef heart protein has the highest antioxidant activity and contains 22 bioactive peptide sequences from 5 parent protein types. Twenty-two sequences of peptides

obtained was GTLEDQIIQANPALEAFGNAK, NLQEEISDLTEQLGSSGK, ISADAMMQALLGAR, SLQSLKDTQIQLDDAVR, SEFKLELDDVTSNMEQIIK, AAAAPAPAPAPPPAPEPSKEPEFDPSKIK, DLEEATLQHEATAAALR, LQNEIEDLMVDVER, NLTEEMAGLDEIIAK, VAPEEHPTLLTEAPLNPK, SYELPDGQVITIGNER, AISEELDHALNDMTSI, ILNPAAIPEGQFIDSR, AVFPSIVGRPR, NLLQAELEE-LRAVVEQTER, DFELNALNAR, DIDDLELTLAK, IEELEEEIEAER, NLTEEM-AGLDEIIAKLTK, LEDEEEMNAELTAK, NLLQAELEELR, and VVDSLQT-SLDAETR. The best sequence is DFELNALNAR. Protein concentrates and hydrolysates of beef offal have the potential to be developed as functional ingredients in food processing and nutraceuticals.

Keywords: Beef offal, Protein hydrolysates, Functional properties, Antioxidant activity with DPPH, Chelating agent