EDIBLE MUSHROOM EXTRACTS AS AN OXIDATIVE STABILIZER OF RAW AND COOKED PORK PATTIES

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I. INTRODUCTION

During production, processing, distribution, and storage, lipid oxidation (LOX) is a significant cause of chemical spoilage in food systems. To avoid or delay this process, synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) commonly used as food preservatives [1]. However, the use of such antioxidants has related to health risks resulting in strict regulations over their use in foods. Accordingly, there is a strong argument for the search of natural antioxidants as an alternative to prevent deterioration of foods [2]. Thus, the objective of the present study was to determine the effectiveness of *Agaricus brasiliensis*, *Ganoderma lucidum* and *Pleurotus ostreatus* as inhibitors of LOX and color deterioration of raw and cooked pork patties subjected to chilled storage.

II. MATERIALS AND METHODS

Total phenolic compounds and antiradical-DPPH• activity of each aqueous-ethanolic extract (*A. brasiliensis* extract, AE; *G. lucidum* extract, GE; *P. ostreatus* extract, PE) was determined [3]. Besides, pork patties were prepared depending on the addition of extract (0.5 and 1.0%) and following the basic formulation: meat (M. *semimembranosus*) 24 h *postmortem* (83.5%), fat (10%), NaCl (1.5%) and water (5%). In the case of cooked samples, patties grilled until reaching an internal temperature of 71 °C. The formed raw and cooked patties were dispensed in polypropylene trays and wrapped with polyvinyl chloride film (17,400 cm^3 O_2/m^2/24 h at 23 °C). The patties were subjected to storage (2 °C) in the dark for 0 and 9 d, and two packs of each formulation opened for analysis of pH, color and thiobarbituric acid-reactive substances (TBARS) [4]. Data were subjected to ANOVA, as well as to a Tukey comparison test ($P<0.05$).

III. RESULTS AND DISCUSSION

The phenolic compounds are the primary compounds responsible for the antioxidant activity in many natural extracts [3]. The results showed that levels of TPC were 4.9, 21.3 and 31.5 mg gallic acid equivalents/g for AE, GE, and PE, respectively; while for the antiradical-DPPH• activity, PE > GE > AE showed an IC_{50} of 76.0, 39.0 and 20.1 µg/ml, respectively. The effects of the edible mushroom extracts at 0.5 and 1.0% on the oxidative stability of raw and cooked patties under chilled conditions present in Table 1. The pH and color (red index or a* value) of raw and cooked pork patties decreased during storage time, while the LOX was increasing regardless of the low temperature (2 °C) and darkness conditions ($P<0.05$). At day 9, in raw and cooked samples all antioxidant at both levels showed the highest ($P<0.05$) pH (>5.4 and >5.7, respectively) when compared with control. Also, a* values of raw and cooked for PE1.0 showed the highest ($P<0.05$) values (>9.0 and >6.5, respectively), i.e., the red color was preserved 53.2% for raw and 62.1% for cooked samples when compared with the control. Likewise, PE1.0 reduced ($P<0.05$) LOX in raw and cooked patties (82 and 69.4%, respectively), in comparison with control (Figure 1). These results agree with several investigations that reported the prevention of fresh meat and meat products against color changes and lipid oxidation, following the inclusion natural plant extracts as antioxidant ingredients [2,5].

Table 1. Effect of edible mushroom extracts addition and storage time on meat quality parameters of pork patties.

Item	Sample-Day	Treatments						
		Control	AE0.5	AE1.0	GE0.5	GE1.0	PE0.5	PE1.0
pH	Raw-0	5.95±0.1^{aB}	5.81±0.1^{aB}	5.86±0.1^{aB}	6.00±0.1^{aB}	5.96±0.2^{aB}	6.04±0.1^{aB}	5.99±0.1^{aB}
	Raw-9	5.30±0.1^{aA}	5.40±0.1^{aA}	5.50±0.1^{abA}	5.70±0.1^{cA}	5.60±0.1^{bcA}	5.50±0.1^{bcA}	5.70±0.1^{cA}
	Cooked-0	6.08±0.1^{aB}	6.15±0.1^{aB}	6.10±0.1^{aB}	6.06±0.1^{aB}	6.15±0.1^{aB}	6.23±0.2^{aB}	6.15±0.1^{aB}
	Cooked-9	5.60±0.0^{aA}	5.60±0.1^{aA}	5.80±0.1^{bA}	5.80±0.1^{bA}	5.70±0.2^{abA}	5.90±0.1^{bA}	5.90±0.1^{bA}
Color (a*)	Raw-0	8.9±2.3^{aB}	8.9±2.0^{aB}	11.4±2.0^{aB}	9.4±2.0^{aB}	11.1±2.0^{aB}	10.4±2.0^{aB}	11.5±1.0^{aA}
	Raw-9	4.4±0.7^{aA}	4.8±0.8^{aA}	5.7±1.0^{aA}	5.8±1.0^{aA}	5.2±1.0^{aA}	7.0±0.7^{bA}	9.4±1.1^{cA}
	Cooked-0	5.8±0.7^{aB}	5.7±1.0^{aB}	6.1±0.4^{aB}	5.3±1.0^{aA}	6.9±1.3^{aB}	6.0±0.3^{aA}	7.5±0.9^{aA}
	Cooked-9	2.5±1.1^{aA}	3.6±1.0^{aA}	5.0±0.4^{bA}	4.1±1.0^{abA}	5.1±0.2^{bA}	5.7±0.7^{bA}	6.6±0.5^{cA}

Different letters (a–c) in the same row indicate significant differences (P<0.05).
Different letters (A–B) in the same column indicate significant differences (P<0.05).

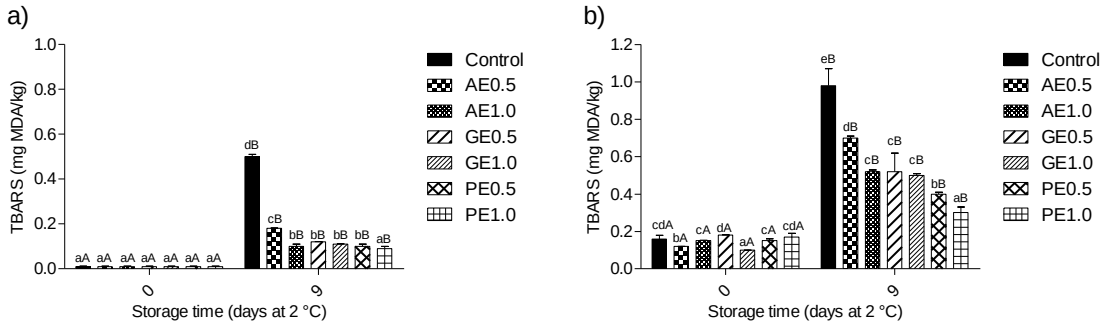

Figure 1. Effect of edible mushroom extracts addition and storage time on lipid oxidation (TBARS) of pork patties. Raw and cooked patties (a and b, respectively). Different letters (a–c) at the same day of samples indicate significant differences (P<0.05); Different letters (A–B) in the same treatment at a different day of sampling indicate significant differences (P<0.05).

IV. CONCLUSION

The present results highlight the potential usage of *A. brasiliensis*, *G. lucidum* and *P. ostreatus* extracts as efficient inhibitors of lipid-oxidation and color changes during chilled storage of raw and cooked pork patties.

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REFERENCES

1. Sánchez-Escalante, A., Djenane, D., Torrescano, G., Beltrán, J. A., & Roncalés, P. (2001). The effects of ascorbic acid, taurine, carnosine and rosemary powder on colour and lipid stability of beef patties packaged in modified atmosphere. Meat Science 58: 421-429.
2. Faustman, C., Sun, Q., Mancini, R., & Suman, S. P. (2010). Myoglobin and lipid oxidation interactions: Mechanistic bases and control. Meat Science 86: 86-94.
3. Cheung, L. M., Cheung, P. C., & Ooi, V. E. (2003). Antioxidant activity and total phenolics of edible mushroom extracts. Food Chemistry 81: 249-255.
4. Vargas-Sánchez, R. D., Torrescano-Urrutia, G. R., Acedo-Félix, E., Carvajal-Millán, E., González-Córdova, A. F., Vallejo-Galland, B., Torres-Llanez, M. J., & Sánchez-Escalante, A. (2014). Antioxidant and antimicrobial activity of commercial propolis extract in beef patties. Journal of Food Science 79: C1-C6.
5. Falowo, A. B., Fayemi, P. O., & Muchenje, V. (2014). Natural antioxidants against lipid-protein oxidative deterioration in meat and meat products: A review. Food Research International 64: 171-181.