71st ICoMST
GIRONA - CATALONIA - SPAIN
3rd-8th August - 2025

VOLATILE COMPONENTS AND SENSORY PROFILE OF RESTRUCTURED SALMON NUGGETS FORMULATED WITH COFFEE SILVER SKIN

Dayane de Darias[1], Sonia Ventanas[3], Yulong Bao[2], Mario Estévez[3], Taliana Bezerra[1], David Morcuende[3]

[1] State University of Paraiba, Joao Pessoa, Brazil; [2] Jiangsu University, Zhenjiang, China; [3] University of Extremadura, Cáceres, Spain

*Presenting author: Yulong Bao; Corresponding authors email: demorcuen@unex.es; mariovet@unex.es.

I. INTRODUCTION

Food scientists are challenged to fulfil the consumer's demand for convenient and palatable muscle foods, while still being nutritious and safe. Ready-to-eat (RTE) muscle foods are of common use in supermarkets owing to their ease to use and convenience. However, the susceptibility to oxidation reduces their shelf life, affects their sensory quality and leads to safety concerns. Consumers' increasingly concern on the use of classic additives explains the growing interest in the so called "*clean-label*" foods. In such foods, conventional additives are replaced by plant-based antioxidants which have been found to be promising for RTE muscle foods [1]. Silver skin is a thin layer tightly adherent to coffee seeds and contains protein, dietary fiber, phenolic compounds, and melanoidins, etc [2]. Since it is a waste material from coffee production, its recycling in the design of muscle foods could be an interesting approach to fulfilling several objectives: i) promote circular economy; ii) reduce the number of classic additives; ii) enhance the quality and safety of processed muscle foods. Warmed-over flavor (WOF) is a common challenge in ready-to-eat meat products, and Martuscelli et al. (2021) demonstrated that addition of coffee silver skin effectively reduced WOF in chicken meat burgers [2]. The present paper was aimed at investigating the role of coffee silver skin on the volatile components and sensory profile of ready-to-eat restructured salmon nuggets after cold storage.

II. MATERIALS AND METHODS

Salmon (*Salmo salar* L.) trimmings were obtained from a local supermarket in Cáceres (Spain) used as a pertinent model of muscle foods with high susceptibility to oxidation. Restructured salmon nuggets (cubes of approx. 2 cm height x 3 width x 4 cm long) were produced by adding 0.2% transglutaminase to trimmings (approx. 0.2 cm^3 particle size) along with 2% NaCl and 3.5% water and kept at chilling temperatures (4ºC) overnight. Two groups were produced depending on the addition (or absence) of silver skin (0.5%), namely, CONTROL and SILVER. Silver skin was obtained from Zeris Coffee Roaster (Cáceres, Spain). All samples were grilled (250ºC/2 min) and subsequently stored in an oxygen-permeable film at 4ºC for 14 days. Samples were analyzed for lipid-derived volatile compounds (SPME-GC-MS) [3] and sensory profile (QDA) by a trained sensory panel (n=10 panelists) [4]. The entire experiment was carried out in triplicate and all analyses were made in duplicate (n=6). Data was analyzed by a student "t" test.

III. RESULTS AND DISCUSSION

Salmon nuggets with the addition of coffee silver skin had very low concentrations of lipid oxidation-derived volatile compounds (Table 1). Many of the characteristic volatile compounds from lipid oxidation, including 2,3-Pentanedione, Pentanal, 2-Heptanone, 4-Heptenal, and 1-Octen-3-ol, were not detected in the silver skin group. Hexanal generation has been successfully used for evaluation of the oxidative state of red meats from different species as well as fish. It was found that hexanal was the dominant volatile compound in the control group, and its generation was largely inhibited with the addition of coffee silver skin. Similar results were reported by Martuscelli et al. (2021) who found that addition of coffee silver skin in chicken burgers could completely inhibit the production of hexanal, along with reduced lipid oxidation and reduced WOF [2]. Despite of a significant reduction in the lipid oxidation-derived volatile compounds, sensory panel did not detect a significant difference in the rancid flavor or WOF in SILVER group (Table 2). The addition of coffee silver skin led to significant differences in sensory traits including pink color, fish odor, fresh fish flavor and bitterness. However, the overall liking was not affected.

Table 1. Lipid oxidation-derived volatile compounds (area, $\times 10^5$) of the salmon nuggets after cold storage for 14 days.

Compounds	CONTROL	SILVER	P-value[a]
2,3-Pentanedione	2.06±0.75	nd	***
Pentanal	2.25±0.80	nd	***
2-Hexanone	1.40±0.40	0.10±0.02	***
Hexanal	30.85±8.88	1.04±0.19	***
2-Heptanone	0.10±0.01	nd	***
4-Heptenal	0.34±0.12	nd	***
Heptanal	1.78±0.50	0.23±0.09	***
1-Octen-3-ol	0.51±0.27	nd	***
Nonanal	0.63±0.18	0.19±0.04	***

[a]the significance level: *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$; ns, not significant, $p > 0.05$

Table 2. Sensory analysis of the salmon nuggets after cold storage for 14 days.

Sensory traits	CONTROL	SILVER	P-value[a]
Pink color	1.78 ± 0.86	7.05 ± 1.60	***
Fish odor	8.43 ± 0.89	4.63 ± 2.08	***
Juiciness	6.77 ± 1.48	5.30 ± 1.74	ns
Fibrousness	3.22 ± 1.65	3.31 ± 1.84	ns
Fresh fish flavor	7.31 ± 1.44	3.21 ± 1.69	***
Rancid flavor	0.63 ± 0.36	1.04 ± 1.00	ns
WOF	1.91 ± 1.30	2.61 ± 1.72	ns
Saltiness	4.77 ± 2.08	4.18 ± 1.75	ns
Sourness	0.58 ± 0.51	0.63 ± 0.53	ns
Bitterness	0.45 ± 0.20	1.32 ± 0.36	***
Overall liking	6.83 ± 1.36	5.88 ± 1.61	ns

[a]the significance level: *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$; ns, not significant, $p > 0.05$

IV. CONCLUSION

This study showed that coffee silver skin can be used as an effective natural antioxidant towards lipid oxidation in ready-to-eat restructured salmon nuggets. The amount of lipid oxidation-derived volatile compounds was very low even after cold storage for 14 days. While the incorporation of silver skin led to some perceived sensory changes regarding color, fish odor, and bitterness, the overall liking of the salmon nuggets was not negatively affected.

REFERENCES

1. Estévez, M. (2021). Critical overview of the use of plant antioxidants in the meat industry: Opportunities, innovative applications and future perspectives. Meat Science, 181: 108610.
2. Martuscelli, M., Esposito, L., & Mastrocola, D. (2021). The role of coffee silver skin against oxidative phenomena in newly formulated chicken meat burgers after cooking. Foods, 10: 1833.
3. Estévez, M., Morcuende, D., Ventanas, S., & Cava, R. (2003). Analysis of volatiles in meat from Iberian pigs and lean pigs after refrigeration and cooking by using SPME-GC-MS. Journal of Agricultural and Food Chemistry, 51: 3429-3435.
4. Ventanas, S., González-Mohino, A., Estévez, M., & Carvalho, L. (2020). Innovation in sensory assessment of meat and meat products. In Biswas, A.K., & Mandal, P.K., Meat quality analysis-Advanced Evaluation Methods, Techniques, and Technologies, (pp 393-418). Academic Press.