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Antimicrobial Efficacy Comparison of Cultured Cane Sugar and Vinegar Powder against Vinegar Powder on *Listeria monocytogenes* Inhibition in Ham

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Objectives

The objective of this study was to evaluate the antimicrobial efficacy of Verdad Opti. Powder N60 cultured sugar and vinegar (CSV-P) versus vinegar powder solution (DV) in ham formulation. The efficacy was evaluated on *L. monocytogenes* growth inhibition in different product treatments incubated at 40°F for 140 d.

Materials and Methods

Pork semimembranosus was injected at 33% pump level of brine solution containing water, sea salt, cane sugar, sodium nitrite, and varying levels of antimicrobial interventions. Each treatment was macerated independently, tumbled, stuffed, and cooked in a steam cabinet to an internal temperature of 162°F. Table 1 outlines the treatment structure, proximate values for the treatments and the *L. monocytogenes* outgrowth data.

Each of these treatments were independently inoculated with a 5 strain cocktail of *L. monocytogenes*, vacuum packaged, and incubated at 40°F. The treatments were sampled in duplicate at regular time intervals, enumerated for *L. monocytogenes* using selective Palcam media. Water activity, pH, and moisture content analysis was performed for all the treatments.

Results

The water activity values for CSV-P treatments were generally lower than control treatment and dried vinegar treatments (Table 1). The lactic acid bacteria outgrowth is significantly influenced by water activity values and lower a_w values correspond to lower growth rate of lactic acid bacteria strains, thereby preventing early spoilage by providing an additional preservation hurdle. The pH values show similar results for different antimicrobial treatments indicating no major impact on ionic strength of the formulations.

The use of 0.5% DV, 0.7% DV, 1.5% CSV-P and 1.8% CSV-P enhanced control in outgrowth of *L. monocytogenes* compared to the control treatment. The 1 and 2 \log_{10} CFU/g outgrowth for *L. monocytogenes* was reached in 7 and 12 d for control treatment, respectively. Addition of 0.5% DV treatment reduced the *L. monocytogenes* outgrowth to less than 2 \log_{10} CFU/g until 50 d. Increasing the DV concentration to 0.7% further reduced the *L. monocytogenes* outgrowth to less than 2 \log_{10} CFU/g until 125 d. For the other 2 treatments (1.5% and 1.8% CSV-P), an inhibition (< 1 log outgrowth) of *L. monocytogenes* was observed during 140 d of incubation, respectively.

Table 1: Water activity, pH, moisture and *Listeria monocytogenes* outgrowth kinetics details for different antimicrobial treatments

Treatment details	a_w	pH	Moisture (%)	Time for 1 \log_{10} CFU/g outgrowth of <i>L. monocytogenes</i> (days)	Time for 2 \log_{10} CFU/g outgrowth of <i>L. monocytogenes</i> (days)
Control	0.980	6.10	75	7d	12d
0.5% DV	0.979	6.10	74	30d	50d
0.7% DV	0.978	6.05	74	55d	125d
1.5% CSV-P	0.974	6.10	73	> 140d	> 140d
1.8% CSV-P	0.973	6.10	73	> 140d	> 140d

Conclusion

This research verifies the antimicrobial efficacy of Verdad Opti. Powder N60 cultured cane sugar and vinegar powder in ham to control *L. monocytogenes* outgrowth and provides the industry with an effective, natural, and clean label ingredient solution to enhance the food safety and shelf life in sensitive meat formulations.