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NUTRITIONAL AND PHYSICO-CHEMICAL PROPERTIES OF CHICKEN PROTEINS AND PEPTIDES

By

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ABSTRACT

The aims were to investigate the physico-chemical properties and antihypertensive and antioxidative activity of chicken collagen and muscle proteins. Chicken skin gelatin (6.67 % w/v) had a higher bloom value (355 ± 1.48 g), melting temperature and stability than bovine gelatin (259 ± 0.71 g) reflecting a higher content of Gly, Pro and H.Pro amino acids. The average molecular weight of chicken gelatin was 285,000 Da. A mixture of chicken gelatin (3, 5 and 10 %) and 10 % whey protein (WPI) resulted in high elastic modulus (G') values; 1860, 23914 and 20145 Pa, respectively, compared with 120 Pa for 10 % WPI alone, increased enthalpy change (ΔH) values and phase separation.

Chicken skin gelatin was hydrolyzed with alcalase, pronase E and collagenase and ultrafiltered to give < 2, 5 and 10 KDa fractions and purified by gel filtration to produce peptides of molecular weight <1000 Da containing mainly Gly, Pro, H.Pro, Ala and Tyr. Antioxidant activity and mechanisms of chicken peptides, trolox and butylated hydroxytoluene (BHT) were determined by peroxide value, thiobarbituric acid method, reducing power, metal chelating (99 %), DPPH radical scavenging (27.94%), hydroxyl radical scavenging (IC_{50} value 81.7 %) and superoxide anion radical scavenging (52.78 %). All fractions showed ACE inhibitory activity which increased with purification. After gel filtration, peptides including one with the sequence Gly-Pro-Ile-Gly-Pro-Pro-Ser-Gly-Gly-Phe-Asp, had an ACE inhibitory concentration (IC_{50}) of 0.04 mg/ml.

Chicken muscle proteins, hydrolyzed with pepsin and pancreatin, and fractionated by ultrafiltration, gel filtration and high performance liquid chromatography produced peptides 200-700 Da, that comprised mainly Asp, Glu, Gly, Ala, Pro, Val and predominantly Lys. Chicken muscle peptides demonstrated concentration dependence in terms of antioxidant activity which was greater than that of BHT, trolox and ascorbic acid in a linoleic acid system. The antioxidant mechanism included reducing power, metal chelating (88.35 %), DPPH radical scavenging (30.95 %), hydroxyl radical scavenging (IC_{50} value 4.43 mg/ml) and superoxide anion radical scavenging (94.88 %).

ACE inhibitory activity and IC_{50} values were 68 % and 4.82 mg/ml for chicken muscle hydrolysate (315-822 Da), 81 % and 2 mg/ml for the < 2 KDa fraction; 81 % and 1.6 mg/ml after gel filtration and 84 % and 1.10 mg/ml respectively after RP-HPLC respectively.

Chicken muscle peptide (< 2KDa) mixed with antioxidants α-tocopherol or epigallocatechin gallate (300:25) showed higher antioxidant activity compared to individual peptides and antioxidants. Chicken muscle peptides (250-1000 Da) with a high content of Asp, Glu, Gly, Ala, Leu and Lys were effective antioxidants when assayed by reducing power, metal chelating activity (93 %), DPPH radical scavenging (28.52 %), superoxide anion (IC_{50} value 2.51 mg/ml) and hydroxyl radical scavenging activity (IC_{50} value 3.80 mg/ml).

Chicken peptides with ACE inhibitory and antioxidant activity have potential neutraceuticals application.