

EFFECT OF CINNAMON POWDER ON FLAVOUR IMPROVEMENT OF FRIED KOREAN NATIVE CHICKEN

Yousung Jung¹, Dong-Jin Shin¹, Soomin Oh¹, Dongwook Kim¹, Anneke¹, Ki-Chang Nam²,
Cheorun Jo³, Jun-Heon Lee⁴, Hyo-Jun Choo⁵ and Aera Jang^{1*}

¹Department of Applied Animal Science, Kangwon National University, Korea

²Department of Animal Science and Technology, Suncheon National University, Korea

³Department of Agricultural Biotechnology, Seoul National University, Korea

⁴Division of Animal and Dairy Science, Chungnam National University, Korea

⁵Poultry Research Institute, National Institute of Animal Science, Korea

*Corresponding author email: ajang@kangwon.ac.kr

I. INTRODUCTION

Korean native chicken (KNC) has been consumed in Korea due to its low fat and cholesterol, as well as its indigenous flavour and texture. Woorimatdag No. 1 (WRMD1) is an improved KNC breed developed to solve the major challenge of a long rearing period. During preservation of meat, freezing and subsequent thawing can result in low sensory perception of the meat. Additionally, long-term thawing processes, which can occur at the retail level, have been linked to lipid oxidation, resulting in adverse effects on meat flavour [1]. Cinnamon is a flavouring and antioxidant agent that has been used to reduce warmed-over flavour in pork and beef. Thus, the aim of this study was to determine the effect of cinnamon powder on the flavour improvement of long-term thawed WRMD1 drumsticks after deep-frying.

II. MATERIALS AND METHODS

The WRMD1 drumstick (n=25) was divided into five groups: conventional thawing (16 h, OS), long-term thawing (48 h, FE), long-term thawing with cinnamon powder added as marinade (0.03%, CM) or batter (1.35%, CB), and long-term thawing with cinnamon powder added as both marinade and batter (0.03% + 1.35%, CMB). Each drumstick was marinated (4°C, 24 h), dipped in the batter, and then fried in a mixture of soybean and rapeseed oil (180°C, 8 min). Sensory evaluation was conducted using a 9-point hedonic scale for aroma, flavour, and overall acceptability (1=extremely undesirable, 9=extremely desirable), and off-flavour (1=intense off-flavour, 9=no off-flavour). Volatile organic compounds (VOC) were analyzed using headspace solid-phase microextraction and Agilent 8890 gas chromatography coupled with Agilent 5977B mass spectrometer (5 replicates). Data were expressed as the standard error of the mean using SAS software (v.9.4).

III. RESULTS AND DISCUSSION

Compared to OS, all the alcohols and hexanal, 5-methyl- tended to increase in FE. 1-Octen-3-ol (raw, mushroom odour) is usually formed from the oxidation of linoleic acid [2]. 1-Octanol (mushroom, green odour) is an expected spoilage-related VOC, while 2-octen-1-ol, (E) (green, plastic odour) could be correlated with lipid oxidation [3]. In this study, all cinnamon-added treatments showed a significant decrease in these alcohols, which may be due to the antioxidant capacity of cinnamon powder. A similar phenomenon was also found in aldehydes. Hexadecanal (cardboard odour), which increases with lipid oxidation, disappeared in all cinnamon treatments compared to FE ($P>0.05$). Cinnamaldehyde (E) is a unique VOC found in cinnamon treatments, contributing to the cinnamon flavour in fried drumstick. Pyrazines are Maillard reaction products that contribute to the baked and roasted aroma of meat. Both CM and CB showed an increasing propensity of the presented pyrazines (Table 1), whereas a decline was observed in CMB compared to FE. 2,3-Butanedione

(butter, caramel odour) belongs to 2-ketones, which are typical flavour contributors to meat products. It was identified only in OS and CM. After long-term thawing, aroma and off-flavour showed a decreasing tendency in FE compared to OS (Table 2). Both CM and CMB received higher aroma scores than FE ($P < 0.05$). In off-flavour, both CM and CB received a higher tendency of off-flavour scores than FE. Additionally, a significant improvement in off-flavour was observed in CMB. Based on the higher aroma and off-flavour scores of CMB, flavour and overall acceptability also tended to be higher in CMB.

Table 1. Volatile organic compounds ($AU \times 10^6$) of fried Woorimatdag No. 1 drumstick by cinnamon powder

Trait	m/z	LRI	OS	FE	CM	CB	CMB	SEM	P-value
1-Octanol	56.1	1077	0.17 ^{ab}	0.25 ^a	0.07 ^c	0.10 ^{bc}	0.08 ^{bc}	0.021	<0.001
1-Octen-3-ol	57.1	969	5.58 ^{ab}	8.31 ^a	2.33 ^b	3.12 ^b	2.55 ^b	0.813	<0.001
2-Octen-1-ol, (E)	57.1	1073	0.27 ^a	0.34 ^a	ND ^b	ND ^b	ND ^b	0.049	<0.002
Cinnamaldehyde, (E)-	131	1273	ND ^c	ND ^c	0.67 ^b	0.14 ^{bc}	2.17 ^a	0.138	<0.001
Hexadecanal	57.1	1816	0.02	0.02	ND	ND	ND	0.005	<0.001
Pyrazine, 2-ethyl-6-methyl-	121.1	988	1.27 ^{bc}	1.24 ^{bc}	1.64 ^a	1.47 ^{ab}	0.96 ^c	0.087	<0.001
Pyrazine, 3-ethyl-2,5-dimethyl-	135	1082	2.55 ^{ab}	2.99 ^{ab}	3.37 ^a	3.60 ^a	1.92 ^b	0.277	<0.001
Pyrazine, trimethyl-	122.1	993	2.69 ^{ab}	2.43 ^b	3.30 ^a	3.00 ^{ab}	1.35 ^c	0.159	<0.001
2,3-Butanedione	43	581	0.03 ^b	ND ^c	0.10 ^a	ND ^c	ND ^c	0.006	<0.001

OS, thawing for 16 h; FE, thawing for 48 h; CM, 'FE' with 0.03% cinnamon marinade; CB, 'FE' with 1.35% cinnamon batter; CMB, 'FE' with 0.03% cinnamon marinade and 1.35% cinnamon batter.

^{a-c} Means within same row with different superscript letters differ significantly ($P < 0.05$). SEM, standard error of mean. LRI, linear retention index. ND, not detected. m/z, mass to charge ratio.

Table 2. Sensory characteristics of fried Woorimatdag No. 1 drumstick by cinnamon powder

Trait	OS	FE	CM	CB	CMB	SEM	P-value
Aroma	7.20 ^{ab}	6.20 ^b	7.53 ^a	7.13 ^{ab}	7.53 ^a	0.296	<0.001
Flavour	6.93	6.53	7.20	7.20	7.67	0.322	<0.001
Off-flavour	6.60 ^{ab}	6.07 ^b	7.47 ^{ab}	7.33 ^{ab}	7.80 ^a	0.375	<0.001
Overall acceptability	6.87	6.47	7.33	7.13	7.60	0.286	<0.001

OS, thawing for 16 h; FE, thawing for 48 h; CM, 'FE' with 0.03% cinnamon marinade; CB, 'FE' with 1.35% cinnamon batter; CMB, 'FE' with 0.03% cinnamon marinade and 1.35% cinnamon batter.

^{a,b} Means within same row with different superscript letters differ significantly ($P < 0.05$). SEM, standard error of mean.

IV. CONCLUSION

This result suggests that cinnamon powder is an effective treatment for enhancing the organoleptic properties of long-term thawed WRMD1 drumstick after deep-frying. It provides cinnamon, baked, and roasted odour, while reducing or masking off-flavour and lipid oxidation-related compounds.

ACKNOWLEDGEMENTS

Authors thank to support of "Cooperative Research Program for Agriculture Science and Technology Development" (Project No. PJ016205) of the Rural Development Administration, Korea

REFERENCES

- Leygonie, C., Britz, T. J. & Hoffman, L. C. (2012). Impact of freezing and thawing on the quality of meat. *Meat Science* 91:93-98.
- Chang, C., Wu, G., Zhang, H., Jin, Q. & Wang, X. (2020). Deep-fried flavour: Characteristics, formation mechanisms, and influencing factors. *Critical Reviews in Food Science and Nutrition* 60:1496-1514.
- Mielnik, M. B., Olsen, E., Vogt, G., Adeline, D. & Skrede, G. (2006). Grape seed extract as antioxidant in cooked, cold stored turkey meat. *LWT* 39:191-198.