

# OXIDATIVE STABILITY OF MINCED PORK TREATED WITH COFFEE SILVERSKIN FERMENTED WITH *PLEUROTUS PULMONARIUS* MYCELIUM

Armida Sánchez-Escalante<sup>1\*</sup>, Stephany C. Terán Rivera<sup>1</sup>, Brisa del Mar Torres-Martínez<sup>1</sup>, Nelson Huerta-Leidenz<sup>2</sup>, Félix J. Ibarra-Arias<sup>3</sup>, Gastón R. Torrescano-Urrutia<sup>1</sup> and Rey D. Vargas-Sánchez<sup>1</sup>

<sup>1</sup>Coordinación de Tecnología de Alimentos de Origen Animal, Centro de Investigación en Alimentación y Desarrollo, Mexico

<sup>2</sup>Department of Animal and Food Sciences, Texas Tech University, USA

<sup>3</sup>Alta Tecnología Industrial para la Salud Animal (ATISA), Mexico

\*Corresponding author email: [armida-sanchez@ciad.mx](mailto:armida-sanchez@ciad.mx)

## I. INTRODUCTION

The coffee industry generates a large amount of waste derived from ground processing, which is an important source of antioxidant compounds like polyphenols, including phenolic acids and flavonoids [1]. Recovery of these compounds through extraction methods is a strategy to obtain new additives for enhancing quality of meat and meat products subjected to oxidative damage [1,2]. In this context, fungal-fermentation-assisted extraction is an alternative to conventional methods like maceration-assisted extraction [2]. Therefore, the present work aimed to evaluate the effect of the extract obtained from coffee silverskin (CSS) fermented with *P. pulmonarius* mycelium (PPM) on the oxidative stability of pork homogenates.

## II. MATERIALS AND METHODS

Czapek-Dox medium (100 mL) was used for liquid fermentation, and treatments were as follows: 1) CN (control), medium without PPM; 2) T1, medium + PPM; 3) T2, medium + PPM + 1.5% CSS. After fermentation (150 rpm/29 °C/10 d), the medium was filtered and dried [3]. The resulting extracts were analysed for total phenolic and flavonoid content (TPC and TFC, respectively). Also, 2,2-diphenyl-1-picrylhydrazyl radical (DPPH) and ferric reducing antioxidant power (FRAP) tests were determined. Butylated hydroxytoluene (BHT) was used as a positive control. Also, an aqueous pork homogenate (m. *Semimembranosus*, 1:10 ratio) was treated with the antioxidants, pro-oxidized with potassium ferrocyanide (0.5%, w/v), and tested for pH, thiobarbituric acid reactive substances (TBARS), and metmyoglobin formation (MMb) [4,5]. Obtained data (n=6) were subjected to ANOVA and mean separation (Tukey-Kramer test) at P<0.05 (NCSS v11).

## III. RESULTS AND DISCUSSION

Table 1 indicates that T2 showed the highest (P<0.05) TPC and TFC values. Also, BHT showed the highest (P<0.05) DPPH and FRAP values. However, an increase (P<0.05) in DPPH and FRAP values of fermented samples (T1 and T2) with respect to CN was observed.

Table 1. Polyphenol content and antioxidant activity of coffee silverskin fermented extracts.

Item	Treatments			BHT	SEM	P-value
	CN	T1	T2			
<i>Polyphenols</i>						
TPC (mg gallic acid equivalents/g)	2.00 <sup>a</sup>	5.10 <sup>b</sup>	5.69 <sup>c</sup>		0.032	<0.001
TFC (mg quercetin equivalents/g)	0.06 <sup>a</sup>	0.81 <sup>b</sup>	1.02 <sup>c</sup>		0.005	<0.001

#### Antioxidant activity

DPPH (% inhibition)	8.54 <sup>a</sup>	11.32 <sup>b</sup>	11.28 <sup>b</sup>	73.56 <sup>c</sup>	0.123	<0.001
FRAP (mg Fe <sup>2+</sup> /g)	0.07 <sup>a</sup>	0.24 <sup>b</sup>	0.28 <sup>c</sup>	1.38 <sup>d</sup>	0.019	<0.001

Values expressed as mean ± SD. Different superscript letters within a row indicate differences between treatments (P<0.05).

Using natural extracts in processed meat products has been considered a potential strategy to reduce meat quality loss [1,2]. However, investigations on the use of extracts obtained by fungal fermentation and their use as additives for meat products are still limited. Phenolic compounds are secondary metabolites widely found in agro-industrial residue extracts, which can be used as functional ingredients [2]. In agreement with our study, it has been reported that a natural extract obtained from fermented agro-industrial residues with fungi mycelium exerts antioxidant properties related to the release of bioactive compounds [3].

Results from assays of pro-oxidized meat homogenates (Fig. 1) indicate that T1 and T2 resulted in lower (P<0.05) pH values than CN and BHT, while TBARS and MMb values were significantly reduced by the antioxidant treatments in the following order: BHT>T2>T1.

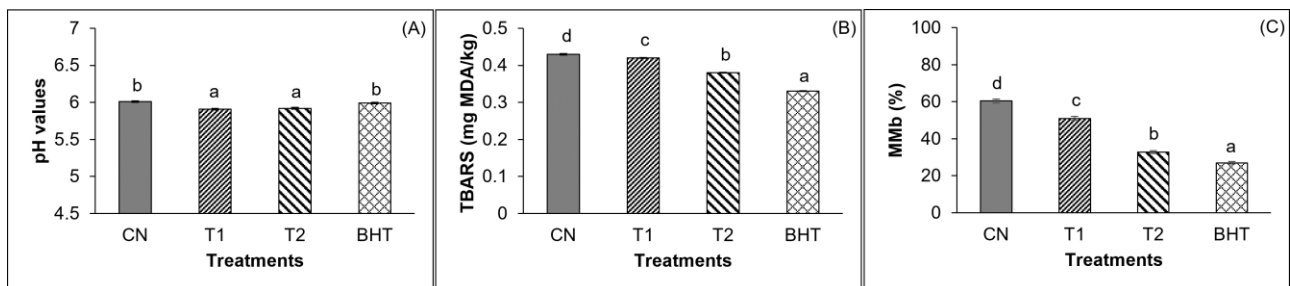


Figure 1. pH (A), TBARS (B), and MMb values (C) of pork meat homogenates subjected to pro-oxidation.

#### IV. CONCLUSION

The addition of the extract obtained from coffee silverskin fermented with *P. pulmonarius* mycelium can improve the oxidative stability of pork meat.

#### ACKNOWLEDGEMENTS

The authors gratefully acknowledge CONACYT for the fellowship of project ID 739, program "Investigadoras e Investigadores por México". A commercial supplier (CAFFENIO®, Sonora, Mexico) donated CSS from dark *Coffea arabica* L.

#### REFERENCES

1. Bondam, A. F., da Silveira, D. D., dos Santos, J. P. & Hoffmann, J. F. (2022). Phenolic compounds from coffee by-products: Extraction and application in the food and pharmaceutical industries. *Trends in Food Science & Technology* 123: 172-186.
2. Vargas-Sánchez, R. D., Torres-Martínez, B. D. M., Torrescano-Urrutia, G. R., Sánchez-Escalante, A. & Esqueda, M. (2021). Extraction of phenolic compounds from agro-industrial by-products by fungal fermentation with potential use as additives for meat and meat products. A review. *Biotechnia* 23: 66-77.
3. Ogidi, C. O., Ubaru, A. M., Ladi-Lawal, T., Thonda, O. A., Aladejana, O. M. & Malomo, O. (2020). Bioactivity assessment of exopolysaccharides produced by *Pleurotus pulmonarius* in submerged culture with different agro-waste residues. *Heliyon* 6: e05685.
4. Ghafar, M. F., Prasad, K. N., Weng, K. K. & Ismail, A. (2010). Flavonoid, hesperidine, total phenolic contents and antioxidant activities from Citrus species. *African Journal of Biotechnology* 9: 326-330.

5. Turan, E. & Şimşek, A. (2021). Effects of lyophilized black mulberry water extract on lipid oxidation, metmyoglobin formation, color stability, microbial quality and sensory properties of beef patties stored under aerobic and vacuum packaging conditions. *Meat Science* 178: 108522.