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The Effect of Specialty Salts on Cooking Loss, Texture Properties, and Instrumental Color of Beef Emulsion Modeling Systems

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Objectives

Salt plays an integral role in meat processing, and reduction or exclusion will have negative impacts on water holding capacity and binding function of protein and fat. Specific to meat emulsions, NaCl is used in the formulation due to its effect on the solubilization (extraction) of myofibrillar meat proteins, which allow the formation and stabilization of the interfacial matrix during manufacture and preparation. While previous research has addressed preservation (shelf-life and oxidation attributes) and flavor (sensory attributes) when using specialty salts in meat products, the application of specialty salts in meat emulsions has never been addressed in a scientific manner. Therefore, the purpose here was to evaluate the incorporation of different levels and types of specialty salts on the physicochemical and textural characteristics of beef emulsions.

Materials and Methods

Three specialty NaCl salts (premium sea salt, pink sea salt, and gray sea salt) were added to beef emulsion modeling systems at three different inclusion levels (0.70, 1.00, and 1.30%) and then compared with commercially sourced white salt. Salt (NaCl) purity levels for commercially sourced white salt, premium sea salt, pink sea salt, and gray sea salt were 99.8, 99.8, 95.2, and 94.9%, respectively. Cooking loss, emulsion stability, proximate composition, pH, texture profile analysis, and instrumental color of the emulsions were evaluated with three independent replications from one batch of ground beef. One batch of ground beef was used to properly control for confounding factors such as beef source and day of manufacture. Treatment was applied to one of twelve 500-g base emulsions (without artificial food dyes, preservatives, spices, and seasonings) containing beef (according to the level of salt added), water (28.14%), oil (8.00%), starch (2.00%), and phosphate (0.35%) for each replication (36 total experimental units). Data were analyzed with PROC GLIMMIX of SAS with fixed effects of salt type, salt inclusion level, and their interaction, and the random effect of replication. Least square means were separated using the PDIFF option with a Tukey-Kramer adjustment, and was further separated using an orthogonal set of estimate statements to analyze linear and quadratic effects for salt inclusion level. Differences were considered different at $P \leq 0.05$.

Results

Emulsion stability and cooking loss were primarily affected ($P < 0.01$) by salt inclusion level rather than salt type ($P \geq 0.13$). Stability increased and cooking loss decreased as salt inclusion level increased (linear $P < 0.01$). Proximate composition of cooked meat emulsions trended differently as salt increased from 0.70% to 1.30% salt inclusion level for the different salt types. Moisture increased and lipid decreased for commercial white salt, while moisture decreased, and lipid increased for all three of the specialty salts. Hardness, springiness, gumminess, and chewiness of emulsions increased as the level of salt increased for all the treatments and were greatest ($P < 0.0001$) in all treatments at the 1.30% salt inclusion level, however, no differences were observed between the salt types.

Conclusion

Overall, salt inclusion level, rather than salt type, had significant effects on the solubilization of protein and dispersion interactions of the emulsions, which affected physicochemical and functional properties.