Effect of Different Chicken Breeds as Raw Materials of Chuncheon Dakgalbi on the Quality Characteristics and Storage Quality in Combination with Modified Atmosphere Packaging

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Abstract- **This study was conducted to evaluate the quality characteristics of Chuncheon Dakgalbi made from different chicken breeds and packed with modified atmosphere packaging (MAP). Chuncheon Dakgalbi were prepared from four different meat sources, those are Korean Native Chicken Woorimatdak (KNC-Woori), Korean Native Chicken Hanhyup 3 (KNC-Hanhyup), Broiler grade 13, and Broiler grade 18. Chuncheon Dakgalbi were prepared by mixing/dipping the meat in chili pepper sauce. The proximate results showed that KNC-Woori contained highest fat and lower pH, and broiler both grade 13 and 18 contained highest protein, lower fat, higher pH, and higher scores of cooked sensory evaluation such as texture and overall liking. On storage quality studies, the Chuncheon Dakgalbi were packed with Air-Packaging (Air-P) and 30% CO_2 MAP (0%O_2:30%CO_2:70%N_2), and stored for 10 d at temperature 5 ^oC. The 30% CO_2-MAP decreased the protein deterioration (VBN) on 4 and 7 d, and lipid oxidation on 7 and 10 d of storage, in all kind of chickens. It was noted that Air-P sharply resulted high concentration of carbondioxide in head space during storage. However, no clear evidence was observed as the effect of different chicken materials. It is suggested to use the 30% CO_2-MAP for Chuncheon Dakgalbi packaging methods.**

Keywords-**Chuncheon Dakgalbi, Chicken breeds, Storage quality.**

I. INTRODUCTION

Chuncheon Dakgalbi is local cuisine in Chuncheon city, Kangwon province, Korea, made by stir-frying chicken, mixed with chili pepper paste (sauce), sliced cabbage, sweet potato and other ingredients in a hot plate. The raw material used in Chuncheon Dakgalbi is limited only with broiler meat. In other hand, Korea has its own native chicken that possibly be used as material of Chuncheon Dakgalbi.

Some researchers reported the different quality was observed from different breeds including native and even cross-breed. South africa's native chicken was higher in sensory evaluation score than commercial broiler on sensory evaluation [1]. [2] reported the higher quality and bioactivity of China's black-bone silky chicken than Lingnan yellow chicken and Chongren chicken. [3] also reported that Thailand native chicken was stronger in antioxidant activity and higher in carnosine content compared to mixed hybrid chicken.

Until now, there is no published paper reported the diversification of chicken breeds as raw material of Chuncheon Dakgalbi. This research was conducted to evaluate the effect of different chicken breeds as raw material of Chuncheon Dakgalbi on the quality characteristic and storage quality in combination with MAP.

II. MATERIALS AND METHODS

A. Sample preparation

Chuncheon Dakgalbi were prepared from four different meat sources, those are Korean Native Chicken Woorimatdak (KNC-Woori), Broiler grade 13, Broiler grade 18, and Korean Native Chicken Hanyup 3 (KNC-Hanhyup). The raw chicken from four different breeds were mixed and dipped with chili pepper sauce. On storage quality studies, the Chuncheon Dakgalbi were packed with Air-Packaging (Air-P) and 30% CO_2 MAP (0%O_2: 30%CO_2: 70%N_2), and stored for 10 d at temperature 5 ^oC.

B. Proximate analysis

The proximate analysis including moisture, crude ash, crude protein and crude fat was performed by AOAC methods as described in [4].

C. The pH measurement

Briefly, 10 g of sample was added with 100 mL distilled water and then homogenized at 10,000 rpm for 60 sec using a homogenizer (PH91, SMT Co. Ltd., Japan), and the pH was measured using a pH meter (SevenEasy pH, Mettler-Toledo GmbH, Switzerland).

D. Thiobarbituric acid reactive substance (TBARS) value

The TBARS value was measured according to [5]. Briefly, 0.5 g sample was mixed with 3 drops of antioxidant solution, 3 mL of TBA solution, and 17 mL of 25% Trichloroacetic acid. The mixture was heated at 100^{o}C for 30 min, and centrifuged at 3,500 rpm for 30 min. An absorbance of supernatant was measured at 532 nm using a spectrophotometer (UV-mini-1240, Shimadzu, Japan). The results were calculated as mg malonaldehyde (MA) per kg sample.

E. Volatile basic nitrogen (VBN) value

The VBN (volatile basic nitrogen) value was measured according to [6]. Briefly, 5 g sample was homogenized with 30 ml 5% TCA using a homogenizer (Ultra Turrax T25 basic, Ika Werke Gmbh & Co., Germany) at 13,500 rpm for 2 min. The homogenate was made up to 50 ml of final volume with 5% TCA and filtered using Whatman filter paper No. 1. One millimeter of filterate and 1 ml of borate buffer were placed in outer and inner of Conway dish, respectively, and incubated at 37^{o}C for 100 min. The inner solution was titrated with 0.01N HCl.

F. Gas composition

Before opening the packs, the gas composition in the head space of pack was measured using gas analyzer (DK Checkmate 9900, PBI Dansensor, Denmark) to check O_2 and CO_2 composition.

G. Sensory evaluation

A Panel contained of tenth laboratory members scored the visual color, taste, flavor and overall likeness of Chuncheon Dakgalbi. The hedonic scores were 1=very dislike, 3=dislike, 5=normal, 7=like, 9=very like.

H. Statistical analysis

All data were analyzed using SPSS 14.0 for Windows Evaluation Version (2005).

III. RESULTS AND DISCUSSION

A. Proximate analysis and pH value

Proximate analysis and pH value of Chuncheon Dakgalbi from different chicken breeds were presented in Table 2. The moisture content of Broiler grade 18 was lower compared to other breeds. Thigh meat of KNC-Hanhyup was lower in fat content and crude ash. In general, breast contained higher level of crude protein than thigh meat in all breeds, except in Broiler grade 18 was same. The pH value of thigh meat also was higher compared to breast meat, regardless the chicken breeds.

B. TBARS and VBN Value

On 1 d of storage, the TBARS value in all chicken breeds packed with two gas compositions was same except of KNC-Woori packed with Air-P was lower (Table 3). As the increasing of storage time, the 30%-MAP detained the lipid oxidation (lower TBARS value) in all chicken breeds. No clear different was found on TBARS value of different chicken breeds. The VBN value was presented on Table 3. On 1 d, the VBN value of Chuncheon Dakgalbi packed with 30%-MAP tended to be higher than Air-P regardless the chicken breeds. As the storage time increased, the VBN value of Air-P was higher compared to 30%-MAP regardless the chicken breeds. [7] mentioned the factors affected the lipid oxidation, such as oxygen concentration, lighting, temperature, the presence of pro- and antioxidant, the saturation degree of fatty acids and the presence of enzymes.

C. Sensory evaluation

The panelist consisted of 10 laboratory members conducted the sensory evaluation, and the scores were presented in Table 1. On juiceness, taste and flavor, no different were found among chicken breeds. Panelists scored a lower point on texture and overall acceptability of KNC-Woori and KNC-Hanhyup. The broiler grade 13 showed the highest score of overall acceptability among chicken breeds.

Table 1. Effect of different chicken breeds as raw materials of Chuncheon Dakgalbi packed with modified atmosphere packaging on the sensory evaluation scores

Breeds	Juiciness	Taste & Flavor	Texture	Overall acceptability
KNC-Woori	5.4±1.2[a]	5.2±1.3[a]	4.0±1.2[b]	4.8±1.1[ab]
KNC-Hanhyup	5.4±1.2[a]	5.2±1.2[a]	4.4±1.2[b]	4.6±1.2[b]
Grade 18	5.6±1.2[a]	5.0±1.2[a]	5.2±1.1[a]	5.2±1.1[ab]
Grade 13	5.4±1.2[a]	5.0±1.2[a]	5.6±1.2[a]	5.4±1.2[a]

[a,b]Means±S.D. in the same row with different superscripts are significantly different (P <0.05).

D. Gas composition

The O_2 concentration decreased and CO_2 increased during the storage in Air-P (Fig 1), but the changes of O_2 and CO_2 changes were more evident in KNC-woori and KNC-Hanhyup. The O_2 concentration decreased until below 5% on 7 d of storage on KNC-Woori packed with Air-P, and on 10 d of storage on KNC-Hanhyup, while O_2 concentration of Broiler grade 13 and 18 were below 15% on the end of storage. The decreased of O_2 and the increased of CO_2 might be caused by the microbial growth on the packs. During storage, the microorganism on the meat utilized the O_2 in the headspace while some other meat microflora and lactic acid bacteria produce carbon dioxide from metabolism [8]. More over, [9] added that both muscle respiration and microbial growth are responsible for O_2 consumption and CO_2 production. The more dramatically decreased of O_2 and increased of CO_2 consequently in KNC-Woori and KNC-Hanhyup packed with air packaging, showed that the microbial growth in KNC-Woori and KNC-Hanhyup might be greater than in Broiler grade 13 and 18.

In MAP the O_2 concentration was maintained 0% during the storage and the CO_2 concentration were decreased on 1 d of storage followed by relatively constant concentration from 4 to 10 d of storage. The trends of lower CO_2 concentration were observed in KNC-Woori and Broiler grade 18 from 4 to 10 d of storage. The declined of CO_2 might be due to the absorption of CO_2 in meat [9]. Since 0% O_2 and 30% CO_2 were applied in this study, aerobic bacteria could not growth on the meat. And so, the produce of CO_2 as metabolism product were small (unlike in air packaging), this might be the reason of the relatively constant gas composition in MAP.

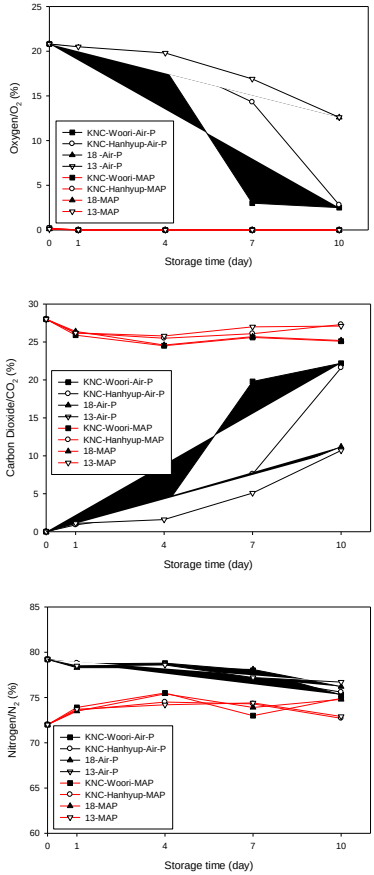

Fig 1. Gas composition of Chucheon Dakgalbi packed with MAP during storage.

IV. CONCLUSION

No clear evidence was observed as the effect of different chicken materials to the quality of Chuncheon Dakgalbi. However, for packaging methods, it is suggested to use the 30% CO_2-MAP for Chuncheon Dakgalbi.

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Table 2. Proximate analysis of KNC, Cross KNC, Broiler grade 13 and grade 18.

Breeds	Parts	Chemical composition				PH
		Moisture	Crude lipid	Crude protein	Crude ash	
KNC-Woori	Breast	74.55±0.78^{ab}	2.56±0.59^{c}	21.96±0.15^{a}	0.93±0.10^{bc}	5.94±0.08^{e}
	Thigh	75.21±0.18^{a}	5.11±0.25^{a}	18.85±0.57^{b}	0.83±0.02^{cd}	6.73±0.10^{b}
KNC-Hanhyup	Breast	74.90±0.83^{ab}	1.67±0.35^{cd}	22.51±1.62^{a}	0.91±0.03^{c}	5.89±0.08^{e}
	Thigh	75.92±0.80^{a}	3.72±0.71^{b}	19.58±0.89^{b}	0.78±0.14^{d}	6.65±0.17^{b}
Grade 18	Breast	73.15±0.30^{ab}	1.89±0.18^{cd}	23.94±0.68^{a}	1.02±0.02^{ab}	6.10±0.08^{d}
	Thigh	71.61±2.67^{b}	4.28±0.74^{ab}	23.24±0.89^{a}	0.86±0.01^{cd}	6.78±0.09^{ab}
Grade 13	Breast	74.70±0.08^{ab}	0.85±0.13^{d}	23.35±0.57^{a}	1.10±0.04^{a}	6.35±0.15^{c}
	Thigh	74.81±1.13^{ab}	5.27±0.87^{a}	19.00±0.43^{b}	0.92±0.07^{bc}	6.90±0.03^{a}

^{a,e}Means±S.D. in the same row with different superscripts are significantly different (P <0.05).

Table 3. Effect of different chicken breeds as raw materials of Chuncheon Dakgalbi packed with modified atmosphere packaging on the TBARS value during storage

	Breeds	Air / O_2:CO_2:N_2	Storage periods (day)			
			1	4	7	10
TBARS	KNC-Woori	Air	0.69±0.09^{b}	0.87±0.15^{bc}	1.25±0.17^{ab}	1.74±0.09^{bc}
		0:30:70	0.90±0.10^{a}	0.95±0.26^{ab}	1.01±0.08^{cd}	1.63±0.04^{c}
	KNC-Hanhyup	Air	0.83±0.11^{a}	0.93±0.28^{ab}	1.11±0.09^{bc}	2.05±0.10^{a}
		0:30:70	0.88±0.06^{a}	0.97±0.29^{ab}	1.11±0.14^{bc}	1.90±0.10^{ab}
	Big Broiler	Air	0.82±0.11^{a}	0.97±0.13^{ab}	1.09±0.12^{c}	2.07±0.20^{a}
		0:30:70	0.82±0.05^{a}	0.83±0.13^{c}	0.92±0.12^{d}	1.69±0.28^{bc}
	Broiler	Air	0.80±0.09^{a}	1.04±0.11^{a}	1.34±0.25^{a}	1.65±0.08^{c}
		0:30:70	0.88±0.17^{a}	0.87±0.13^{bc}	0.96±0.11^{cd}	2.01±0.18^{a}
VBN	KNC-Woori	Air	23.81±1.40^{b}	36.00±4.51^{ab}	41.46±3.03	48.37±5.96^{ab}
		0:30:70	24.18±2.83^{ab}	35.72±0.96^{ab}	39.01±6.30^{ab}	46.13±25.67^{b}
	KNC-Hanhyup	Air	22.22±2.53^{b}	32.08±6.43^{b}	37.98±8.19^{ab}	45.69±14.96^{a}
		0:30:70	24.65±0.56^{ab}	29.41±3.35^{b}	30.25±1.52^{c}	38.10±8.55^{b}
	Big Broiler	Air	25.21±1.75^{a}	40.48±6.18^{a}	40.90±6.61^{a}	63.51±13.02^{a}
		0:30:70	25.21±1.48^{a}	27.66±4.34^{b}	34.17±1.45^{abc}	41.28±9.12^{b}
	Broiler	Air	22.69±1.75^{b}	31.09±3.59^{b}	35.46±1.89^{abc}	39.22±3.91^{b}
		0:30:70	25.77±1.12^{a}	30.33±8.35^{b}	32.77±1.48^{bc}	35.25±11.12^{b}

^{a,d}Means±S.D. in the same row with different superscripts are significantly different (P <0.05).