THE INFLUENCE OF CHEMICAL DENATURANTS ON THE STRUCTURAL CHARACTERISTICS OF MECHANICALLY RECOVERED POULTRY MEAT MODEL SYSTEMS IN THE PRESENCE AND ABSENCE OF ADDED NON-MEAT PROTEINS.

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Background

During the manufacture of comminuted meat products, a critical balance between protein-protein interactions and protein-water interactions is necessary to give the desired textural and water holding properties in the final meat product. If protein-protein interactions are too strong, then the product may have a tight aggregated structure with poor water holding properties and a very firm texture. In contrast, if protein-water interactions are dominant the product may lack structural integrity and have a very soft texture. However, regardless of the molecular interactions involved, myofibrillar protein is accepted as being the primary functional protein source (Morrissey et al., 1987; Gordon and Barbut, 1992). One method that has been employed to elucidate the role of these myofibrillar proteins in the structure/function relationships of batter texture and stability, is the incorporation of specific chemical blockers (Gordon and Barbut, 1992). Whiting (1987) for example, reported that addition of urea stabilised meat batters and increased cook yields, thus concluding that this interaction was a result of the disruption of H-bonds, electrostatic interactions and increased availability of hydrophobic bonds. The increasing number of functional non-meat proteins used as alternative protein emulsifiers/stabilisers in meat product manufacture has led to more complex multicomponent gelled meat systems. The main objective of this study was to evaluate a range of non-meat proteins to determine the potential interactions occurring between added proteins and myofibrillar proteins using a selection of chemical denaturants. A texture profile analysis (TPA) and cook loss measurement was applied to determine these interactions.

Materials and methods

Frozen (-20°C x 48 h) mechanically recovered poultry meat (MRPM) obtained 48h *post mortem* was minced, mixed (Composite analysis: protein 15%, fat 15%, water 67%) and randomly assigned to treatments. Test protein batters were prepared in a 1:1 ratio (50% MRPM: 50% of a 10% non-meat protein solution). Total sample weights of 500g were prepared for testing. Denaturants added included, dithiothreitol (DTT) (0.05%), Triton-x-100 (1%), sodium dodecyl sulphate (SDS) (1%) and urea (5%). Concentrations of denaturants were based on levels reported by previous workers (Whiting, 1987; Gordon and Barbut, 1992). Commercial non-meat proteins assessed in the study included, thermally modified high gelling WPCs: (35.0% protein, Dairygold Foods, Mitchelstown, Ireland), soya isolate (90.0% protein, Protein International, Leper, Belgium), Na caseinate (88.5% protein, DMV Veghel, Holland) and egg albumen (75% Lactosan, London U.K.). Treatments were mixed using a Eurostar digital IKA laborotechnik mixer (900rpm x 5min). All denaturants were dissolved in the water phase. Control mixtures included a 1:1 ratio of MRPM to water mixture. All samples were tested in triplicate, with trials repeated three times. MRPM samples were weighed into cans (100±0.5g), sealed, cooked at 80°C x 2h in a Zanussi oven (Model ZGI IP25) and finally cooled at 4°C x 16h. Cook losses were determined on reheating cans at 45°C x 1h, cans were opened and the cook losses decanted off, where % cook losses were recorded as the weight difference between samples before and after cooking. MRPM samples were also filled (n=3) into glass tubes (length-125mm i.d-15mm). Tubes were heated in a Julabo FH programmable water bath to 80 °C at a rate of 1 °C/min, held at 80 °C x 30min and cooled to 20 °C at a rate of 1 °C/min. On heating, tubes were removed and cook losses decanted. Samples were stored at 4°C x 16h. A texture analyser, Model TA-XT2I (Stable micro-systems) fitted with a 5kg load cell was used to determine the viscoelastic and textural parameters of final gels (15mm x 15mm). 20% gel compressions on samples (n=6) were performed using a 50mm diameter cylindrical probe. The viscoelastic and texture properties of gels were finally determined as described by Bourne (1978 and 1988).

Results and discussion

Cook losses of test samples containing 50% mrm/50% non-meat protein (10% protein solution) showed decreasing cook losses in the order control >Na caseinate >soya >WPC >egg albumin (Fig. 1a). Gel strength (hardness) values decreased in the following order Soya > egg albumin > WPC > Na caseinate > control (Fig. 1b). Soya isolate gave the highest values for hardness followed by egg albumin and WPC. Soya however, gave lower values for water holding capacity *versus* WPC or egg albumin, indicating a more open structure in the MRPM gels formed using these latter two proteins. Denaturant results (Table. 2) showed that on addition of DTT, gel hardness decreased while cooking losses increased in WPC test batters. This result would suggest that disulphide bonds play a significant role in MRM/WPC batter stabilisation (Gordon and Barbut, 1992). Urea causes the disruption of hydrogen and electrostatic bonds and the increases the availability of hydrophobic bonds (Gordon and Barbut,1992). In the soya batters, both urea and SDS reduced cook loss and decreased hardness. SDS further reduced hardness values in the egg albumin treatments. Similarly, addition of SDS and urea to Na caseinate samples reduced cook losses and hardness values.

Conclusion

Egg albumin and WPC were shown to provide good meat batter stability texture (and water retention). Denaturant results showed that disulphide bonds were important in mrm/WPC batter stabilisation, with H-bonds/electrostatic and hydrophobic interaction being more important in

mrm/soya and mrm/casein stability and texture, with these latter molecular interactions having a possible role in mrm/albumin batter stabilisation.

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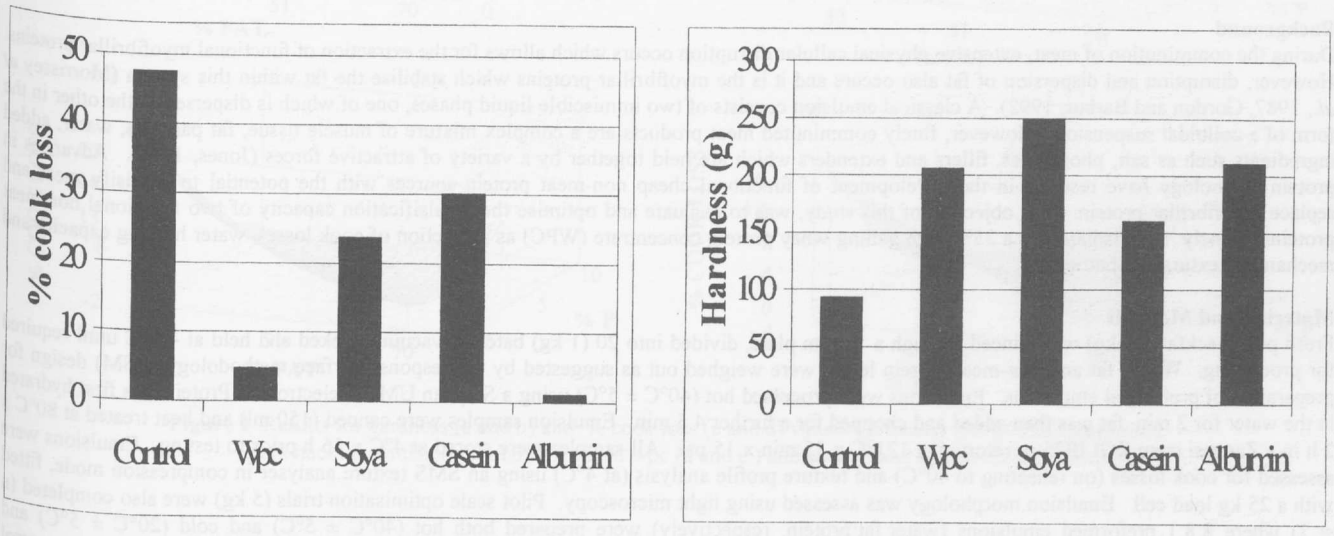

Figure 1. Mean values (n=3) for cook losses (a) and mechanical compression (b) values for control mechanically recovered poultry meat (MRPM) treatments containing 50% meat and 50% water, and test samples containing 50% MRPM with 50% of a 10% non-meat protein solution containing either 35% whey protein concentrate (WPC), 90% Soya isolate, 85% sodium caseinate or 76% egg albumin.

		Denaturants				
	Treatment	**Dtt**	**Triton**	**SDS**	**Urea**	**Control**
A	Meat 50%+Water 50%	46.82±1.33	46.19±2.95	49.77±2.37	40.88±3.61	47.54±0.18
	Whey protein	12.33±0.51	4.31±0.71	5.33±1.7	1.86±0.73	4.73±0.61
	Soya	24.87±1.53	22.96±1.33	2.59±0.97	10.11±0.54	23.65±1.32
	Na Caseinate	24.87±1.53	22.92±1.33	2.59±0.97	8.38±2.43	29.98±0.48
	Egg Albumin	0.99±0.17	8.76±0.25	2.47±0.9	0.81±0.14	1.08±0.15
B	Meat 50%+Water 50%	61.08±3.72	105.5±4.98	51.06±8.26	64.67±6.045	92.51±3.16
	Whey protein	147.47±7.41	194.48±15.53	218.81±9.58	158.46±7.2	205.12±9.18
	Soya	146.57±7.82	215.83±7.96	115.41±9.6	167.07±7.21	248.4±12.6
	Na Caseinate	77.32±3.87	163.1±10.11	28.12±6.9	88.39±5.08	159.66±11.33
	Egg Albumin	246.68±16.844	230.73±14.58	225.26±6.65	173.09±32.42	210.27±29.48

Table 1. Mean values (n=3) and standard deviation for (A) cook losses and (B) hardness values (g) for control mechanically recovered meat (MRM) treatments containing 50% meat and 50% water (with and without denaturants) and test samples containing 50% MRM with 50% of a 10% protein solution of non-meat proteins, proteins WPC (whey protein concentrate), soya isolate, sodium caseinate and egg albumin.

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