Isolation and activity of antioxidant peptides from silkworm pupae pretreated by irradiation technology

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Introduction

The silkworm pupae protein has a variety of effects such as lowering blood pressure, lowering blood sugar and antioxidant, and is a high-quality natural protein. However the traditional scheme cannot completely hydrolyze silkworm pupae protein. Irradiation is a safe and non-residual treatment of silkworm pupae, which can open the secondary structure of the protein so that the hydrophobic groups are exposed, and effectively improve extraction rate of silkworm pupae protein.

Therefore, the treatment of silkworm pupae protein by irradiation and the preparation of natural antioxidant peptides are beneficial to the high-value development of silkworm resources.

Methods

The silkworm pupa protein was treated by irradiation, and the hydrolysate was separated by ultrafiltration, sephadex G-15 gel column and reverse chromatography to obtain the antioxidant activity product. The structure of silkworm pupa protein was identified and the antioxidant activity of the isolated product was determined.

Results & Discussion

Fig. 1 shows that the solubility of untreated and irradiated silkworm pupae proteins. After irradiation treatment, the solubility of silkworm pupae proteins increased significantly, which was 2.9 times higher than that of untreated group.

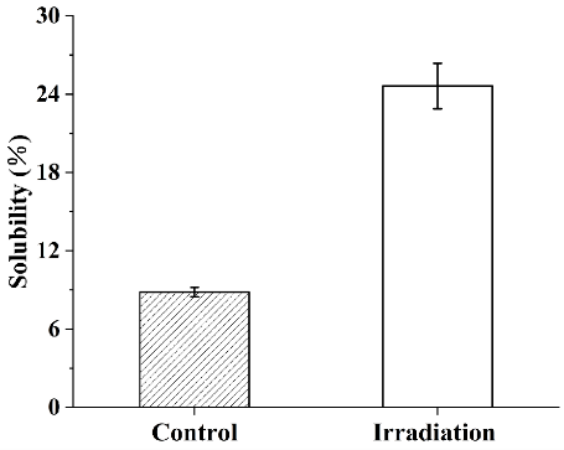

Fig. 1 The solubility of untreated protein and irradiated protein

Table 1. The antioxidant activity of polypeptides from untreated and irradiated group after ultrafiltration.

Ultrafiltration(<5 kDa)	Antioxidant activity			
	Scavenging rate of DPPH (%)	Inhibition of hydroxyl radical (U/mg)	$ABTS^+$ scavenging assay (Mm Trolox)	Chelating rate of Fe^{2+} (%)
Control	46.42±2.99	8.35±0.88	0.72±0.01	51.81±2.87
Irradiation	46.62±14.06	20.52±1.14	1.33±0.01	93.38±2.10

Table 1 shows that the antioxidant activity of polypeptides from untreated and irradiated group after ultrafiltration (<5 kDa). The results show that the antioxidant capacity of polypeptides in the irradiation group was significantly increased compared with the control group, among which the ability to inhibit hydroxyl free radicals, reduce power, and chelate Fe2+ increased by 2.5, 1.8, and 1.8 times, respectively.

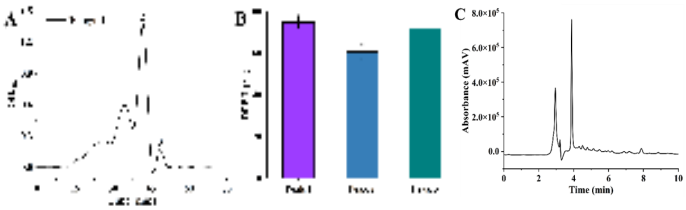

Fig. 2. Separation and determination of antioxidant peptides from silkworm pupae. (A) Sephadex G-15 gel chromatogram; (B) DPPH determination of peak 1, peak 2 and peak 3; (C) HPLC chromatograms.

Fig 2 shows the isolation and identification of antioxidants in the irradiated group. The results showed that peak 1 had the best scavenging ability of DPPH, so component one is further separated by high performance liquid chromatography

Conclusion

- The spatial structure of silkworm pupa protein changed after irradiation, and its solubility was 2.9 times higher than that of the control group.
- The antioxidant capacity of irradiated protein hydrolysates was significantly improved, and the ability to inhibit hydroxyl radicals, reducing power and iron chelating ability were increased by 2.5, 1.8 and 1.8 times, respectively.
- After the hydrolysate was separated by ultrafiltration, gel chromatography, and reverse phase chromatography, the antioxidant capacity was further improved.

Acknowledgement

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