# BREADFRUIT FLOUR ENGINEERED WITH DIFFERENT TWIN-SCREW EXTRUSION CONDITIONS AND THE EFFECTS ON PHYSICOCHEMICAL PROPERTIES OF FLOUR AND TECHNOLOGICAL PROPERTIES OF MEAT EMULSIONS

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## I. OBJECTIVES

The objective was to determine the structural and technological properties of beef emulsion modeling systems prepared with breadfruit flour engineered with different twin-screw extrusion conditions.

## II. MATERIALS AND METHODS

Native breadfruit flour was extruded with twin-screw extrusion technology (Coperion ZSK MV PLUS 27, Ramsey, NJ) under different conditions, which included feed moisture content (17% or 30%) and last barrel temperature (80°C or 120°C). Based on these different conditions, 4 extruded flours with different mechanical and thermal energy were obtained and defined as (1) Low Specific Mechanical Energy (SME; 74 kJ/kg)–Low Temperature (83°C) (LS-LT), (2) Low SME (74 kJ/kg)–High Temperature (105°C) (LS-HT), (3) High SME (145 kJ/kg)–Low Temperature (100°C) (HS-LT), and (4) High SME (145 kJ/kg)–High Temperature (126°C) (HS-HT). Proximate composition, water-binding capacity, oil-binding capacity, swelling power, and pasting property were assessed in the native and extruded flours. Beef emulsion modeling systems ($n = 3$ for each treatment) were used to determine the effects of the 4 extruded breadfruit flours at an inclusion level of 3% on the structural and technological properties of beef emulsion modeling systems. pH, cooking loss, texture, instrumental color, microstructure, and dynamic rheological characteristics were evaluated. Statistical analysis was performed with PROC GLIMMIX of SAS (SAS Institute Inc., Cary, NC) with a fixed effect of treatment and a random effect of replication. Least-squares means were separated using the PDIFF option with a Tukey-Kramer adjustment.

## III. RESULTS

Extrusion treatment did not change ($P > 0.05$) the main compositional attributes of the flour, namely starch and protein. Lower SME (74 kJ/kg) extrusion treatments (LS-LT and LS-HT) resulted in an increased ($P < 0.05$) capacity for water absorption compared to higher SME (145 kJ/kg) extrusion treatments (HS-LT and HS-HT). Setback viscosity was decreased ($P < 0.05$) in all extruded flours compared with the native flour. Replacement of ground beef with native or extruded flours in meat emulsions did not change ($P > 0.05$) cooking loss, instrumental Minolta redness, and viscoelasticity. Addition of LS-HT, HS-LT, or HS-HT extruded flours decreased ($P < 0.05$) hardness, while hardness of meat emulsions prepared with native flour or LS-LT extruded flour was not different ($P > 0.05$) compared with control (no-flour-added) samples. Replacement of ground beef in the meat emulsions with 3% native or any of the extruded flours did not change ($P > 0.05$) springiness and adhesiveness.

Moreover, microstructure and dynamic rheology showed that extruded flours behaved differently in the meat matrix compared with the native flour.

## IV. CONCLUSION

This research is beneficial to the meat industry since it provides a characterization of the structural network and functional changes apparent when meat emulsions were formulated with native and pre-gelatinized extruded breadfruit flours, which are novel, previously unresearched flour ingredients. Overall, it can be concluded that incorporation of extruded breadfruit flours can modify the structural and technological attributes of beef emulsions compared with the incorporation of native flour, but technological functions of beef emulsions formulated with different extruded flours were not different.

Keywords: breadfruit flour, extruded flour, meat emulsion modeling