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Effects of Plum Concentrate, Potato Starch, and Rice Starch as a Phosphate Replacement on Quality and Sensory Attributes of Whole Muscle Hams

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Objectives

The purpose of this study was to evaluate the functionality of potato starch (PS), rice starch (RS), and plum concentrate (PC) as a replacement for phosphates in clean label curing brines, determined by the industry significant attributes of smokehouse yields, sensory analysis, and color scores.

Materials and Methods

Fresh inside ham pieces (Semimembranosus + Adductor) (n = 80), USDA-IMPS # 402F, were denuded and split into halves. Inside ham pieces were randomly assigned to one of four treatments including: a control containing traditional curing ingredients (CON), and three treatments with natural curing alternatives containing either plum concentrate (PC), potato starch (PS), or rice starch (RS) as phosphate replacement. Clean label treatment hams (CLT) were evaluated in conjunction with a traditional processed ham control (CON). The control brine was made with the addition of phosphate; whereas, the three clean label treatment brines received phosphate replacement inclusion via the vacuum tumbler. The ham pieces from all treatments were injected to approximately 125% of their fresh weight using a multi- needle injector. Hams were vacuum tumbled with a target post tumble weight of 130%. Inclusion rates for treatments included 2.25% (PS, RS) and 1.1% (PC) of the projected final meat block weight. Hams were then tumbled for 2 h at –15 mm Hg and 12 RPM (industry standard). Hams were cooked to an internal temperature of 62.7°C without the addition of smoke and chilled in accordance with USDA-FSIS Appendix B. They were then vacuum packaged and held under refrigeration (4°C) for 21d. Hams were evaluated for smokehouse yields, sensory analysis, and color scores. Ham samples were evaluated for: initial and sustained juiciness, initial and sustained tenderness, off flavors, ham flavor intensity, and mouth feel. Ham slices were held vacuum packaged, under refrigeration for an additional 7d, and then evaluated for L*, a*, b* color space values at 28d post cooking to simulate a retail setting. Differences in treatment results were analyzed using the MIXED models procedure of SAS.

Results

Hams treated with PS had the highest cooking and overall yield ($P < 0.05$), PC hams had the lowest cooking and overall yield ($P < 0.05$), and RS hams were comparable to CON. The CLT were darker and less red than CON ($P < 0.05$). Similarly, CON had the highest a* value ($P < 0.05$) indicating a significant redder color compared to PS, RS, and PC; additionally, CON had a higher b* ($P < 0.05$) compared to clean label treatments. The CON had decreased tenderness compared to CLT ($P < 0.05$). For all other sensory attributes CLT was comparable to CON. Trained sensory analysis determined all phosphate replacements maintained or improved sensory attributes over the control. Cooking yields were improved by PS, held similar by RS, and decreased significantly by PC when compared to the control. Both PS and RS should be considered acceptable phosphate replacements in natural curing brines.

Conclusion

Based on research presented, PS and RS are suitable replacement for phosphates in natural curing brines based on similar or improved yields, and similar or improved sensory attributes. Due to its extreme cooking loss PC is not a recommended phosphate replacement.