EFFECT OF THREE DIFFERENT FRUIT EXTRACTS AS NATURAL ANTIOXIDANTS ON TBARS AND LACTIC ACID BACTERIA IN FERMENTED SAUSAGE

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I. INTRODUCTION

The demand for natural antioxidant which can inhibit the impact of lipid oxidation reactions on the quality of meat and meat products is considered a challenge [1]. There, formulation of meat products like fermented sausage by adding natural fruit extracts as natural antioxidants proves necessary to attend the demand by consumers [2]. The effects of incorporating natural antioxidants derived from fruit have been investigated and have has shown promising results, which having a more natural appeal are healthier at the same time [2, 3]. In addition, consumers recognize plant-based products as natural products [4]. Therefore, this study investigated the effect of addition of Opuntia-ficus-indica (OFI), Fortunella margarita (FM) and Hylocereus monacanthus (HM) extracts as natural antioxidants on TBARS and Lactic acid bacteria (LAB) values.

II. MATERIALS AND METHODS

The OFI and HM extracts were extracted according to Bellucci et al. [3], the FM extract was extracted according to Lou et al. [5] (Figure 1). Five fermented sausage formulations were produced: Control (without antioxidant), ERY (sodium erythorbate 0.5%) OFI (OFI extract 0.75%), FM (extract 0.75%) and HM (HM extract 0.75%). Fermented sausages were produced according to Santos *et al.* [2] on two different dates.

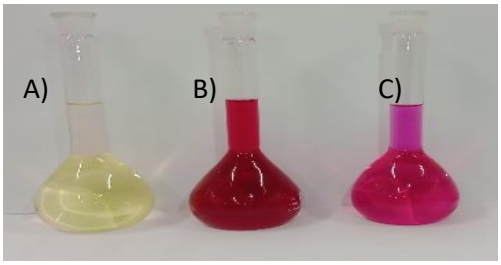

Figure 1. Natural aqueous extracts (1:99 in water) of *Fortunella margarita* (A), *Opuntia-ficus-indica* (B) and *Hylocereus monacanthus* (C).

TBARS analysis was performed according to Bellucci *et al.* [3]. For the lactic acid bacteria count analysis the analyses were performed according to Bedia *et al.* [6]. All analyses were performed at 0, 15 and 26 days during processing in triplicate TBARS analysis was performed according to Bellucci et. [3]. Total lactic acid bacteria (LAB) counts were determined by plate counting in MRS agar (OXOID, Hampshire, United Kingdom) after 48 h at 37 °C anaerobically. All analyses were performed at 0, 15 and 26 days during processing in triplicate. All treatments were analysed during the production (at 0, 15 and 26 days). For the statistical analysis of the results, analysis of variance (ANOVA) was performed using the General Linear Model (GLM). The production time and the treatment were considered fixed effects, while the manufacturing repetition was a random effect. Statistical analyses were performed with STATISTICA software version 7 (StatSoft, Inc., 2004).

III. RESULTS AND DISCUSSION

There was a significant difference ($P < 0.05$) among the treatments with addition of extracts both for TBARS and LAB values (Table 1) at the three different points of analysis (0, 15 and 26 days). For TBARS values, ERY treatment showed lower values at 15 and 26 days of production, but FM and HM

treatments did not show significant difference ($P < 0.05$) between ERY, while OFI treatment showed to be different from ERY (15 days), but at the end of the production process (26 days) it did not differ from ERY treatment.

Table 1. TBARS (mg of malonaldehyde /MDA) and LAB (log of CFU/g) values of fermented sausage with addition of fruit extracts.

		Days		
	Treatments	**0**	**15**	**26**
TBARS	**Control**	0.31	0.59[a]	0.63 [a]
	ERY	0.26	0.35[c]	0.29 [b]
	OFI	0.27	0.45 [b]	0.37 [b]
	FM	0.28	0.36 [bc]	0.34 [b]
	HM	0.28	0.41 [bc]	0.42 [b]
	SEM	0.01	0.03	0.04 [b]
	P - value	0.78	0.00	0.00
LAB	**Control**	5.15 [b]	5.74 [b]	5.69 [b]
	ERY	5.65 [ab]	6.80 [ab]	7.69 [a]
	OFI	8.39[a]	9.00 [a]	9.39 [a]
	FM	8.01 [a]	8.80 [a]	8.15 [a]
	HM	8.15 [a]	8.65 [a]	8.39 [a]
	SEM	0.47	0.46	0.42
	P - value	0.00	0.01	0.01

[a, b, c,] According to Tukey test, samples on the same column with different letters show significant difference between them ($P < 0.05$); *P - value*: significance ($P < 0.05$); SEM: standard error of the mean.

LAB count of treatments with added fruit extracts (OFI, FM and HM) showed significantly difference ($P < 0.05$) with highest values, however, the ERY treatment showed no difference among the treatments with the three fruit extracts or control treatment.

IV. CONCLUSION

The addition of the three different fruit extracts (OFI, FM and HM) has been shown to be a natural additive that can be added in fermented meat products to stabilize lipid oxidation and increase the population of lactic acid bacteria.

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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. Bellucci, E. R. B., Dos Santos, J. M., Carvalho, L. T., Borgonovi, T. F., Lorenzo, J. M., &; da Silva Barretto, A. C. (2022). Açaí extract powder as natural antioxidant on pork patties during the refrigerated storage. Meat Science 184: 108667.
3. Santos, J. M., Ignácio, E. O., Bis-Souza, C. V., Silva-Barretto, A. C. (2021). Performance of reduced fat-reduced salt fermented sausage with added microcrystalline cellulose, resistant starch and oat fiber using the simplex design. Meat Science 175: 108433.
4. Boeing, H., Bechthold, A., Bub, A., Ellinger, S. Haller, D., Krone, A., Leschik-Bonnet, E., Muller, M, J., Oberritter, H., Schulze, M., Stehle, P., Watzl, B. (2012). Critical review: vegetables and fruit in the prevention of chronic diseases. European Journal of Nutrition 51(6): 637–663.
5. Lou, S. N., Lai, Y. C., Hsu, Y. S., Ho, C. T. (2015). Phenolic Content, Antioxidant Activity and Effective Compounds of Kumquat Extracted by Different Solvents. Food Chemistry: S0308814615300959.
6. Bedia, M., Méndez, L., & Bañón, S. (2011). Evaluation of different starter cultures (Staphylococci plus Lactic Acid Bacteria) in semi-ripened Salami stuffed in swine gut. Meat Science 87(1): 381-386.