

COLLAGEN CONTENTS AND CHEMICAL PROPERTIES OF EXTRACTS FROM PORK SKIN BY TEMPERATURE AND TIME

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I. INTRODUCTION

Collagen is extracted from pig skin and used as medicines (tablets capsule, tourniquets, artificial kidneys, artificial skin and suture), cosmetics (creams, unction) and foods (binder, extender, and physical properties improvers). In recent years, functional food materials related to obesity inhibition, skin aging inhibition, and skin elasticity improvement have gradually expanded in scope of use (1). All meats contain a certain amount of the connective tissue protein collagen. Collagen content is important to the structure and quality of meat and to the functional properties of emulsion products. Collagen constitutes the major protein in skin, bone, tendon, and cartilage. Collagen contains a high concentration of the amino acid hydroxyproline. Therefore, hydroxyproline determination is generally accepted as a method of estimating collagen (2). Therefore, this study was conducted to find the extraction conditions of collagen from pig skin according to temperature and extraction time.

II. MATERIALS AND METHODS

We obtained vacuum packed pig skin from Hansalim. 5 L of water and 2 kg of pig skin were put into an electronic pressure extractor and collagen was extracted according to temperature and time. Extracts from pig skin were stored at 4 ° C for 24 hours and used immediately for analysis. Analysis traits were moisture, fat, ash, protein, pH, volatile basic nitrogen (VBN), 2-thiobarbituric acid (TBA), collagen content and soluble collagen content. This experiment is based on time and temperature (T1: 65 °C-4h, T2: 65 °C-8h, T3: 65 °C-12h, T4: 80 °C-4h, T5: 80 °C-8h, T6: 80 °C-12h, T7: 100 °C-4h, T8: 100 °C-8h, T9: 100 °C-12h). Statistical analyses were carried out using the generalized linear model procedure of the SAS package Release 9.4 (SAS Institute, Cary, NC, USA). Means were compared using Duncan's multiple range test at a level of significance of $p < 0.05$.

III. RESULTS AND DISCUSSION

Table 1 shows proximate analysis of pig skin extracts according to extraction time and temperature. Moisture content was significantly lower at the T8 (100 °C, 8h) and T9 (100 °C, 12h) than the other treatments ($p < 0.05$). As the temperature and extraction time increases, the fat and protein contents of extracts were increased significantly ($p < 0.05$). The ash contents did not show consistency tendency according to extraction time and temperature. Table 2 shows pH, VBN, and TBA of extracts extracted from pig skin. In the pH values of extracts, the extracts extracted at 65 °C and 80 °C showed a range of 7.16-7.74, while the extracts extracted at 100 °C showed a range of 6.64-8.39. The VBN and TBA values of extracts extracted at 65 °C were significantly lower compared to those of extracts extracted at 80 °C and 100 °C. Table 3 shows total collagen and soluble collagen contents of extracts extracted from pig skin. Total collagen content were higher in the T6 (80 °C, 12h) and T8 (100 °C, 8h) than the other treatments, and the soluble collagen content was higher in T2 (65 °C, 8h) and T5 (80 °C, 8h) than the other treatments ($p < 0.05$). Kołodziejska et al. (2008) reported that as the time and

temperature increased, the gelatin extraction rate of fish offals increased. On the other hand, this study did not show increase of collagen extraction yield with increasing extraction temperature and time.

Table 1 Proximate analysis of extracts extracted from pig skin by temperature and time (%)

Treatment [*]	T1	T2	T3	T4	T5	T6	T7	T8	T9
Moisture	99.13±0.00 ^b	99.73±0.11 ^a	99.39±0.43 ^{ab}	98.70±0.00 ^c	98.30±0.17 ^d	96.91±0.29 ^e	98.71±0.17 ^c	96.34±0.10 ^f	96.27±0.22 ^f
Fat	0.00±0.00 ^b	0.00±0.00 ^b	0.00±0.00 ^b	0.02±0.00 ^b	0.03±0.01 ^b	0.02±0.01 ^b	0.04±0.06 ^b	0.19±0.11 ^a	0.14±0.06 ^a
Ash	0.07±0.00 ^a	0.01±0.00 ^d	0.01±0.00 ^d	0.05±0.00 ^b	0.06±0.00 ^{ab}	0.05±0.01 ^b	0.02±0.00 ^c	0.03±0.00 ^c	0.05±0.01 ^b
Protein	0.78±0.05 ^e	0.25±0.11 ^f	0.58±0.43 ^{ef}	1.21±0.00 ^d	1.60±0.17 ^c	3.00±0.30 ^b	1.19±0.21 ^d	3.48±0.09 ^a	3.52±0.17 ^a

^{a-f}Means±SD with different superscripts in the same row differ significantly(p<0.05).

Table 2. Values of pH, VBN, and TBA of extracts extracted from pig skin by temperature and time

Treatments [*]	T1	T2	T3	T4	T5	T6	T7	T8	T9
pH	7.26±0.02 ^c	7.16±0.03 ^c	7.18±0.02 ^c	7.45±0.04 ^b	7.60±0.06 ^b	7.74±0.02 ^b	8.39±0.51 ^a	7.75±0.01 ^b	6.64±0.01 ^d
VBN (mg%)	7.68±1.92 ^c	4.30±0.31 ^d	6.68±1.40 ^c	19.03±0.88 ^a	19.58±0.83 ^a	6.95±1.14 ^c	20.22±1.6 ^a	10.61±0.4 ^b	20.95±0.9 ^a
TBA(mg malonaldehyde/ 1,000g)	0.18±0.02 ^f	0.18±0.04 ^f	0.11±0.00 ^f	0.83±0.11 ^c	0.75±0.06 ^c	0.55±0.12 ^d	3.03±0.06 ^a	0.42±0.06 ^e	1.04±0.12 ^b

^{a-c}Means±SD with different superscripts in the same row differ significantly(p<0.05).

Table 3 Collagen contents of extracts extracted from pig skin by temperature and time

Treatments [*]	T1	T2	T3	T4	T5	T6	T7	T8	T9
Collagen (g/100g)	0.96±0.04 ^d	1.16±0.00 ^c	0.65±0.03 ^f	1.22±0.05 ^c	0.93±0.02 ^d	2.04±0.01 ^a	0.80±0.02 ^e	1.40±0.03 ^b	1.20±0.01 ^c
Soluble collagen (g/100g)	0.26±0.04 ^c	0.59±0.00 ^a	0.02±0.03 ^e	0.36±0.02 ^{cd}	0.36±0.02 ^b	0.04±0.01 ^e	0.24±0.02 ^c	0.05±0.03 ^e	0.14±0.01 ^d

^{a-f}Means±SD with different superscripts in the same row differ significantly(p<0.05).

IV. CONCLUSION

As the extraction temperature and time increased, the protein and fat contents of pig skin extract increased, but total collagen and soluble collagen contents showed no consistent results with treats. Total collagen content was the highest at T6 (80 °C, 12 h) and soluble collagen was the highest at T2 (65 °C, 8 h). Therefore, the optimal extraction conditions for extracting pig skin collagen were determined to be range of 65-80 °C and 8-12 hours, and further study is required for detailed extraction conditions.

ACKNOWLEDGEMENTS

This work (Grants No. C0505236) was supported by Business for Cooperative R&D between Industry, Academy, and Research Institute funded Korea Small and Medium Business Administration in 20.

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