OPTIMISATION OF ADDED NON-MEAT PROTEINS IN THE MANUFACTURE OF PREFORMED EMULSIONS USING RESPONSE SURFACE METHODOLOGY

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Background

During the comminution of meat, extensive physical cellular disruption occurs which allows for the extraction of functional myofibrillar proteins. However, disruption and dispersion of fat also occurs and it is the myofibrillar proteins which stabilise the fat within this system (Morrissey *et al.*, 1987, Gordon and Barbut, 1992). A classical emulsion consists of two immiscible liquid phases, one of which is dispersed in the other in the form of a colloidal suspension. However, finely comminuted meat products are a complex mixture of muscle tissue, fat particles, water, added ingredients such as salt, phosphates, fillers and extenders which are held together by a variety of attractive forces (Jones, 1984). Advances in protein technology have resulted in the development of functional cheap non-meat protein sources with the potential to emulsify meat and replace myofibrillar protein. The objective of this study, was to evaluate and optimise the emulsification capacity of two functional non-meat proteins, namely: soya isolate and a 35% high gelling whey protein concentrate (WPC) as a function of cook losses, water holding capacity and mechanical textural properties.

Materials and Methods

Fresh pork backfat (20 kg) was minced through a 10 mm plate, divided into 20 (1 kg) batches, vacuum packed and held at -20°C until required for processing. Water, fat and non-meat protein levels were weighed out as suggested by the response surface methodology (RSM) design for preparation of preformed emulsions. Emulsions were processed hot (40°C ± 5°C) using a Stephan UMC 5 electronic. Protein was first hydrated in the water for 2 min. fat was then added and chopped for a further 4.5 min. Emulsion samples were canned (150 ml) and heat treated at 80°C x 2 h in a Zanussi oven ZGI IP25 or retorted at 121°C x 15 min x 15 psi. All samples were stored at 4°C x 16 h prior to testing. Emulsions were assessed for cook losses (on reheating to 40°C) and texture profile analysis (at 4°C) using an SMS texture analyser in compression mode, fitted with a 25 kg load cell. Emulsion morphology was assessed using light microscopy. Pilot scale optimisation trials (5 kg) were also completed ($n = 3$) where 8:8:1 preformed emulsions (water:fat:protein, respectively) were prepared both hot (40°C ± 5°C) and cold (20°C ± 5°C) and evaluated using the same parameters employed in RSM trials. Samples analysed included Soya, WPC, a commercial sodium caseinate control and a fat control.

Results and Discussion

RSM data presented for cook losses and emulsion hardness in samples processed at 80°C showed that preformed 8:8:1 emulsions were shown to give near optimum results for emulsion stability (Fig. 1). Results show that soya isolate gave better emulsion stability than WPC over the range of preformed emulsion ratios assessed. Pilot scale trials ($n = 3$) of 8:8:1 preformed emulsions showed that can cook losses were significantly ($p < 0.05$) reduced on addition of non-meat proteins in both hot and cold emulsions compared to control. In hot preformed emulsions, cook losses were significantly ($p < 0.05$) lower than that of the cold preformed emulsion. No significant difference ($p > 0.05$) was observed between samples cooked at 80 and 121°C. Whey protein concentrates were significantly ($p < 0.05$) more compressible in hot emulsions than cold. Light microscopy showed large differences in final emulsion morphology when processed hot and cold, with greater stability observed in hot systems.

Conclusions

RSM trials showed that soya isolate was more effective over a greater emulsion range compared with the WPC. However, utilisation of the 35% WPC in pilot scale trials produced very similar results for emulsion stability *versus* soya isolate. Results showed that the addition of non-meat proteins in meat systems significantly reduced cook losses, thereby influencing texture and morphology, especially when applied in a hot emulsion system.

References

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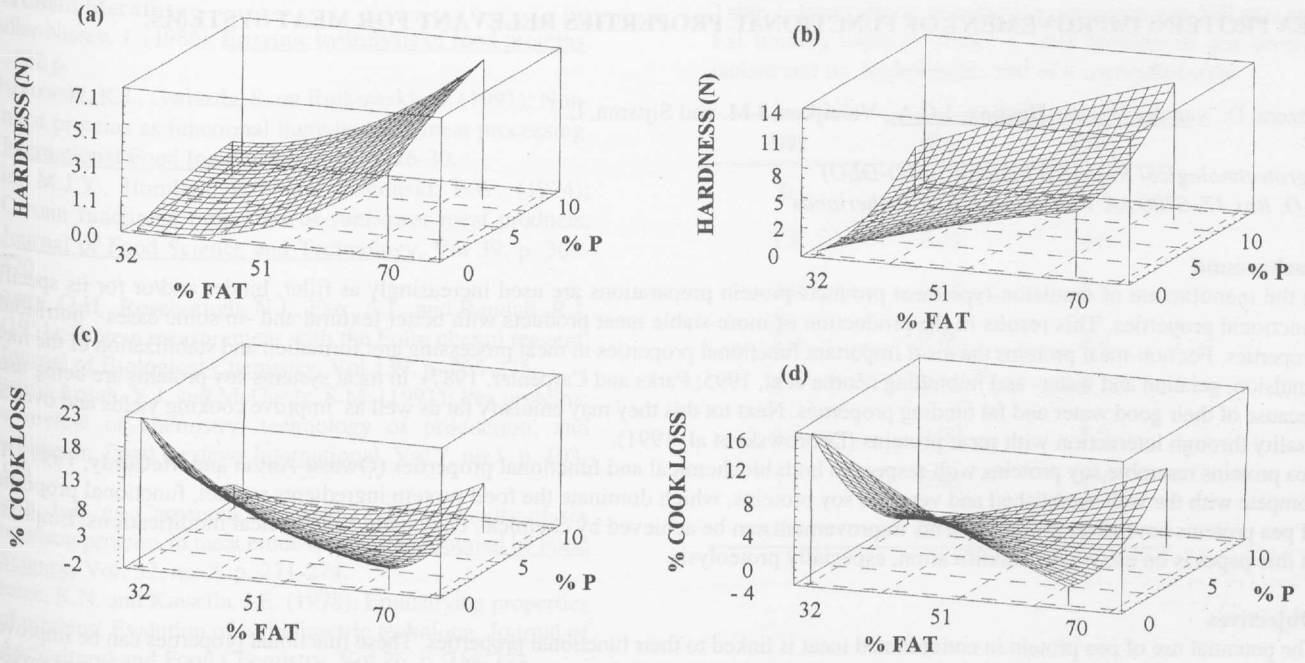

Figure 1 Results for hardness (a and b) and % cook loss (c and d) values for heated (80°C x 2h) preformed pork backfat emulsions containing added wpc (a and c) and soya (b and d) non-meat proteins (%**P**)

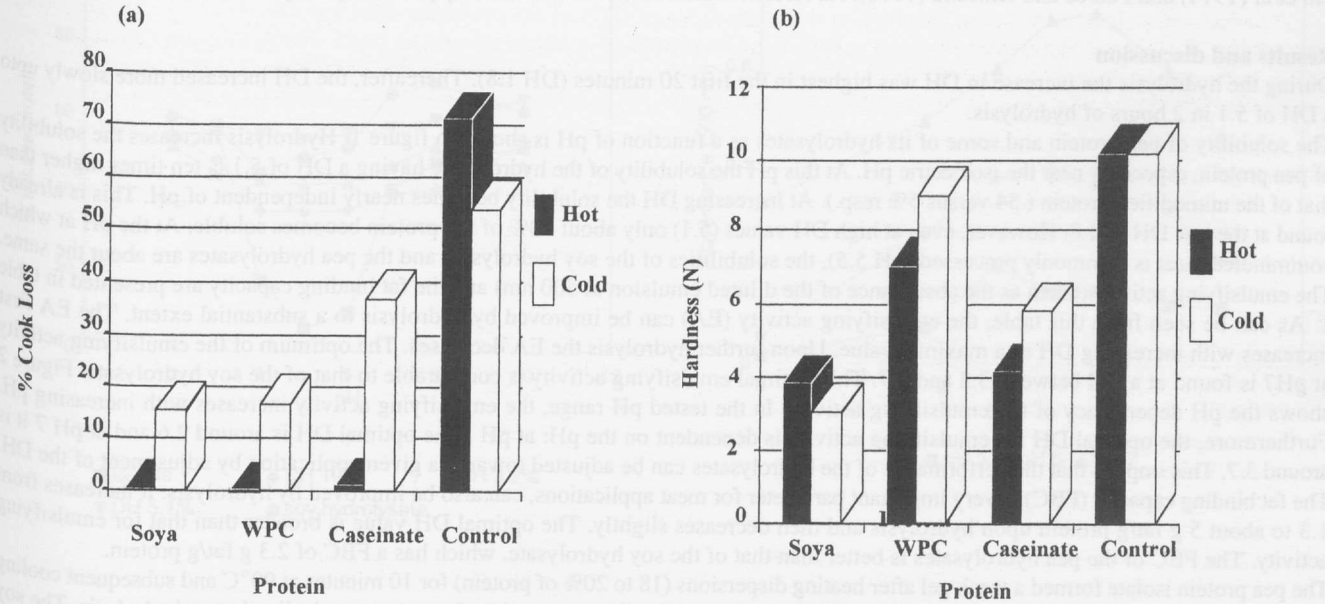

Table 1 Mean values (n = 3) from pilot scale trials of cook losses (a) and hardness compression values (b) for preformed emulsions prepared both hot (>40°C) and cold (<20 °C) and cooked at 80 °C x 2 h.