Application of açaí and celery extracts as antioxidants in Italian-type salami

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I. INTRODUCTION

Consumers increasingly turn food purchasing into a decision-making process, critically evaluating labels, comparing brands, and, most importantly, analyzing ingredient lists. Natural fruit extracts have been widely studied as potential substitutes for synthetic antioxidants in various products. They aim to reduce oxidation reactions that begin at the animal's slaughter stage and influence meat's sensory quality and nutritional value and by-products [1]. This study aimed to evaluate the addition of açaí and celery extracts as natural antioxidants in Italian-type salami, focusing on lipid oxidation during maturation time and post-slicing storage.

II. MATERIALS AND METHODS

To make the açaí extract, water was added to the pulp in a 1:1 ratio, stirred for 30 min at 150 rpm (protected from light), and centrifuged (4500 rpm for 20 min). The supernatant was filtered, frozen, and lyophilized. four formulations of Italian-type salami added with açaí and celery extracts were prepared: **ERI:** formulation with 500 mg/kg of sodium erythorbate, 150 mg/kg of sodium nitrite and 150 mg/kg of sodium nitrate, **EA**: with 150 mg/kg sodium nitrite, 150 mg/kg sodium nitrate and 500mg/kg açaí extract, **EAA150**: with 150ppm celery extract and 500mg/kg açaí extract, **EAA300**: with 300ppm extract of celery and 500mg/kg açaí extract. 0.025mg/kg of Bactoferm® T-SPX starter culture was used in all treatments. The pork meat and pork back fat were ground (8 mm) and mixed with NaCl and other ingredients. The samples of all treatments were stuffed into collagen casings (15 cm in length, 50 mm in diameter). Temperature and relative humidity parameters (T °C and RH%) were controlled following the procedure for 14 days. The lipid oxidation (TBARS) was determined by Vyncke [2] and expressed in the MDA/kg sample.

III. RESULTS AND DISCUSSION

The TBARS values during the maturation time (Table 1) obtained from the treatments with added açaí and celery extracts did not differ from the ERI treatment on days 0 and 14. On day 10, only the EAA300 treatment differed from the ERI treatment, highlighting the antioxidant potential of açaí and celery extracts against lipid oxidation. At the end of the maturation time (days 10 and 14), no significant differences ($P < 0.05$) were observed between them, but the values were significantly higher ($P < 0.05$) at the beginning of processing (day 0).

During storage, the TBARS values (Table 2) obtained from treatments with added açaí and celery extracts did not differ from the ERI treatment on days 0, 7, and 21, except on day 14, when treatments EAA150 and EAA300 presented higher values compared to EA and ERI treatments. All treatments with added natural antioxidants (celery and açaí extracts) did not show significant differences ($P > 0.05$) during the storage period, demonstrating the antioxidant effect of the extracts on the shelf life of Italian-type salami.

Table 1. Lipid oxidation values of Italian-type salami during maturation time.

Treatments	Days				
	0	**10**	**14**	**SEM**	***p-value***
ERI	0,377^{b}	0,619^{Ba}	0,697^{ABa}	0,043	*
EA	0,448^{b}	0,667^{Ba}	0,624^{Bab}	0,035	*
EAA150	0,469^{b}	0,721^{ABa}	0,816^{Aa}	0,044	*
EAA300	0,543^{b}	0,831^{Aa}	0,723^{ABa}	0,036	*
SEM	0,033	0,022	0,023		
p-value	ns	*	*		

$^{A-B}$ Mean values in the same column (different treatment on the same day) with different letters indicate a significant difference (P < 0.05); $^{a-b}$ Mean values in the same line (same treatment on different days) with different letters indicate a significant difference (P < 0.05); SEM: standard error of the mean; Sig.: Significance: n.s.: Not significant; * P < 0.05. Treatments: **ERI**: sodium erythorbate with 500 mg kg−1, sodium nitrite with mg kg−1 and sodium nitrate with 150 mg kg−1, **EA**: açaí extract with 500 mg kg−1, sodium nitrite with 150 mg kg−1 and sodium nitrate with 150 mg kg−1, **EAA150**: celery extract with 150 mg kg−1 and açaí extract with 500 mg kg−1, **EAA300**: celery extract with 300 mg kg−1 and extract of açaí with 500 mg kg−1.

Table 2. Lipid oxidation values of Italian-type salami during post-slicing storage.

Treatments	Days					
	0	**7**	**14**	**21**	**SEM**	***p-value***
ERI	0,718^{a}	0,680^{ab}	0,660^{Bab}	0,594^{b}	0,016	*
EA	0,664	0,673	0,666^{B}	0,652	0,022	ns
EAA150	0,783	0,707	0,722^{AB}	0,689	0,021	ns
EAA300	0,738	0,797	0,796^{A}	0,743	0,024	ns
SEM	0,022	0,024	0,016	0,027		
p-value	ns	ns	*	ns		

$^{A-B}$ Mean values in the same column (different treatment on the same day) with different letters indicate a significant difference (P < 0.05); $^{a-b}$ Mean values in the same line (same treatment on different days) with different letters indicate a significant difference (P < 0.05); SEM: standard error of the mean; Sig.: Significance: n.s.: Not significant; * P < 0.05. Treatments: **ERI**: sodium erythorbate with 500 mg kg−1, sodium nitrite with mg kg−1 and sodium nitrate with 150 mg kg−1, **EA**: açaí extract with 500 mg kg−1, sodium nitrite with 150 mg kg−1 and sodium nitrate with 150 mg kg−1, **EAA150**: celery extract with 150 mg kg−1 and açaí extract with 500 mg kg−1, **EAA300**: celery extract with 300 mg kg−1 and extract of açaí with 500 mg kg−1.

IV. CONCLUSION

The study demonstrates that the incorporation of açaí and celery extracts in Italian-type salami provides an effective antioxidant effect, as evidenced by the TBARS values measured during both maturation and storage periods. The treatments containing these natural extracts showed similar lipid oxidation levels compared to the control treatment (ERI) at most time points. This suggests that açaí and celery extracts are viable natural alternatives for enhancing the oxidative stability of meat products, offering a promising approach for clean label formulations in the food industry.

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REFERENCES

1. Asioli, D., Aschemann-Witzel, J., Caputo, V., Vecchio, R., Annunziata, A., Næs, T., & Varela, P. (2017). Making sense ofthe “clean label” trends: A review of consumer food choice behavior and discussion of industry implications. Food Research International, 99, 58-71.
2. Vyncke, W. (1975). Evaluation of the direct thiobarbituric acid extraction method for determining oxidative rancidity inmackerel. Fette, Seifen, Anstrichmittel, 77: 239–240.