COMPARISON OF PHYSICO-CHEMICAL CHARACTERISTICS OF EXTRACTS FROM VARIOUS BONES IN HANWOO CATTLE

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Abstract – This study was conducted to investigate the physico-chemical characteristics of various bone extracts in Hanwoo cattle. Experimental design was as follows (T1: Shank bone extract, T2: Tail extract, T3: Beef feet extract, T4: The other bones extract). In the proximate composition, the T1 and T2 showed higher moisture and fat contents than those of T3 and T4 ($p<0.05$), and the T3 had the highest protein content among the bone extracts ($p<0.05$). The quality properties including sugar content, salinity, turbidity and yellowness (b^*) values were significantly higher in the T3 than the other extracts ($p<0.05$). However, the pH value of T3 was significantly lower than the other extracts. In conclusion, T3 (Beef feet extract) exhibited superior physico-chemical characteristics compared to those of the other bone extracts. These results could be suggested to be the basis information for further research using Hanwoo bone extract.

Key Words – bone extract, Hanwoo cattle, beef feet

I. INTRODUCTION

In Korea, edible bones of Hanwoo cattle are composed of shank bone, rib bone, tail, knee bone, and the other bones, and in general these bones are consumed as extracts "Gomtang" by heating at high temperature with water. The bones are distributed on market cheaply [1, 2]. On the other hand, recently nutritional importance of microelements in human diets has gained attention. Among these, calcium is one of the components that can be most insufficient in human diets. Especially, calcium derived from bovine bone is an effectively available calcium source because of higher calcium bioavailability than other calcium sources [3]. Deficiency of calcium intake is closely related to growth and bone maintenance, osteoporosis, fractures, and bone diseases [4]. However, globally countries which eat soups extracted from bovine bones are very rare, and studies related to this eating culture are rarely found except for research in Korea. Thus, this study was conducted to investigate the proximate composition, quality and sensory characteristics of various bone extracts in Hanwoo cattle.

II. MATERIALS AND METHODS

Commercial shank bone (T1), tail (T2), beef feet (T3) and the other bones (T4) in Hanwoo cattle were purchased from a local market. Visible impurities, subcutaneous debris, and excessive connective tissues were removed from bones. The bones were washed thrice with water, and this water was discarded. The extraction process was performing by adding 10 L distilled water to the 5 kg bones and boiling them 100 ℃ heat during 6 hours. The extracts were used for analysis of physico-chemical characteristics (proximate composition, pH, sugar content, salinity, turbidity, color). 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

The proximate composition of various bone extracts are presented in Table 1. The moisture contents of bone extracts were in the range of 98.34–99.44%, and then T1 and T2 had higher moisture contents than those of T3 and T4 ($p<0.05$). The fat contents of bone extracts were in the range of 0.04–0.23%, and the fat contents also had higher in the T1 and T2 than T3 and T4 ($p<0.05$). The T3 showed the highest protein content among the bone extracts ($p<0.05$). The ash contents were in the range of 0.01–0.02%, and there were no significant differences among the treatments.

The quality properties of various bone extracts are presented in Table 2. The pH value of T4 was 7.64, which was the highest compared to the other extracts ($p<0.05$), and the range of pH values were 7.10-7.64. The sugar contents

were in the range of 1.13-2.70%, and the T3 showed the highest value as 2.70% ($p<0.05$). The T3 had the highest values for 2.30% salinity and 0.36% turbidity among the bone extracts ($p<0.05$). The reason that the highest salinity and turbidity values in the T3 was probably due to the high contents of connective tissues in beef feet. In the hunter color, the lightness (L^*) values had no significant differences in the treatments, and the redness (a^*) values showed 0.27-0.73 ranges. In the yellowness (b^*) values, the T3 had the highest, and T1 had the lowest among the extracts ($p<0.05$).

Table 1. Proximate composition of various bone extracts in Hanwoo cattle (%)

Treatments*	T1	T2	T3	T4
Moisture	99.30±0.12^{a}	99.44±0.02^{a}	98.34±0.12^{c}	99.11±0.01^{b}
Fat	0.20±0.02^{a}	0.23±0.02^{a}	0.04±0.00^{b}	0.05±0.00^{b}
Protein	0.73±0.00^{bc}	0.56±0.00^{c}	2.05±0.23^{a}	0.86±0.01^{b}
Ash	0.01±0.00	0.02±0.01	0.02±0.00	0.01±0.00

* T1 : Shank bone extract, T2 : Tail extract, T3 : Beef feet extract, T4 : The other bones extract
$^{a-c}$Means±SD with different superscripts in the same row differ significantly ($p<0.05$).

Table 2. Quality properties of various bone extracts in Hanwoo cattle

Treatments*		T1	T2	T3	T4
pH		7.27±0.00^{b}	7.14±0.00^{c}	7.10±0.00^{d}	7.64±0.00^{a}
Sugar content (%)		1.23±0.15^{bc}	1.40±0.17^{b}	2.70±0.10^{a}	1.13±0.05^{c}
Salinity (%)		1.10±0.10^{b}	0.93±0.05^{c}	2.30±0.10^{a}	1.00±0.00^{bc}
Turbidity (%)		0.15±0.00^{d}	0.18±0.00^{c}	0.36±0.01^{a}	0.26±0.00^{b}
Hunter color[1)]	L^*	31.40±1.11	30.69±1.90	32.67±3.43	30.35±1.86
	a^*	0.73±0.11^{a}	0.31±0.12^{bc}	0.52±0.20^{ab}	0.27±0.16^{c}
	b^*	0.32±0.24^{c}	1.65±0.68^{b}	3.25±0.64^{a}	2.30±0.35^{b}

* T1 : Shank bone extract, T2 : Tail extract, T3 : Beef feet extract, T4 : The other bones extract
[1)] L^*: lightness, a^*: redness, b^*: yellowness
$^{a-d}$Means±SD with different superscripts in the same row differ significantly ($p<0.05$).

IV. CONCLUSION

We analyzed the physico-chemical characteristics of various bone extracts in Hanwoo cattle, and it is thought that beef feet extract exhibited superior physico-chemical characteristics compared to those of the other bone extracts. Also, these results could be suggested to be the basis information for further research using Hanwoo bone extract.

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