SEEDS OIL OLEOGELS BASED ON NATURAL EDIBLE WAXES: OXIDATIVE STABILITY, SENSORY PROPERTIES, AND APPLICATION IN MEAT BURGERS PORK FAT SUBSTITUTES

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I. OBJECTIVES

The objective of this study was to investigate the possibility of replacing pork fat in meat burgers by oleogels produced from hemp seed oil containing 3% and 7% waxes.

II. MATERIALS AND METHODS

Oleogels were produced from hemp seed oil by mixing with rice bran wax or Candelila wax. Meat burgers were formulated from beef with 5 different lipid sources: (1) 20% pork fat (control), (2) 20% Oleogel with 3% rice bran wax, (3) 20% Oleogel with 7% rice bran wax, (4) 20% Oleogel with 3% Candelila wax, and (5) 20% Oleogel with 7% Candelila wax. Burgers were analyzed raw and cooked. Instrumental texture parameters (the firmness, stickiness, and spreadability for oleogels, texture profile analysis) and tenderness for burgers were measured with a Texture Analyzer (INSTRON 3343). Color parameters (CIE *L*a*b**) and lipid oxidation parameters were measured for oleogels and burgers. A sensory panel for the descriptive analysis consisted of 8 assessors (selected and trained according to the ISO 8586) experienced in sensory evaluation of meat and other products. The sensory attributes of the cooked samples were analyzed by using a standardized sensory descriptive method (ISO 13299). A structured numerical scale was used for the evaluation of the intensity of each attribute. The left side of a scale corresponding to the lowest intensity of an attribute was given the value of 1, and the right side corresponding to the highest intensity was given the value of 15. All sessions were conducted in a climate-controlled sensory analysis laboratory equipped with individual booths. A data collection system for automatic acquisition of the assessors scores and data analysis was used (FIZZ, Biosystems, France). All experiments were carried out with 3 replications. Data were analyzed using IBM SPSS version 25 (IBM Corp., Armonk, NY), and one-way analysis of variance was performed. Least significant difference was used to determine significant differences at $P < 0.05$.

III. RESULTS

The application of Candelila wax (3% and 7%) to produce the oleogels had a positive effect on hemp oil peroxide value in comparison to that of fresh hemp seed oil. Mechanical analysis of texture revealed that oleogels were able to match pork fat in some texture properties, such as spreadability and adhesiveness. Cooking losses were lower for control samples, while samples with oleogels' cooking losses were up to 20% higher ($P < 0.01$). Sensory profiles of cooked burgers revealed that off-flavor was not detected in all burgers, so it was possible to replace pork fat by oleogels without significant negative effect on the flavor properties of the burgers. However, control burger samples (formulated only with pork fat) had higher juiciness values ($P < 0.001$) and were more soft ($P < 0.05$) than samples with oleogels. During chewing process of burgers with oleogels, greasiness was perceived in mouth, which was not expressed in control burgers. This could be explained by the lower water/oil binding capacity of the burgers made with oleogels as determined by cooking losses. The results showed that wax-based oleogels from Candelila and rice bran have potential as pork fat substitutes in

burgers' matrixes. However, ways to increase the oil binding capacity to keep the juiciness typical for burgers should be developed.

IV. CONCLUSION

The results demonstrated a potential application of oleogels as a substitute for animal fat in meat burgers. Future studies should be focused on how to mimic pork fat sensory properties.

Keywords: natural waxes, oleogel, oxidative stability, pork fat substitutes, sensory