

Antioxidant Activities of Fish-Derived Protein Hydrolysates Fractions with Different Isoelectric Points in Food Model System

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Abstract: The objectives of the present study were to investigate the antioxidant activity of fish-derived protein hydrolysates with different isoelectric points and elucidate their antioxidant properties in a food model system. Fish-derived protein hydrolysates were fractionated, based on the amphoteric nature of sample peptides by preparative isoelectric focusing, which has been referred to as autofocusing. Antioxidant activities of each autofocusing fraction were evaluated by 1,1-diphenyl-2-picrylhydrazyl (DPPH) and hydroxyl (OH) radical scavenging activities, oxygen radical absorbance capacity (ORAC), and Fe²⁺ chelating assays. Lipid oxidation of cooked pork patties was determined at 24, 48 and 72 h of storage at 4°C in the dark. Basic fractions exhibited the highest DPPH and OH radical scavenging activities. Higher ORAC was noted in both weak acidic and weak basic fractions than it was in crude hydrolysate-before fractionation. The acidic fraction exhibited the highest chelating activity on Fe²⁺. Also, acidic autofocusing fractions prominently suppressed the oxidation of lipids in the patties compared to the crude hydrolysate before fractionation. These results suggest that autofocusing fractions of fish-derived protein hydrolysates are effective ingredients to improve shelf life of lipid-containing foods, and that autofocusing could be useful to increase antioxidant activity for application to food model system.

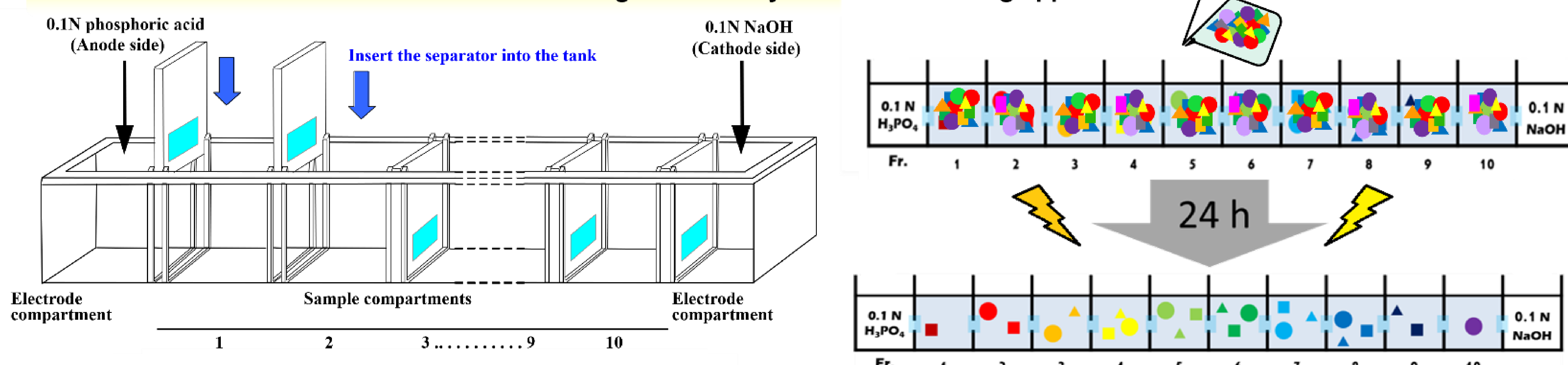
Materials and Methods

Sample : Fish-derived protein hydrolysates (Salmon Protein Hydrolysates: SMPs)

Fractionation of peptides in Salmon Protein Hydrolysates : Peptides in salmon protein hydrolysate were fractionated by autofocusing using an apparatus (975 mm in length × 200 mm inner width × 120 mm in height) with 10 sample compartments (66.5 mm in length × 80 mm in width × 80 mm in height).

Analytical methods : DPPH and OH radical scavenging activities, oxygen radical absorbance capacity (ORAC), Fe²⁺ chelating activity, Lipid oxidation determination of cooked patties

< Schematic drawing of assembly of an autofocusing apparatus >

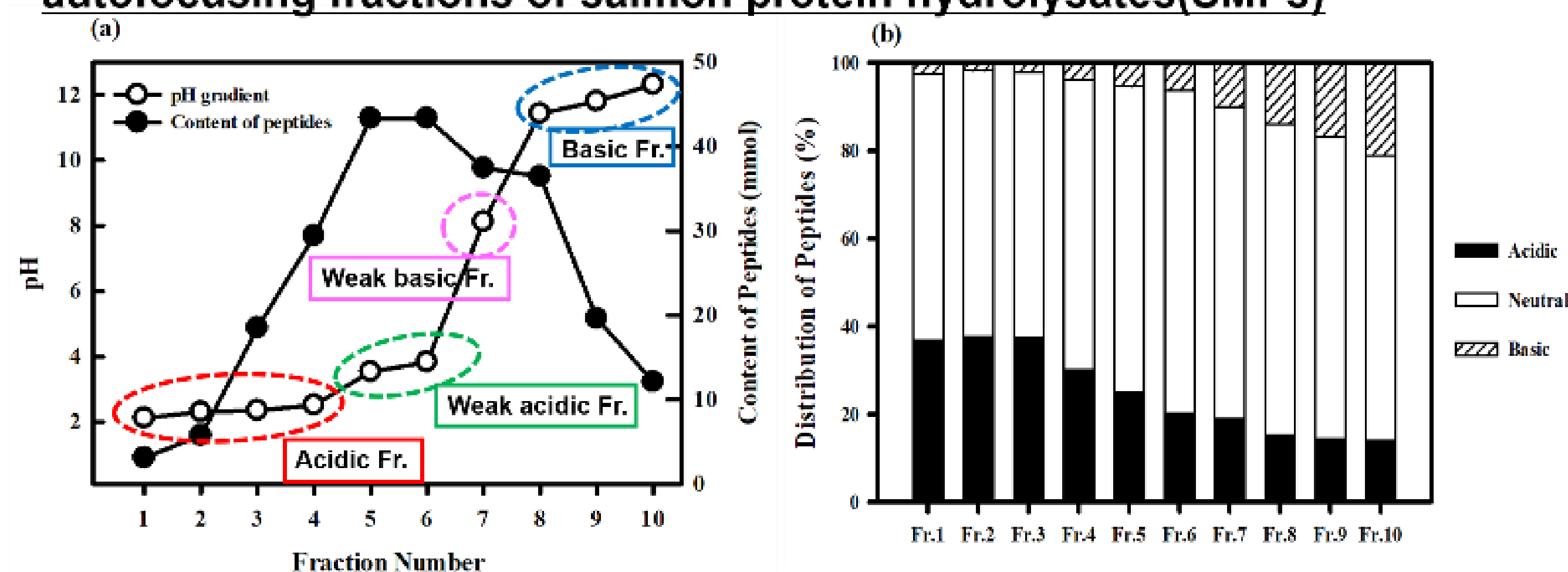


Sample compartments were filled with 5 L of 2 % sample solution. Autofocusing of peptides was performed at a constant voltage of 500 V for 24 h.

The autofocusing fractions were combined in equal amounts and they are as follows: SMP 1; acidic, Fr. 1-4, SMP 2; weak acidic, Fr. 5-6, SMP 3; weak basic, Fr. 7, SMP 4; basic, Fr. 8-10.

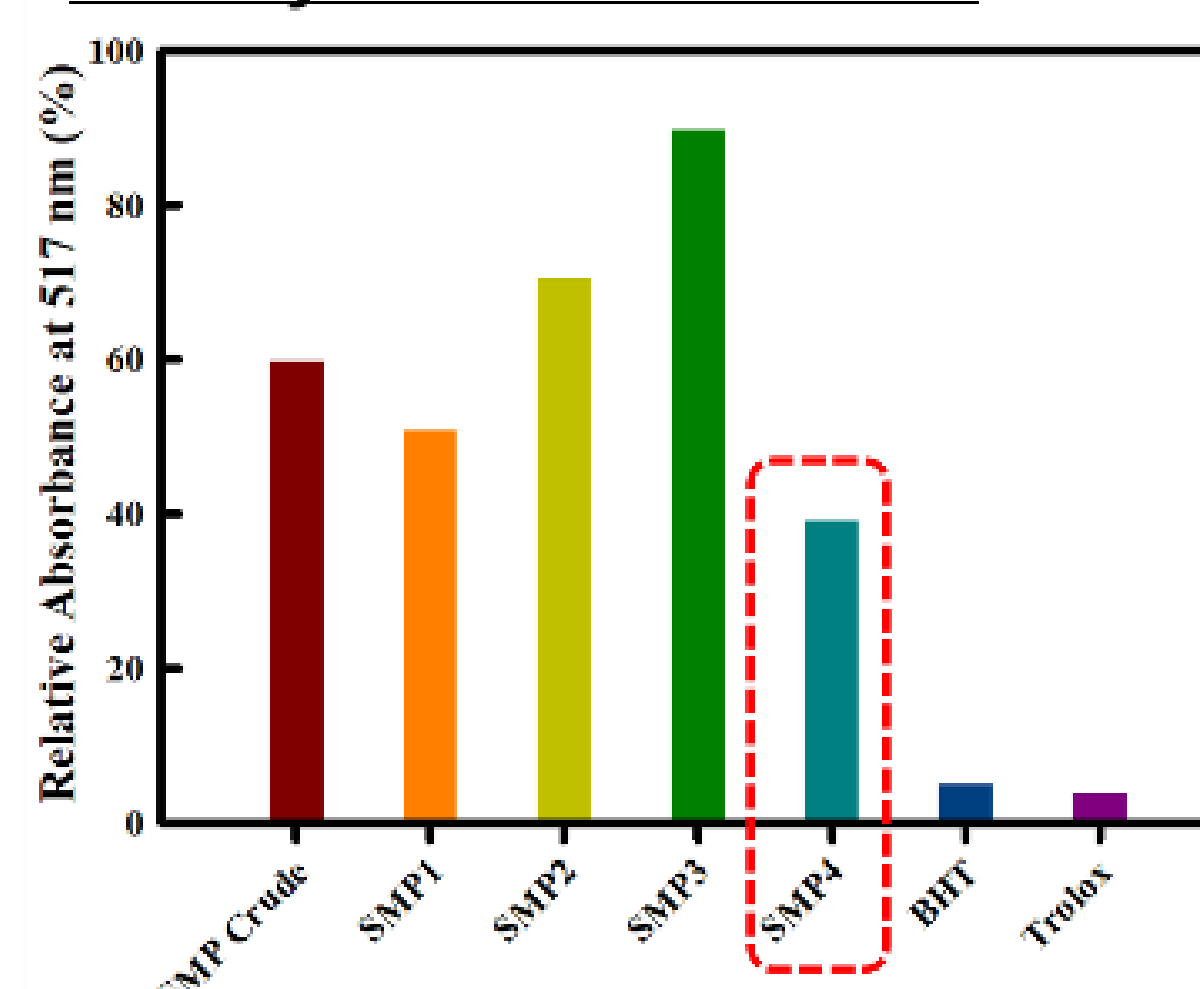
Results and Discussion

Fig. 1. Peptide contents, pH gradient(a), and amino acid composition(b) of autofocusing fractions of salmon protein hydrolysates(SMPs)



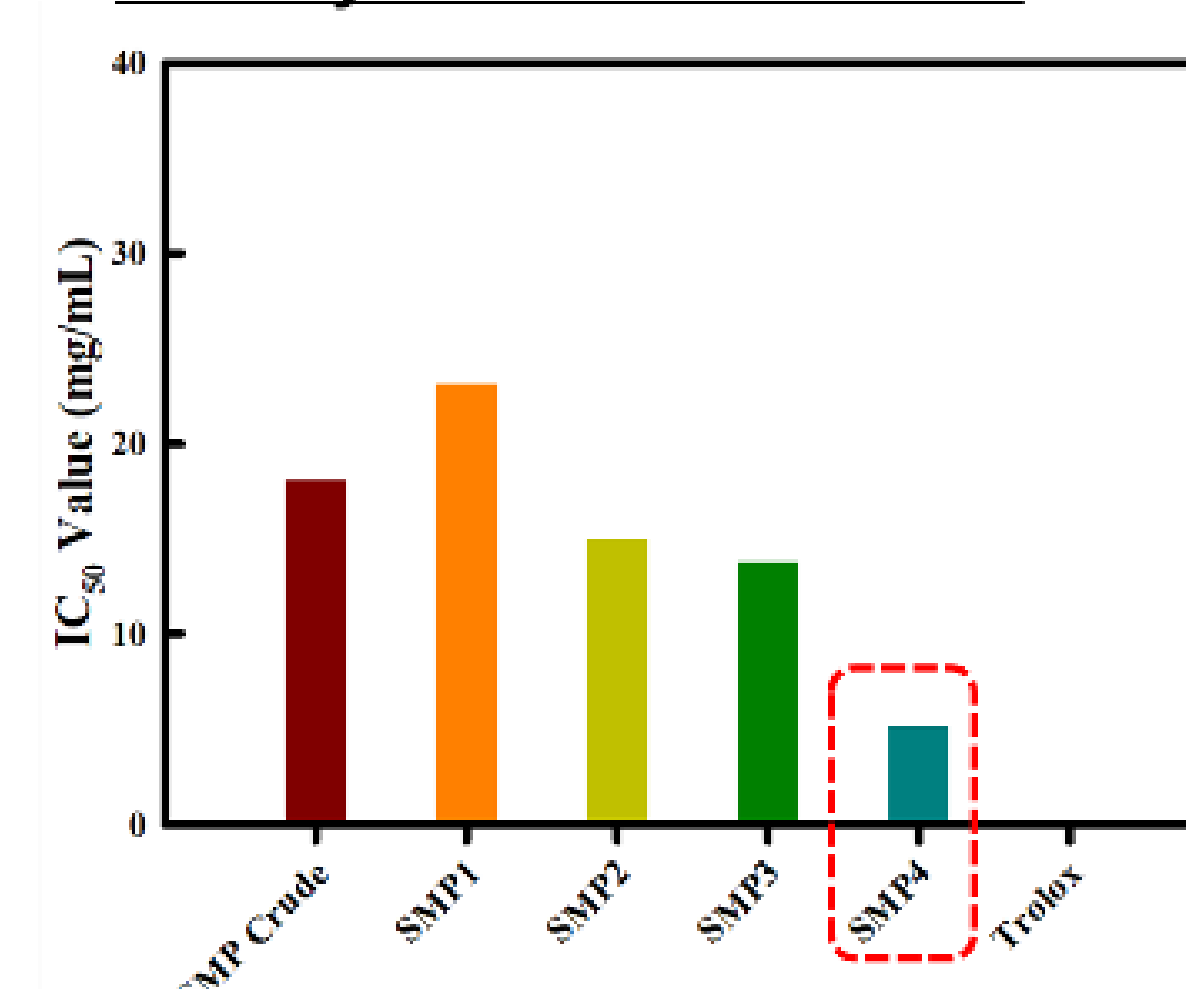
The peptides in the acidic and basic fractions are characterized by a higher content of acidic and basic amino acids, respectively.

Fig. 2. DPPH radical scavenging activity of SMPs fractions



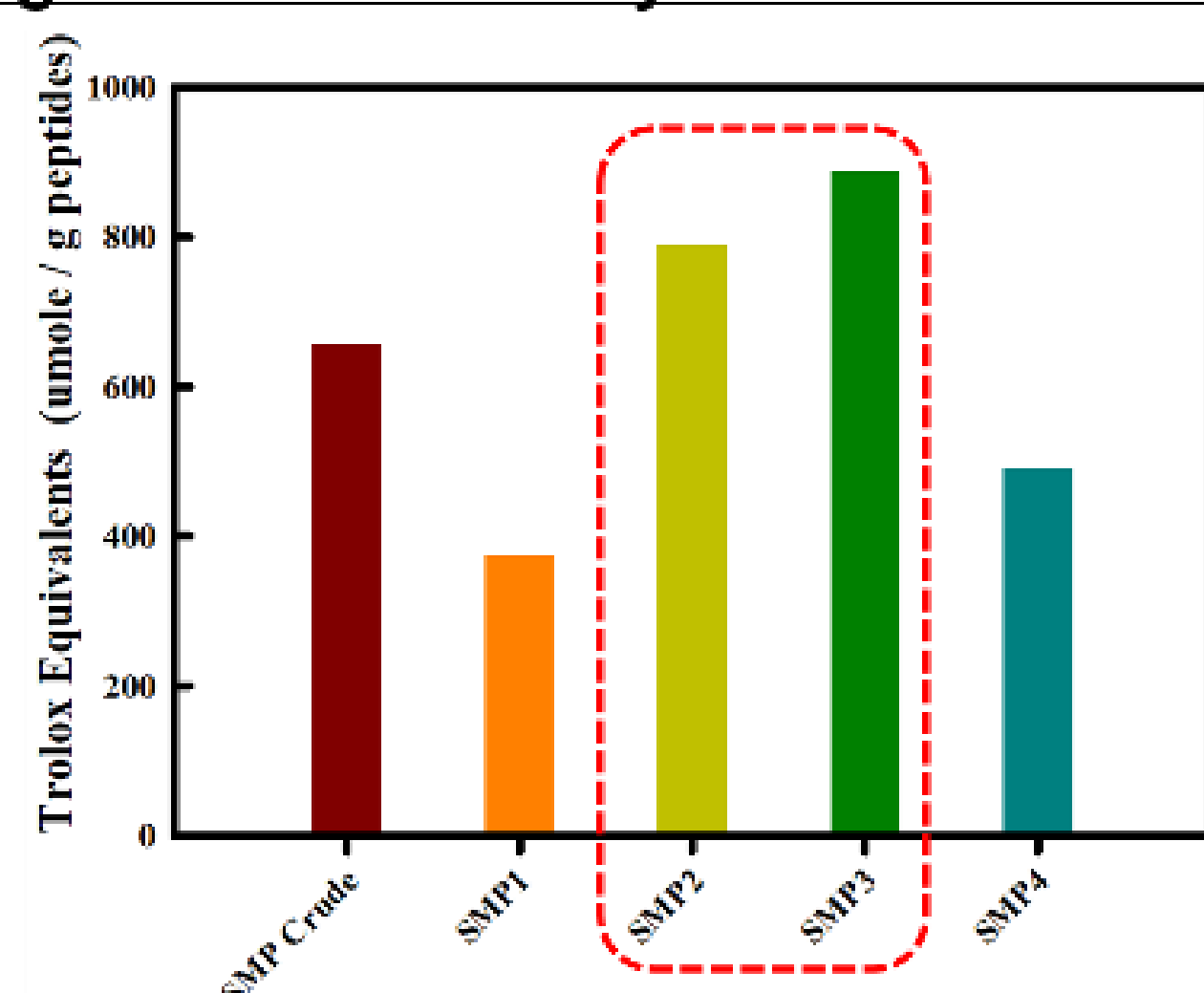
Basic fraction (SMP4) exhibited the highest DPPH radical scavenging activity.

Fig. 3. OH radical scavenging activity of SMPs fractions



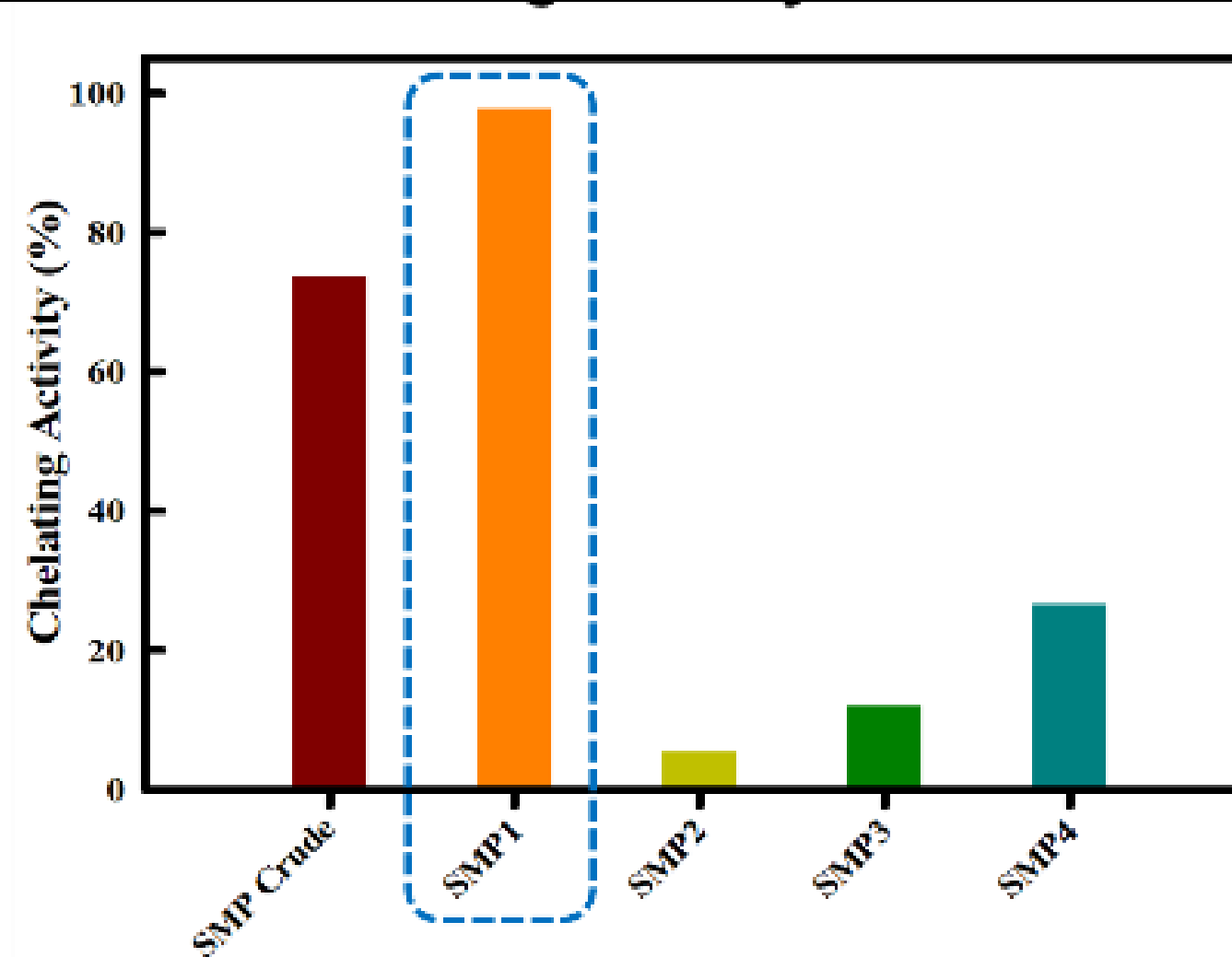
Basic fraction (SMP4) exhibited the highest OH radical scavenging activities.

Fig. 4. ORAC activity of SMPs fractions



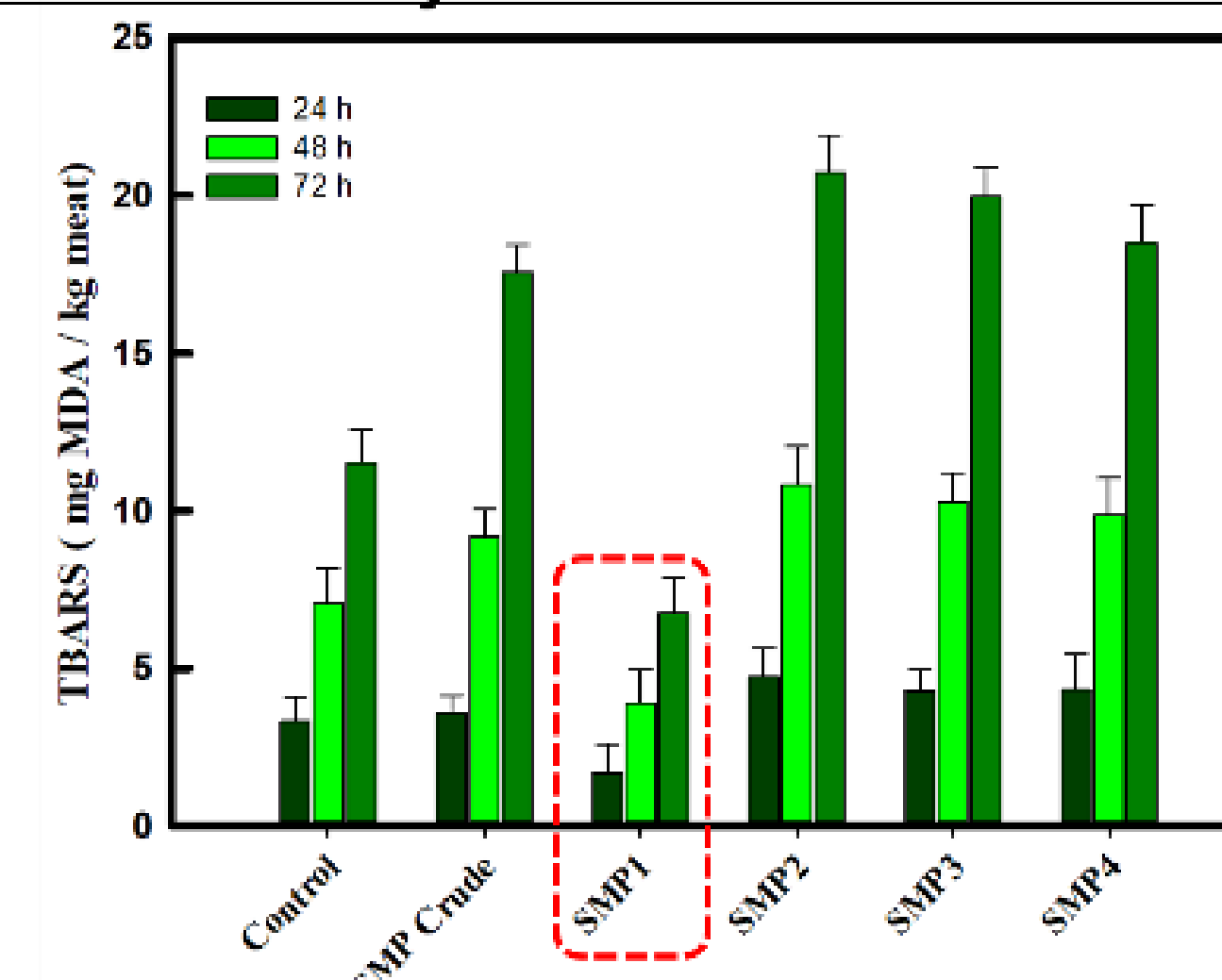
ORAC was higher in the weak acidic (SMP2) and weak basic (SMP3) fractions than the pre-fractionated crude hydrolysate.

Fig. 5. Metal chelating activity of SMPs fractions



Acidic fraction (SMP1) exhibited the highest chelating activity on Fe²⁺ (96.84%).

Fig. 6. Antioxidant activity of SMPs fraction in the meat patties



Acidic fraction (SMP1) has the highest antioxidant activity in meat patties.

The results indicated that the autofocusing fractions showed higher antioxidant activities than crude salmon protein hydrolysates. The results indicated that the autofocusing fractions showed higher antioxidant activities than crude salmon protein hydrolysates. Especially, the acidic fraction exhibited the highest metal chelating activity and suppressed the lipid oxidation in the meat patties. Therefore, the autofocusing peptide fractions of salmon protein may play an important role to improve shelf life of lipid-containing food

- References :** 1) Park et al. (2012). *J. Agric. Food Chem.* 60(30), 7483-7488. 2) Park et al. (2020). *Culi Sci & Hos Res.*, 26(11), 262-271.
3) Park et al. (2018). *Culi Sci & Hos Res.*, 13(4), 178-185. 4) Hashimoto et al. (2006). *J. Agric. Food Chem.*, 54(3), 650-655.