EVALUATION OF ANTIOXIDANT CAPACITY OF MESQUITE POD EXTRACT IN FRESH BREAKFAST SAUSAGES

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I. INTRODUCTION

Lipid oxidation is one of the leading factors that contributes to meat spoilage. To preserve meat, the meat industry uses mostly synthetic antioxidants [1,2], such as butylated hydroxytoluene, butylated hydroxyanisole, tert-butylhydroquinone, and propyl gallate, for example. However, their application is regulated because of their possible carcinogenic effects [3]; for this reason, the meat industry is looking for viable alternatives. Mesquite pods contain functional compounds, including phenols, flavonoids, tannins, anthocyanins, carotenoids, and volatile compounds, that function to delay the lipid oxidation of other molecules [4,5]. The development of additives with antioxidant activity from mesquite pods and their application in meat products may be a novel alternative for delaying or inhibiting lipid oxidation. This study determined the antioxidant effect of mesquite pod extract (*Prosopis chilensis* and *Prosopis alba*) in fresh pork breakfast sausages.

II. MATERIALS AND METHODS

The effects of mesquite extract were evaluated considering two treatments (T1: *P. chilensis*; T2: *P. alba*) and a control. Ultrasonic assisted extraction (50 °C) with ethanol and a 1:1 mix of ethanol-water were used as part of a double extraction process to obtain the extracts. For the sausage elaboration, 24 h *postmortem* pork meat and pork fat were used. The formulation consisted of 30% fat, 5% water, 1.53% salt, 0.5% extract, 0.06% black and white pepper, and 0.04% sage, and the rest was ground meat. The pork was stuffed into collagen casing, and the sausages were wrapped and stored in refrigeration under darkness. The quality analysis (thiobarbituric acid reactive substances or TBARS, pH, and color) was carried out on days 0, 3, 6, and 9 of storage using pre-established methodologies [6,7]; six sausages per day were taken for analyses. Color measurement was made with a reflectance spectrophotometer: L*, a*, and b* measurements were based on a 10-point scale considering the external face of the sausage. The statistical analysis was based on a one-way ANOVA with a significance level of $P<0.05$ (NCSS, 2011).

III. RESULTS AND DISCUSSION

Table 1 shows the results of pH, TBARS, and color. The pH values remained constant during storage, and no differences were found ($P>0.05$) between treatments. These results agree with those of Aispuro [8], who used ethanolic extracts of *P. velutina* in pork burgers; similarly, no differences in pH values between treatments were found. With respect to sausage color, the L* parameter did not present differences between the control and the treatments ($P>0.05$), although it was decreased during storage for sausages containing mesquite extract. Likewise, the a* value decreased ($P<0.05$) with increasing preservation time and was higher for the control than for the sausages containing the extract. These L* and a* values can be related to the fat content in the formulation. Meanwhile, the b* values fluctuated over the storage period; an increase was noted between days 6 and 9 for the sausages with extracts compared to the control. These results are in agreement with those of Aispuro [8], who found increased b* values compared to the control. Lipid oxidation increased during storage time in all treatments; nevertheless, the lipid oxidation of the control was always higher than that of the samples with mesquite extract. The extracts were able to protect against oxidation; a 35% delay was found at day 0, a 75% delay at day 3, and a more than 80% delay at days 6 and 9 compared to the control. No differences were found between the utilized extracts ($P>0.05$). These results are also in

agreement with those of Aispuro's [8] study, which used 0.3% ethanolic extract in patties that resulted in a 75% delay in lipid oxidation on the 10th day of storage.

Table 1. Effect of mesquite extract on pH, color, and TBARS on sausages, during storage at 4 °C.

Treatment	Days	pH	L*	a*	b*	TBARS (mg eq MDA/kg)
Control	0	5.60 ± 0.23 ^{aA}	64.48 ± 0.73 ^{aA}	4.66 ± 0.00 ^{cB}	13.94 ± 0.80 ^{cA}	0.37 ± 0.20 ^{aB}
	3	5.70 ± 0.02 ^{aB}	64.56 ± 1.35 ^{aA}	3.76 ± 0.06 ^{bB}	13.11 ± 0.60 ^{abA}	1.27 ± 0.85 ^{bB}
	6	5.67 ± 0.13 ^{aB}	64.45 ± 0.86 ^{aA}	3.32 ± 0.23 ^{aA}	12. 23 ± 0.31 ^{aA}	2.46 ± 0.66 ^{cB}
	9	5.67 ± 0.10 ^{aA}	62.87 ± 0.33 ^{aA}	3.32 ± 0.27 ^{aA}	13.06 ± 1.27 ^{bA}	3.44 ± 0.30 ^{dB}
P. chilensis	0	5.66 ± 0.23 ^{aA}	64.71 ± 3.05 ^{bA}	3.80 ± 0.05 ^{bA}	13.45 ± 0.32 ^{abA}	0.24 ± 0.08 ^{aA}
	3	5.67 ± 0.02 ^{aAB}	62.74 ± 3.31 ^{abA}	3.53 ± 0.18 ^{abAB}	12.75 ± 0.45 ^{aA}	0.27 ± 0.14 ^{aA}
	6	5.60 ± 0.08 ^{aAB}	62.33 ± 3.12 ^{abA}	2.95 ± 0.53 ^{aA}	12.81 ± 1.25 ^{abB}	0.42 ± 0.14 ^{bA}
	9	5.75 ± 0.08 ^{aA}	61.67 ± 2.85 ^{aA}	3.14 ± 0.80 ^{aB}	13.62 ± 1.80 ^{bAB}	0.42± 0.06 ^{bA}
P. alba	0	5.63 ± 0.26 ^{aA}	64.10 ± 2.45 ^{abA}	3.74 ± 0.27 ^{cA}	13.46 ± 0.45 ^{aA}	0.25 ± 0.07 ^{aA}
	3	5.62 ± 0.06 ^{aA}	64.18 ± 2.16 ^{abA}	3.33 ± 0.11 ^{bA}	13.22 ± 0.45 ^{aA}	0.31 ± 0.17 ^{bA}
	6	5.51 ± 0.08 ^{aA}	65.21 ± 1.78 ^{bB}	3.28 ± 0.15 ^{aA}	13.25 ± 1.02 ^{aB}	0.46 ± 0.16 ^{cA}
	9	5.75 ± 0.13 ^{aA}	62.06 ± 1.78 ^{aA}	2.58 ± 0.01 ^{aA}	12.43 ± 2.19 ^{aB}	0.45 ± 0.03 ^{cA}

Different letters indicate significant differences ($P<0.05$). Lowercase letters indicate differences between storage days, and uppercase letters represent differences between treatments on the same day of storage.

IV. CONCLUSION

Mesquite pod extract shows potential for use as an antioxidant additive in the development of meat products and responds to the demands of current consumers who are looking for healthier foods without added chemical antioxidants.

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