

Effects of added functional proteins on the quality characteristics of comminuted meats using response surface methodology

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Background

Utilisation of natural functional proteins in meat processing has gained considerable interest in recent years (Ensor *et al.*, 1987; Lecomte *et al.*, 1993). Incorporation of functional adjuncts such as soya, and collagen proteins in processed meats has been shown to stabilize emulsions and increase water and fat retention (Osburn *et al.*, 1997). This demand for natural functional proteins is driven largely through a growing consumer demand for meat products containing reduced levels of additives and increasing pressures on meat processors to prepare cost effective meat products. The objective of this study was therefore, to evaluate novel proteins (soya protein isolate -SPI-, porcine blood plasma -BP- and porcine connective tissue -PCT-) using beef and pork model meat systems in terms of % cook losses, water holding capacity (WHC), colour (Hunter L, a, b values) texture (texture profile analysis TPA) and purge losses (freeze thaw stability).

Materials and Methods

Response Surface Methodology (RSM) was used to study the effect of two compositional variables namely protein addition (0-30%) and added water level (10-50%) in both comminuted pork and beef model systems. Protein and added water replaced meat as suggested by the RSM design with NaCl levels being kept constant at a level of 2%. Meat, water, salt, and dry test ingredients were chopped in a Stephan Mixer (Stephan u. Sohner GmbH & Co., Stephanplatz 2, D-31789 Hameln, Germany) for 2 min. After chopping meat batter was filled into cans (100 +/- 0.5 g), cans were hermetically sealed, and cooked in either a Zanussi steam oven at 80°C for 2 h or retorted at 121°C for 15 min before final cooling at 4°C x 16 h. Cook losses were determined on reheating cans (50°C x 1 h). Cans were opened and cook losses decanted off with % cook loss being recorded as weight difference. Test samples were compared against controls containing no added test proteins for the additional properties of colour, texture, water holding capacity -WHC- and purge loss.

Results and Discussion

Results for cooked products gave similar trends in % cook loss and WHC values for products processed at 80°C and 121°C. However, product stability was shown to be greatest at the lower processing temperatures. Moreover, % cook loss data showed that an increase in test protein

additions resulted in significant ($p < 0.001$) decreases in % losses in pork products when compared with similar data for beef products. Medium levels of protein and water addition (15% protein and 30% water addition) to pork products cooked at 80°C produced the optimum combinations for SPI and CT, resulting in cook losses of 8% and 13%, respectively (Fig 1). Water holding capacity data showed that an increase in SPI addition and added water significantly ($p < 0.01$) increased the % held moisture in pork processed at 80°C and 121°C. Optimum protein levels at which SPI and CT retained moisture occurred at a levels of 15% protein and 30% water addition, resulting in 45% and 55% held moisture respectively. Increasing BP and CT protein levels in combination with water addition resulted in a significant increase in hardness values. Optimal functionality for BP was determined at 15% protein addition and 30% water addition producing maximum hardness values (9000g) when compared with control values. BP was found to have the most significant ($p < 0.05$) effect on meat Hunter 'a' values.

Conclusion

Ranking of proteins showed that BP > SPI > (WPC) > CT for the properties of cook loss and WHC. Results for mechanical force showed that increasing levels of CT, BP and SPI decreased shear force values. BP gave the greatest increases in Hunter 'a' values and produced the lowest purge loss values. In summary, data showed that proteins could be employed successfully in the manufacture of processed meat products as meat extenders.

References

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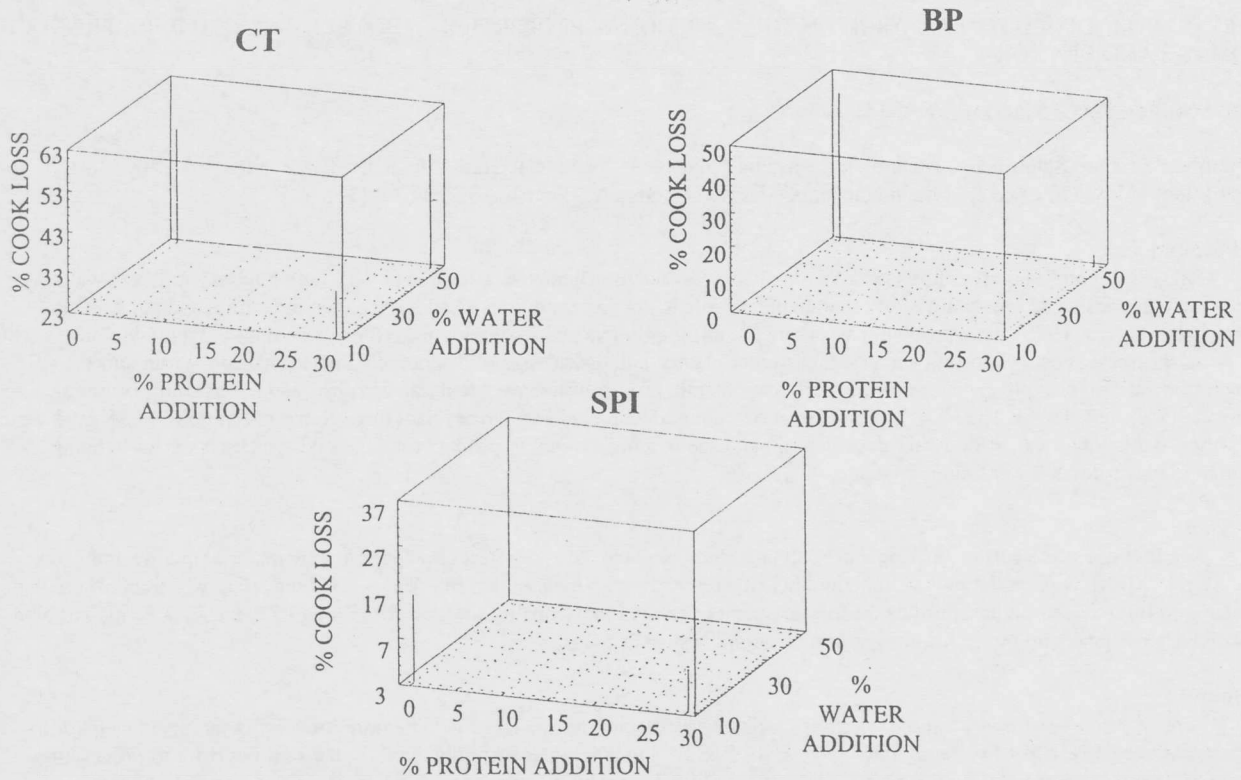


Fig. 1 RSM results for cook loss (%) values for cooked (80°C x 2 h) pork batters containing pork connective tissue (CT), porcine blood plasma (BP) and soya protein isolate (SPI) at levels of 0 - 30% powder addition in combination with added water level of 0 - 30%.

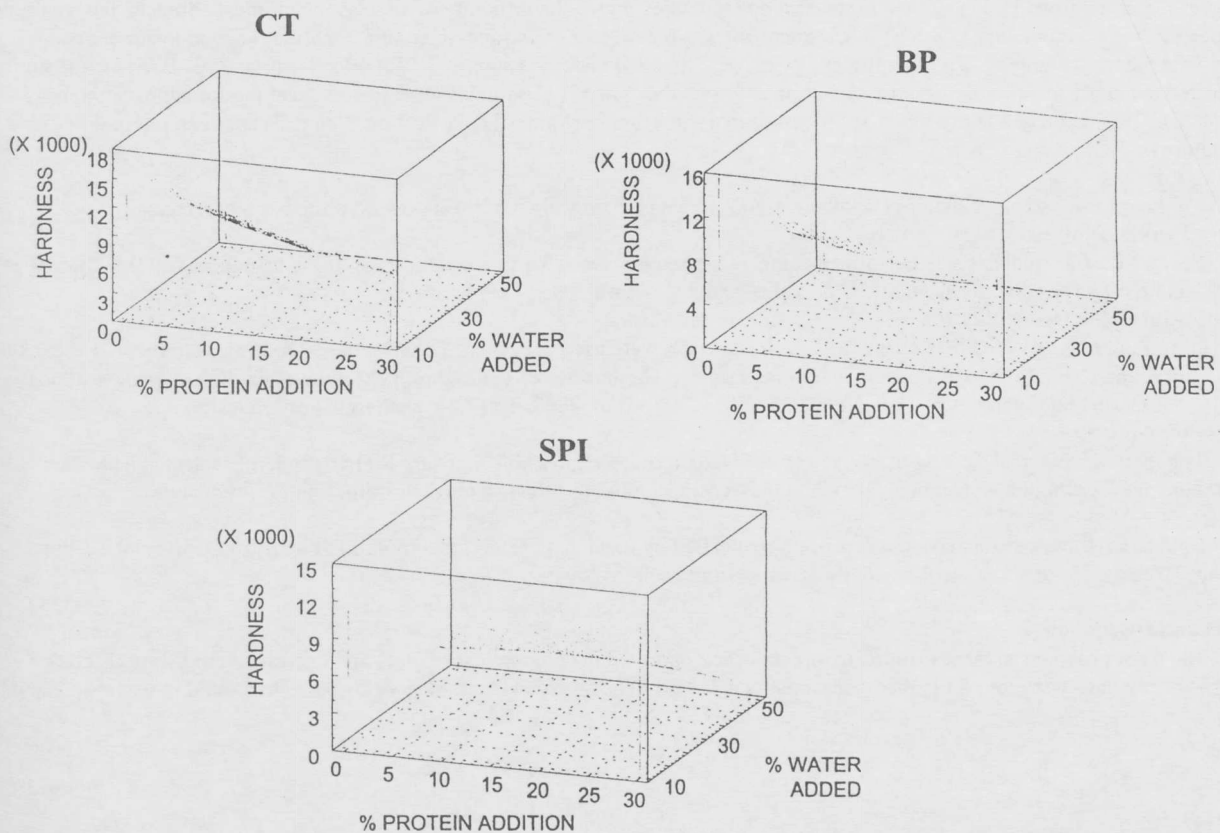


Fig. 2 RSM results of hardness values (KgF) values for cook loss (%) values of cooked (80°C x 2 h) pork batters containing pork connective tissue (CT), porcine blood plasma (BP) and soya protein isolate (SPI) at levels of 0 - 30% powder addition in combination with added water level of 0 - 30%.