The Development and Evaluation of Naturally Cured Lamb Ham

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I. INTRODUCTION

"Natural" or organic foods and ingredients are currently a growing trend in the current U.S food market. Natural curing agents derived from nitrate rich vegetables (celery, spinach, beets) can be used to replace curing salts that contain sodium chloride and sodium nitrite [1]. Vegetables can be fermented into solutions and/ or dried into powder to convert sodium nitrate to sodium nitrite (Jo et al., 2020). The fermented vegetables were tested on pork and showed properties like curing salt on color changes, quality, shelf life, and food safety [2, 3, 4]. Currently, celery powder is commonly used in "uncured" meat products in the U.S market. Swiss chard is a nitrate-rich vegetable with potential for use as meat a curing agent. The current study evaluated both Swiss chard and celery as a pre-converted powder (powders with sodium nitrate converted to sodium nitrite) for use as a dried rubbed on lamb. The objective of this was to compare the effects of vegetable powders (celery and Swiss chard) on the quality characteristics i.e., color, water activity (aw), pH, residual nitrite levels, and textural properties of lamb hams.

II. MATERIALS AND METHODS

Lamb legs were dry cured using a two-part process (curing and salt equalization) with rubs containing varying levels of Swiss chard and celery compared to curing salt. Three different rubs used in this study which contained curing salt (Prague salt) or one of the two natural vegetable powders (containing sodium nitrite) namely, Swiss chard powder (SC) and celery powder (CP). The curing agents were added to obtain 327 ppm nitrites in control rub, 250 and 500 ppm nitrites in SC and 250 and 500 ppm nitrites in CP. These rubs were applied by rubbing on it on the surface as dry-ingredient mixes. The dry rub mixes were applied to obtain a final concentration of sodium nitrite below 100 ppm in the finished product. Any excess rub mix was removed either brushed off by hand or washed off. The rubbed lamb legs were then placed in a cooler. at 2.8 ± 1°C and 70 - 80% (RH) for 9 days per kg. The lamb was rested on metal wire racks wrapped with 4 mil heavy duty plastic sheeting which had four rectangular cuts (15.24 cm x 2.54 cm) per each of the three rows. The lamb hams were briefly removed from the cooler on day 7 and 14 to apply the fresh rub, brushing and washing off previous rub with water before applying the next portion. They were returned to the cooler and now held at 12.8℃ ± 1°C. The lamb hams equalized for 4 days per kg. The lamb hams were finished after this stage. The finished lamb hams texture was evaluated with a texture profile analysis (TPA) test and a unique puncturable test.

III. RESULTS AND DISCUSSION

The water activity showed a significant difference when the CP (500ppm) treatment was compared to CP (250ppm) and the control. Over the processing time, the water activity decreased from 0.98 on day 0 to 0.89 on day 42 (Fig. 1C, 1D, and 1D). The progressive decrease in the water activity occurred in all the treatment groups as expected with dry curing with a slightly lower water activity in the celery powder groups. Figure 3 showed the CP500 treatment group decreasing slightly lower (about 0.89) than CP250, SC250, SC500, and control (0.91 to 0.92). The Swiss chard unlike the celery powder acted like the control regardless of the cure mixture. The different treatment groups show that celery powder and Swiss chard can be used to replace Prague salts (control) with a consideration of the other ingredients in the curing agents. Swiss chard lamb treated at 500 ppm of sodium nitrite created

the best final product compared to the control because the treatment had the most significantly similar values throughout all the analyses. The Swiss chard treated groups was the least not significantly different than the control group, but the celery powder treatment at 500 ppm showed various significant differences. The additional ingredients (salt and silica) in the celery powder impacted the qualities of the lamb hams when the celery powder was added at higher quantities. An adjustment in the formulation to reduce the amount of pure salt added would adjust for the quality effects caused by additional salt. The firmness (hardness) of the lamb ham was the significantly highest in CP500 and lower for SC250 and SC500 and CP250 and lowest for the control (Fig. 2).

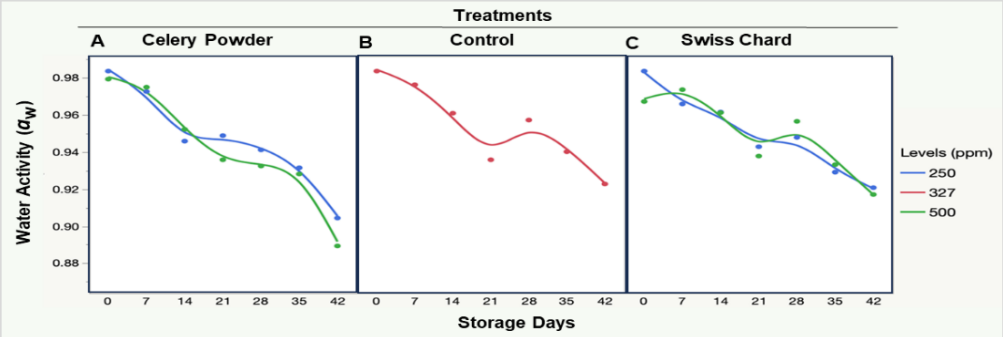

Figure 1. The images show the vegetable powders celery powder (A) and Swiss chard powder (B). The water activity decreased over time of lamb ham naturally cured with celery powder (C), control (D), and Swiss chard (E).

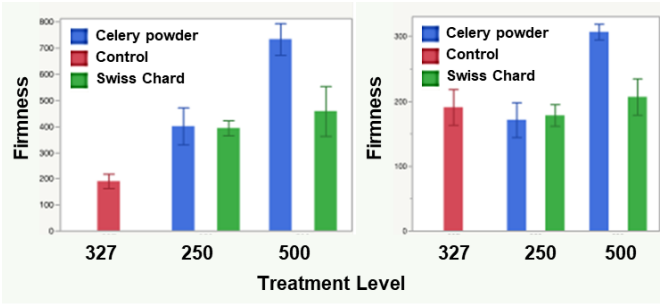

Figure 2. The hardness of final lamb ham shows the firmness (hardness) from the textural profile analysis and force required to fracture the final sliced lamb ham. The force was measured in grams (g).

CONCLUSION

Overall, the dry-curing process caused the expected decrease in water activity and redness development in the cured lamb hams. Further investigation of this group could result in a new high value dry-cured product for the U.S market as there is no dry-cured sliced lamb ham in the U.S market. Overall, a naturally cured lamb ham is a viable product that could enter the U.S market. Further tests for the success of a naturally cured lamb ham would first need to test the microbial safety followed by consumer acceptability tests. Future products could add aging or smoking tests to further process the meat and develop specific flavors.

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