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Identification of Novel Water Soluble and Volatile Components Associated With Saltiness Potentiation in Frankfurters

E. Price^{1*}, S. Rankin², T. Horiba³, M. Drake⁴, and J. Sindelar¹

¹Animal Science, University of Wisconsin–Madison, Madison, WI, 53706, USA; ²Food Science, University of Wisconsin–Madison, Madison, WI, 53706, USA; ³Kikkoman USA R&D Laboratory, Inc., Madison, WI, 53706, USA; ⁴Food, Bioprocessing, and Nutrition Sciences, North Carolina State University, Raleigh, NC, 27695, USA

*Corresponding author. Email: emprice2@wisc.edu (E. Price)

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Objectives

The objective of this research is to identify compound(s) associated with and potentially responsible for saltiness potentiation from the volatile and aqueous fractions of frankfurters containing soy sauce.

Materials and Methods

Previous research has shown sodium can be reduced in frankfurters through the addition of soy sauce (SS) while maintaining or potentiating a salty taste. This study involved 2 phases of research. The purpose of Phase I was to identify compounds potentially responsible for saltiness potentiation by manufacturing 2 treatments (TRT) of frankfurters with 2.50% salt (total formulation) with varying levels of flake salt (FS) and SS. The control (C) contained 100% FS, and the TRT contained 50% salt from FS and 50% salt from SS. A trained sensory panel evaluated the samples for the following attributes: smoke, meaty, salt, umami, hardness, and crosswise hardness. Aqueous fractions were generated by centrifugation and analyzed using LC-MS. Volatile compounds were analyzed using SPME and GC-MS.

The purpose of Phase II was to evaluate compounds identified in Phase I for their ability to potentiate saltiness. Traditionally manufactured frankfurters contained 2.50% salt (100% FS) were injected with aqueous solutions, post-manufacture, sufficient to yield various concentrations of selected volatiles at levels near published aroma thresholds. Volatile solutions were added by injecting into the center of each piece with a sterile hypodermic needle and allowed to equilibrate within the frankfurter at refrigeration temperature. A trained

sensory panel evaluated the samples for the following attributes: smoke, meaty, salt, umami, astringent, hardness, and crosswise hardness. Physiochemical analysis was conducted at d 14 for both research phases and included proximate analysis, internal and external measure of color ($L^*a^*b^*$), salt, pH, purge, emulsion stability, cook yield, and texture and puncture analysis.

Results

Phase I trained sensory analysis results showed the TRT had higher ($p < 0.05$) sensory scores for saltiness and umami flavor. Further, specific sensory attributes were unique to the SS containing TRT. Seven aqueous compounds identified were present at higher levels ($p < 0.05$) in the TRT. Fifty-six volatile compounds were identified in both the TRT and C. Semi-quantitative and qualitative means were used to identify specific volatiles that were either more abundant ($p < 0.05$) or unique to the TRT. Based on Phase I associations and high correlations with the salt attribute, specific volatiles were selected to be evaluated in Phase II. The TRT revealed lower ($p < 0.05$) internal L^* and a^* and external a^* values, and higher ($p < 0.05$) internal and external b^* values. Phase II results revealed TRT 1 was saltier ($p < 0.05$) and scored higher ($p < 0.05$) with aromas associated with the Phase I sensory studies than C. A nonlinear relationship was observed for volatile concentrations and their sensory attributes, which likely influenced saltiness perception. For external color, TRTs 1 and 2 had lower ($p < 0.05$) L^* values compared with C, and TRT 1 had higher ($p < 0.05$) a^* and b^* values than C.

Conclusion

This research identified a possible mechanism for the saltiness potentiation phenomenon observed in

frankfurters containing SS, where results suggest volatile compounds have the ability to contribute to saltiness potentiation in processed meat products.