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Utilization of Conventional and High Oleic Soybean Oil Oleogels Structured with Rice Bran Wax to Replace Pork Fat in Mechanically Separated Chicken-Based Bologna Sausage

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Objectives

The objective of this study was to assess the quality and organoleptic attributes of bologna formulated with soybean oil/rice bran wax (RBW) oleogels made with either conventional (CO) or high oleic (HO) soybean oil as pork fat replacers.

Materials and Methods

Six bologna treatments were manufactured using combinations of mechanically separated chicken and a lipid source to achieve a finished product fat target of 25.5%. The lipid sources used were: (1) 90% CO:10% RBW oleogel (C90); (2) 97.5% CO:2.5% RBW oleogel (C97.5); (3) 90% HO:10% RBW oleogel (H90); (4) 97.5% HO:2.5% RBW oleogel (H97.5), (5) liquid CO (CO); and (6) pork back fat (PF; control treatment). Treatments 1–5 were designed to replace 100% of the pork fat, which was approximately 41% of total fat. Treatment effects on emulsion stability, cook/chill yields, instrumental texture (Texture Profile Analysis [TPA] and incisor puncture) and color (CIE L*a*b*), lipid oxidation (TBARS), and sensory parameters were evaluated over a storage period of 98 d at 0–1°C. The experiment was replicated three times. Statistical analysis was conducted as a mixed model using JMP Pro 13.2.0 (SAS Institute, Cary, NC).

Results

No treatment effects were observed for fat loss in emulsion stability, but CO resulted in significantly higher ($P < 0.05$) water loss, suggesting a less stable batter. L* instrumental color values revealed that PF was significantly darker ($P < 0.05$) and CO and C97.5 were significantly lighter ($P < 0.05$) than all other treatments. a* values were also highest ($P < 0.05$) for PF and lowest ($P < 0.05$) for CO and C97.5. b* values were highest ($P < 0.05$) for PF and lowest ($P < 0.05$) for C97.5. This agrees with sensory color analysis, which found color intensity to be highest ($P < 0.05$) in PF and lowest ($P < 0.05$) in CO. TPA parameters (firmness, cohesiveness, springiness, resilience, chewiness) were not significantly different ($P > 0.05$) among treatments. No treatment effects were observed for incisor peak force values ($P < 0.05$). There were no treatment effects for the following sensory parameters: sensory bologna aroma, other aroma, texture, moistness and other flavor. However, bologna flavor was significantly higher ($P < 0.05$) for PF than for CO, H90 and C97.5, but not than for H97.5 and C90. No storage time effects were observed in sensory analysis ($P > 0.05$). There were significant ($P < 0.05$) treatment effects on lipid oxidation, with TBARS values being lowest for PF and CO; however, none exceeded 0.29 mg malondialdehyde/kg over the length of the study, indicating acceptable oxidative stability for all treatments throughout the entire storage period. Microstructure analysis showed fat globule size was larger in PF and smaller in CO than in all other treatments, which could be partly responsible for the lower emulsion stability observed.

Conclusion

Oleogels made with either high oleic or conventional soybean oil resulted in bologna products of similar quality and organoleptic properties, indicating they are easily interchangeable for this application. Use of high oleic soybean oil, however, would result in a product with a more favorable fatty acid profile. Pork fat replacement with liquid oil, while possible, could result in more unstable raw batters, less desirable color and lower flavor intensity.