

Grumixama (*Eugenia Brasiliensis* Lam.): a Brazilian native fruit as natural antioxidant on beef patties during the refrigerated storage

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I. INTRODUCTION

Lipid and protein oxidation decrease the shelf life of meat products, along with altering the color, which are characteristics associated with freshness for final consumption (Bellucci et al., 2022). In this sense, the Myrtaceae family stands out for bioactive compounds with a potential application in the food industry (Saber et al., 2023), such as *Eugenia Brasiliensis* Lam., native to the Atlantic Forest. Popularly known as “grumixama” or “Brazilian cherry”, could be a renewable alternative source of natural food colorings with bioactive properties (Albuquerque et al., 2024). Although many studies suggest its use as a potential antioxidant, no studies have been found regarding its application in food products. The objective of this paper is to evaluate the oxidative and color stability of grumixama pulp (GP) in beef patties during refrigerated storage.

II. MATERIALS AND METHODS

After removing the seed, the fruit was homogenized and filtered. Four formulations of beef patties were prepared: CON – control; ERY – 500 mg.kg⁻¹ of erythorbate; GP3 – 3% of pulp; GP6 – 6% of pulp. The patties were stored under refrigeration at 4°C and analyzed at three-time points: 0, 3, and 6 days. The lipid oxidation (TBARS) was determined by Bellucci et al. (2022) and expressed as mg of malonaldehyde (MDA)/kg of sample. The instrumental color parameters were measured using a ColorFlex45/0 colorimeter (Hunterlab, Reston, United States) and reported in the CIELAB color space. For statistical analysis, the experimental design was randomized blocks in a split-plot scheme. Analysis of variance (ANOVA) and Tukey's multiple comparison test were performed for cases in which there was significance in the ANOVA, using R software version 4.1.3.

III. RESULTS AND DISCUSSION

For TBARS values (Table 1), ERY, GP3 and GP6 were statistically equal on the third day. However, the addition of 6% of GP showed the lower value on the sixth day when compared to ERY and CON, but was similar to GP3. This antioxidant effect can be explained by the bioactive compounds present in grumixama as described by Nehring et al. (2023), it is high values of flavonoids, phenolic acids, total monomeric anthocyanins, and total proanthocyanidins.

TBARS (mg of f MDA/g sample)	Refrigerated storage (days)			SEM
	0	3	6	
CON	0.178	0.271 ^a	0.331 ^a	0.045
ERY	0.124	0.190 ^{ab}	0.203 ^{ab}	0.042
GP3	0.135	0.133 ^b	0.138 ^{bc}	0.045
GP6	0.117	0.145 ^b	0.115 ^c	0.052
Sig.	ns	*	*	

a–c Mean values in the same column with different letters indicate significant difference ($P < 0.05$); SEM: standard error of the mean; Sig.: Significance; * $p < 0.05$. Treatments: CON: patties without antioxidant; ERY: patties with sodium erythorbate at 500 mg kg⁻¹; GP3: patties with GP at 3%; GP6: patties with GP at 6%;

Regarding the color parameters (Table 2), due to the purple color of GP, the a^* values were significantly higher as its concentration increased ($p < 0.05$), suggesting an increase in the reddish color in sausages. Similarly, Yıldız-Turp et al. (2010) report a rise in a^* values when adding plum puree to raw beef burgers. Furthermore, on the sixth day, the a^* values remained higher in the treatments added with pulp in relation to the others, indicating a desired maintenance of the red color throughout the storage period. The L^* value decreased between treatments possibly due to the replacement of water by pulp. For the b^* value, there was no significant difference between treatments.

Table 2. Color parameters of beef patties during refrigerated storage.

Parameters	Days	Treatment				Sig
		CON	ERY	GP3	GP6	
L^*	0	46.1	45.8	45.9	44.7	ns
	3	49.4 ^a	47.1 ^{ab}	44.7 ^b	44.9 ^b	*
	6	47.4	47.1	44.4	44.9	ns
	SEM	0.960	0.433	0.441	0.067	
a^*	0	13.3	13.7	13.7	14.1	ns
	3	9.75 ^c	10.4 ^c	11.6 ^b	14.4 ^a	*
	6	6.48 ^b	6.93 ^{ab}	7.85 ^{ab}	8.27 ^a	*
	SEM	1.969	1.955	1.711	1.995	
b^*	0	14.7	14.7	15	15.01	ns
	3	14.2	14.2	12.7	13.6	ns
	6	14.2	13.9	13.6	13.2	ns
	SEM	0.167	0.233	0.669	0.549	

a–b Mean values in the same row with different letters indicate significant difference ($P < 0.05$); SEM: standard error of the mean; Sig.: Significance; Ns.: Not significant; * $p < 0.05$. Treatments: CON: patties without antioxidant; ERY: patties with sodium erythorbate at 500 mg kg⁻¹; GP3: patties with GP at 3%; GP6: patties with GP at 6%;

IV. CONCLUSION

Grape pulp (GP) exhibit promising antioxidant effects as a viable alternative to sodium erythorbate. Incorporating GP into beef patties at concentrations of 3% or 6% has been shown to enhance color and inhibit lipid oxidation during refrigerated storage.

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