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QUALITY OF BEEF PATTIES ADDED WITH *Pleurotus djamor* AND *Hibiscus sabdariffa* CO-PRODUCT

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I. INTRODUCTION

Due to the recent concerns about the sustainability of meat product and negative health issues associated to high meat products intakes, the use of different vegetal sources including co-products to partially replace meat in meat products is on the spotlight. There is abundant literature about the use of different plant-based ingredients and alternative proteins used in meat products [1]. In this regard, edible mushrooms have become an interesting source to improve the nutritional profile of meat products [2] considering the notable protein and fiber content, as well as the umami flavor. In the case of *Pleurotus djamor* (also known as pink oyster), this mushroom also possesses a light pink [3] color and a milder scent which make it an excellent candidate to develop meat products. On the other hand, the roselle calyxes (*Hibiscus sabdariffa*) have been attributed excellent antimicrobial and antioxidant properties and an attractive red color. Although, it is used to prepare beverages by a decoction process, the co-product still retains some functional components [4]. In this work the effect of partial replacement of meat by *Pleurotus djamor* powder and *Hibiscus sabdariffa* co-products on physicochemical, oxidation processes and sensorial properties in beef patties was studied.

II. MATERIALS AND METHODS

Four 2 kg-formulations of beef patties were elaborated with the inclusion of 5% of *P. djamor* powder (Pd), 2% of *H. sabdariffa* co-product powder (Hs) and 5% of Pd and 2% of Hs (Pd-Hs) replacing the same amount of meat compared with a control elaborated with minced beef meat (8 mm plate), 0.7% of NaCl and 10% of cold water. 80 g portions were molded into 10 cm patties and then packaged with a gas mixture (80% O2/ 20% CO2) and stored at 4 ± 1 °C for 12 days to periodically evaluate lipid oxidation by the development of thiobarbituric acid reactive substances (TBARS) according to Tarladgis et al. [5] method, and cooking loss according to Heck et al. [6]. Chemical composition and pH were determined only on day 1 according to regular procedures [7], as well as color (L*a*b* parameters) and sensory analysis. Sensory evaluation of the samples was performed using a 7-point hedonic scale by 66 consumers, where 7 corresponded to “highly acceptable” and 1 represented “highly not acceptable” [8]. The test included the evaluation of color, odor, texture, taste, and overall acceptability. Statistical analysis of the data obtained was performed using the Statgraphics Centurion XVI version 16.1.03. Mean values were compared using the one-way ANOVA and Tukey multiple range tests were used to estimate the level of significance among patty formulations.

III. RESULTS AND DISCUSSION

Chemical composition and color values are presented in Table 1. The replacement of meat by Pd and Hs did not significantly affect the protein and fat contents, but moisture was reduced especially with the introduction of Pd. The pH, ash and fiber contents were also significantly affected. The presence of Hs significantly decreased the pH. Cooking loss and TBARs results are shown in Figure 1. The presence of *Pleurotus djamor* powder in the samples significantly reduced the cooking losses, while the inclusion of Hibiscus co-product limited the capacity to retain meat components during cooking, probably due to the reduction of pH, and therefore, reducing the water holding capacity of meat. Related to TBARs *Pleurotus djamor* was totally inefficient in controlling lipid oxidation, while the antioxidant effect attributed to roselle co-products was also limited. Sensorially, the incorporation of Hs negatively affected the visual aspect of the patties because of the darkening of the product and the rest of the sensorial parameters were also lowered scored, bordering on acceptability due to the reduction of pH values. On the contrary, Pd hardly modified sensorial properties with similar values to control samples.

Table 1. Chemical composition and color (L*a*b* parameters) of the formulations

	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Dietary fiber (%)	pH	L*	a*	b*
C	76.12^{c}	3.55	18.09	1.49^{a}	ND	5.97	41.69^{b}	17.51^{b}	15.04^{b}
Pd5	72.62^{a}	3.00	18.75	1.51^{a}	1.24 ^{a}	6.01^{b}	42.25^{b}	20.12^{c}	17.92^{c}
Hs2	74.85^{b}	4.03	18.24	1.52^{a}	1.26 ^{a}	5.23^{b}	38.63^{b}	9.08^{a}	10.32^{a}
Pd5-Hs2	72.31^{a}	3.44	18.41	1.78^{b}	2.52^{b}	5.37^{a}	33.70^{a}	8.47^{a}	9.34^{a}

$^{a–c}$ Means in the same column with a different letter are significantly different ($p < 0.05$).

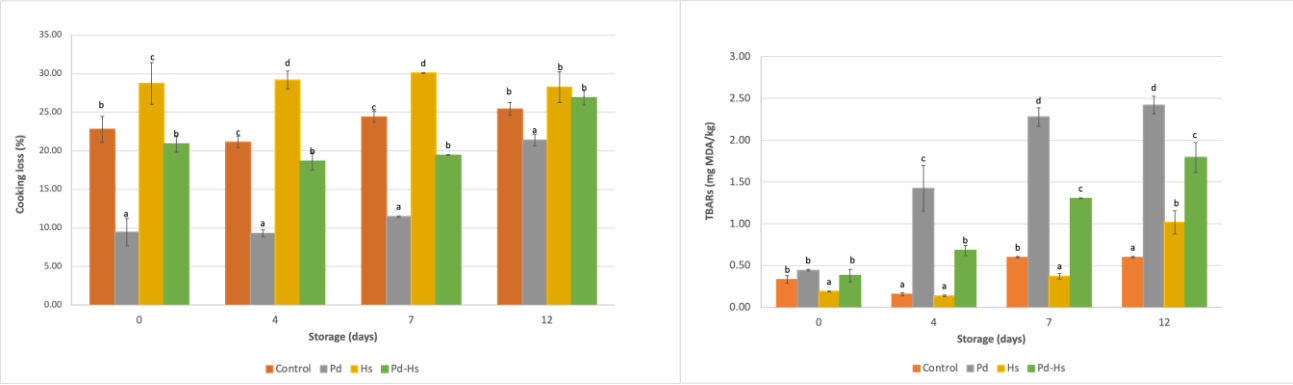


Figure 1. ~~Results from c~~Cooking loss (a) and TBARs (b) of beef patties

IV. CONCLUSION

Despite the antioxidant properties described for *Hibiscus*, its introduction in beef patties was not sensorially appreciated, while the incorporation of *Pleurotus djamor* resulted in better sensory properties, similar to control samples. However, the mushroom powder affected lipid stability, slightly increasing TBARs.

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REFERENCES

1. Pintado, T.; Delgado-Pando, G. (2020) Towards More Sustainable Meat Products: Extenders as a Way of Reducing Meat Content. Foods *9*: 1044.
2. Montes, A.P.; Rangel-Vargas, E.; Lorenzo, J.M.; Romero, L.; Santos, E.M. Edible mushrooms as a novel trend in the development of healthier meat products (2021). Curr. Opin. Food Sci. 37: 118–124.
3. Siti-Nuramira, J.; Farhana, R.; Nabil, S.; Jafari, S.M.; Raseetha, S. (2022) Impact of drying methods on the quality of grey (*Pleurotus sajor caju*) and pink (*Pleurotus djamor*) oyster mushrooms. J. Food Meas. Charact. 16: 3331–3343.
4. Amaya-Cruz, D.M.; Perez-Ramirez, I.F.; Ortega-Diaz, D.; Rodriguez-Garcia, M.E.; Reynoso-Camacho, R. (2018) Roselle (*Hibiscus sabdariffa*) by-product as functional ingredient: Effect of thermal processing and particle size reduction on bioactive constituents and functional, morphological, and structural properties. J. Food Meas. Charact. 12: 135–144.
5. Tarladgis, B.G.; Watts, B.M.; Younathan, M.T.; Dugan, L. (1960) A distillation method for the quantitative determination of malonaldehyde in rancid foods. J. Am. Oil Chem. Soc. 37: 44–48.
6. Heck, R.T.; Vendruscolo, R.G.; de Araújo Etchepare, M.; Cichoski, A.J.; de Menezes, C.R.; Barin, J.S.; Lorenzo, J.M.; Wagner, R.; Campagnol, P.C.B. (2017) Is it possible to produce a low-fat burger with a healthy n-6/n-3 PUFA ratio without affecting the technological and sensory properties? Meat Sci. 130: 16–25.
7. Bermúdez, R.; Echegaray, N.; Fraqueza, M.J.; Pateiro, M.; Domínguez, R.; Munekata, P.E.S.; Lorenzo, J.M.; Santos, E.M. (2022) *Methods to Assess the Quality of Meat Products*; Lorenzo, J.M., Domínguez, R., Pateiro, M., Munekata, P.E.S., Eds.; Springer Nature: New York, USA, pp. 1–16
8. Perez-Baez, A.J.; Camou, J.P.; Gonzalez-Aguilar, G.; Lucas-Gonzalez, R.; Valenzuela-Melendres, M.; Viuda-Martos, M. (2021) Roselle (*Hibiscus sabdariffa* L.) extracts added to Frankfurt-type sausages: Effects on chemical, physicochemical, and sensorial properties. J. Food Process. Preserv 45: e15782