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Evaluation Of Alkaline Electrolyzed Water To Replace Traditional Phosphate Enhancement Solutions: Effects On Water Holding Capacity, Tenderness, And Sensory Characteristics

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Objectives

The objective of this research was to evaluate the applicability of alkaline electrolyzed reduced water as a replacement for traditional salt and phosphate enhancement solutions in pork loins.

Materials and Methods

Across three replicates, 64 pork loins were randomly selected from a multinational pork processor's first shift, packaged according to industry standards, and shipped to the University of Georgia Meat Science Technology Center where they were stored (1 ± 1°C) until 4 d postmortem. Four days postmortem the loins were randomly assigned to 1 of 4 enhancement treatments including: alkaline electrolyzed reduced water (EOH; pH ≈ 11.5), EOH plus 2.5% potassium-lactate (EOK; pH ≈ 10.9), industry standard (IS; 0.35% sodium tri-polyphosphate, 0.14% sodium chloride, 2.5% potassium-lactate; pH ≈ 6.8), or no enhancement (CON). Loins were enhanced to target 110% of raw weight. After a 15 min rest period the loins were cut into chops (2.54-cm). The first 2 chops were cut from the anterior end of the loin and immediately frozen for Warner-Bratzler shear force. Subsequently, 7 chops were cut and randomly assigned to 0 to 30 d vacuum storage to evaluate water retention ability on a 5-d interval. Water analysis was performed to measure stepwise water loss with increasing force on a per assay basis, as well as, water loss on a 100% basis to obtain an additive model. First the chops were hung for 24 h to evaluate free drip, then all chops were vacuum packaged until their designated storage day to evaluate water loss due to vacuum pressure, followed by water loss by gravimetric force, and finally oven drying. Two additional chops were immediately vacuum packaged and frozen for trained sensory analysis (overall tenderness, pork flavor intensity, juiciness, and off flavor). Data were analyzed as a split plot using PROC MIXED (SAS Inst. Inc., Cary, NC; V9.4) where loin was the whole plot and chop was the sub-plot. Loin within replicate by treatment was considered the random term. Significance was determined at $\alpha < 0.05$.

Results

All treatments had similar raw meat pH, and despite solution pH differences all loins post-enhancement remained similar in pH (5.71 to 5.86). Although pre-enhanced and post rest period weights were similar ($P > 0.05$) among all treatments, EOH loins had greater solution pickup ($P < 0.05$) than EOK and IS loins. However, after being cut EOH chops exuded more total water ($P < 0.05$) than IS, and CON chops on a 100% basis while CON chops were similar ($P > 0.05$) to IS. Moisture lost during cooking followed similar trends as water loss assays where EOH treated chops lost the most ($P < 0.01$) water, while IS treated chops lost the least water ($P < 0.01$). The use of alkaline water alone did not improve WBSF compared to IS treated chops, however EOK and IS treated chops were similar ($P > 0.05$) and more tender ($P < 0.01$) than CON chops. Sensory panelists rated EOK as being more tender ($P < 0.01$) than both EOH and CON, but less tender ($P < 0.01$) than IS chops. Panelists rated IS treated chops as juicier ($P < 0.01$) than all other treatments, which were similar ($P > 0.05$).

Conclusion

As a stand-alone enhancement solution alkaline electrolyzed reduced water was not a suitable replacement for industry standard solutions.