STABILITY OF MODEL SYSTEM BEEF EMULSIONS CONTAINING LINSEED OIL-IN-WATER GELLED EMULSIONS

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Abstract –The aim of this paper was to investigate the characteristics of model system beef emulsions produced with linseed oil-in-water gelled emulsions (GE) as beef fat (BF) replacers. Four different meat emulsions were prepared with 100% BF (C), 70% BF+30% GE (G1), 50% BF+50% GE (G2) and 30% BF+ 70% GE (G3). It was found that G3 samples had the most significant effect to increase emulsion stability, water-holding capacity and jelly-fat separation of beef emulsions. Our results indicated that replacing 70% of beef fat with GE might have promising impacts to provide stable emulsions and could be a new option to compensate for animal fat in technological manner to develop healthier meat product formulations.

Key Words – meat emulsion, gelled emulsion, linseed oil, beef fat, gelatin, inulin.

I. INTRODUCTION

Today consumers mostly associate meat with a negative image as a high fat and cancer-promoting food, thus an important goal for the meat industry is to suggest novel fat modification strategies for meeting consumer demands. Gelled emulsion (GE) systems are one of the novel proposals in reformulation of meat products in order to develop healthier profiles related to lipid content and fatty acid composition. An emulsion gel is defined as an emulsion with a gel-like network structure and solid-like mechanical properties [1]. Although oil-in-water (O/W) emulsions have been widely used for lipid modification, GEs could be a better option to mimic functional and sensory characteristics of animal fat used in most of the currently consumed meat products [2]. Linseed oil is known as a functional oil which is rich in long chain ω-3 polyunsaturated fatty acids [3]. In this study, we aimed to investigate emulsion characteristics of model beef systems produced with linseed oil-in-water GEs stabilized with gelatin and inulin as partial beef fat replacers.

II. MATERIALS AND METHODS

Fresh boneless beef shoulder, beef fat, linseed oil and other additives were supplied from local market. GE was prepared according to Serdaroğlu *et al.* [4]. Each treatment was formulated to contain 20% total fat. Control (C) group was consisted of 100% beef fat. GE was added to the formulations by replacing 30% (G1), 50% (G2) or 70% (G3) of beef fat. Model system beef emulsions were produced according to Öztürk *et al.* [5]. Emulsion stability (ES) as total expressible fluid (TEF) and expressible fat (EFAT) [6], water-holding capacity (WHC) [6], jelly and fat separation (JFS) [7] were analyzed to evaluate emulsion characteristics. Data was analyzed by ANOVA and Duncan Post-Hoc tests using the SPSS software.

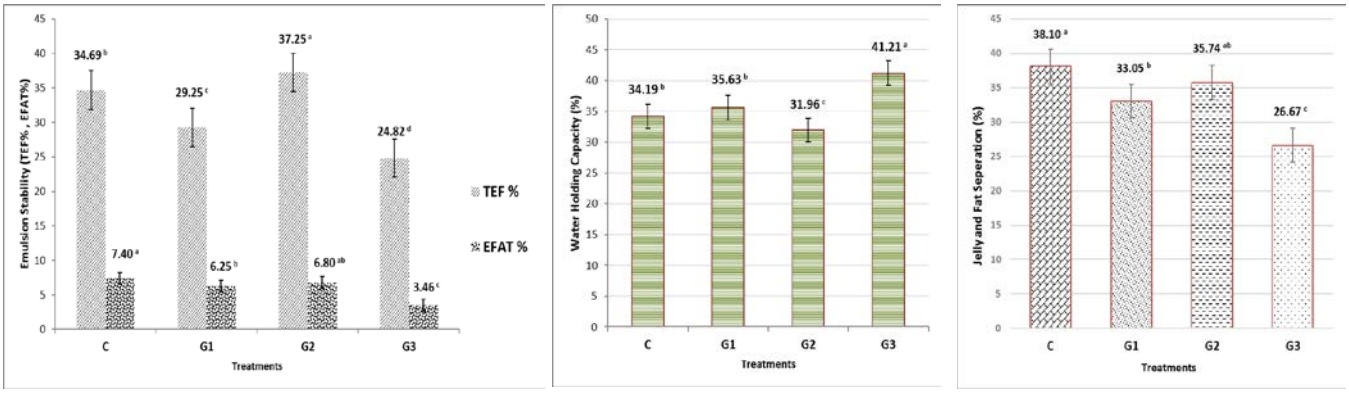
III. RESULTS AND DISCUSSION

Stability of an emulsion is defined as the ability of the structure to resist changes over time. ES of the treatments in terms of TEF and EFAT is presented in Fig. 1(a). TEF% values were between 24.82-37.25%, whilst EFAT% values were between 3.46-7.40%. Both of the TEF and EFAT values were lowest in G3 samples compared to other treatments (P<0.05), meaning that the highest ES was detected in this group. The highest TEF and EFAT values were detected in G2 and C samples, respectively (P<0.05). Although G1 samples had better ES compared to G2, the most stable group was detected as G3. This result showed that a better ES could be achieved in GE concentrations more than 70% as fat replacers.

WHC, which is the ability of meat to retain moisture is an important quality indicator associated with ES. WHC of the samples, which could be seen in Fig. 1(b), ranged between 31.96-41.21%. G3 samples had the highest and G2 samples had the lowest WHC compared to others (P<0.05), but the values were similar in C and G1 samples. These values showed that likewise ES, increasing GE concentration to 70% might prevent water release from the structure.

The amount of liquid released from emulsions at a certain temperature is referred to JFS value, which is an indicator of emulsion destabilization. JFS values of the samples are shown in Fig. 1(c). The values were between 26.67-38.10%.

Similar to ES and WHC results, the lowest JFS was determined in G3 samples (P<0.05). C samples had higher JFS compared to G1 (P<0.05), however C and G2 samples had similar values.
The results indicated that 50% beef fat replacement with GE lead to emulsion destabilization compared to both 30% and 70% BF replacement. Therefore, increasing GE concentrations to 70% could have a potential to increase emulsion stability, probably due to solid-like structure and the binding abilities of gelling agents used in the formulation. Previous studies reported that gelled emulsions offer advantages to produce various meat products showing good technological properties (2-4).



(a) (b) (c)

Figure 1. (a) Emulsion stability (Total expressible fluid and total expressible fat) (b) water-holding capacity (c) jelly and fat separation of model system beef emulsion samples (abcd: means with the different letter are significantly different (P<0.05).

IV. CONCLUSION

The results of our study indicated that linseed oil gelled emulsions have a potential to improve emulsion characteristics in terms of stability, water-holding and fluid separation when used as 70% of beef fat, thus these systems might present an opportunity to compensate for animal fat and protect the stability in healthier meat product formulations. There should be further research on this topic regarding total fat replacement and its effects on different quality attributes.

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