ASSESSMENT OF NON-MEAT PROTEINS IN THE MANUFACTURE OF REFORMED CURED MEAT PRODUCTS

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Background

Successful manufacture of processed meats is achieved through adequate solubilisation and extraction of myofibrillar proteins *via* salts and/or mechanical manipulation, with heat induced gelation of these proteins leading to water, fat and meat binding in final products (Morrissey *et al.*, 1987). The range of novel functional non-meat proteins currently available for use in processed meat products including, dairy (Haylock and Sanderson, 1991) and vegetable (Hoogenkamp, 1992) sources have allowed for even greater scope in meat formulation and manufacture. This is due primarily to the ability of these non-meat proteins to act as potential alternate water binding, meat extending, texture modifying and/or nutritional enhancing adjuncts in place of meat proteins. Therefore, the aim of this study was to evaluate commercial non-meat proteins for the quality characteristics of processing yields, water holding capacity, Hunter L, a, b colour values, as well as sensory attributes of flavour, salt intensity, juiciness, bind, colour and odour in whole porcine muscle cured ham products compared to controls.

Methods

Non-meat proteins evaluated in this study are outlined in Table 1b. Powders 1, 2 and 3 were added at residual powder levels of 1.0 to 4.0% in increments of 0.5%, with powders 4, 5 and 6 added at a level of 1.0%. Protein powders were hydrated in half of the brine water and mixed for 15min. Sodium chloride (2.0% residual), and sodium nitrite (250mg/kg residual) were hydrated and mixed in the other half. Treatments (n=2) were prepared in the presence and absence of Tripolyphosphate (0.25% residual). Brine fractions were combined and mixed for 10min prior to injection. Sodium ascorbate (1%) was added to the brine during this final mixing stage. Whole de-boned pork legs obtained 24h *post mortem* within a pH range of 5.6-6.0 were injected to a target level of 25%. Injected meat was massaged under vacuum (28mm/Hg) at 4°C for a total time of 14h at 10 revs/min, with 20min on and 10min off, for a total of 5,600revs. Control sample, without added proteins, was always used in paired tests in conjunction with non-meat protein treatments tested. On massaging, meat was stuffed into cryovac bags, vacuum packaged and dipped in hot water (80°C x 1.5mins). Meat was cooked in a Sumann oven to a core temperature of 68°C at cabinet temperatures of either 70 or 80°C, chilled at 4°C on cooking and stored for 18h prior to analysis. Cook yields, Grau Hamm water Binding capacity (WBC) results. Sensory analysis was carried out by an in-house panel (n=10) in duplicate using an eight point scale (8=extremely: juicy, intense, strong, red, strong, with 1=extremely: dry, bland, weak, pale and bland, respectively). Data was assessed statistically (general linear regression model) using Minitab.

Results

A significant ($p<0.05$) 3 way interactive effect (*powder x powder concentration x temperature*) was observed for cook yield, WBC and Hunter 'a' values (Table 1a). Increased cooking temperatures (80°C) gave lower cooking yields, WBC values and Hunter 'a' values. Temperature significantly influenced protein functionality with powders having a beneficial effect when cooked at cabinet temperatures of 80°C. Addition of non-meat proteins, especially high gelling WPCs significantly ($p<0.05$) increasing cook yields (up to 6%) and WBC results both in the presence and absence of phosphates. Protein type significantly ($p<0.05$) influenced cook yields, WBC, colour and sensory values. A 1% residual powder level of Na caseinate decreased product yield, colour, and sensory scores. Meat bind was also greatly reduced when Na caseinate was added as previously reported (Kerry *et al.*, 1995). Soya and Na caseinate and egg albumin powders were added at a maximum level of 1% residual powder due to unacceptable increases in brine viscosity and foaming with a further decrease in organoleptic scores for colour, flavour and odour in meat. Residual WPC powder levels of 2–4% significantly ($p<0.05$) increased final cook yields and WBC values. A 2-4% addition of the 35% WPC significantly ($p<0.05$) increased cook yields, WBC and Hunter 'a' values *versus* controls with the latter result correlating with organoleptic colour scores (Table 2). Cook yield and WBC results showed that addition of phosphate (0.25%) significantly ($p<0.01$) increased cook yields on average by 10% and did not significantly ($p<0.05$) affect protein functionality. Sensory analysis showed that the addition of protein isolates and increased levels (3-4%) of the 75% protein WPCs resulted in decreased sensory scores for flavour and colour (Table 2).

Conclusion

Addition of non-meat proteins significantly ($p<0.05$) enhanced (with the exception of Na caseinate) cook losses, WBC, Hunter 'a' values and sensory scores of cooked ham products. Powders were ranked as follows, High gelling (HG) 35% WPC > Soya isolate > HG 75% WPC > egg albumin > regular 75% WPC > Control > Na caseinate.

References

Haylock, S.J. and Sanderson, W.B. (1991) *American Chem. Soc. Washington, DC, U.S.A.* pp. 59–72; Hoogenkamp, H.W. (1992) Corby: *Protein Technologies International*, pp. 0-258; Kerry, J.F., Morrissey, P.A., O' Neill, E.A. and Buckley, D.J. (1995) *41st ICoMST* San Antonio, Texas, U.S.A. 441-442; Morrissey, P.A., Mulvihill, D. M. and O' Neill, E.A. (1987) In: *Developments in Food Proteins.* ed. Hudson, B.J.F. Elsevier, Appl. Sci., London. pp. 195-256.

Table 1a

Delta (test – control) values for hams cooked at 80°C to a core temperature of 68°C containing added non meat protein powders (Pow) at residual powder levels of 1 and 4% applied in the presence and absence of phosphate (P). Results are presented for Water binding capacity (WBC), Hunter 'L' and 'a' values and % protein levels.

Pow	Conc	Phos	CY	SD	WBC	SD	'a'	SD	'l'	SD	P	SD
1	1	+	0.45	0.11	0.15	0.02	0.96	0.07	0.42	0.02	0.26	0.06
1	1	-	0.98	0.04	0.24	0.02	0.86	0.05	0.71	0.21	0.56	0.02
2	1	+	0.70	0.20	0.17	0.05	0.39	0.18	0.12	0.11	0.40	0.11
2	1	-	1.02	0.03	0.43	0.03	0.34	0.01	0.25	0.06	0.59	0.02
3	1	+	0.47	0.02	0.23	0.03	0.46	0.04	0.28	0.04	0.27	0.01
3	1	-	0.64	0.04	0.51	0.03	0.49	0.04	0.31	0.07	0.37	0.02
4	1	+	-0.28	0.04	0.05	0.02	-0.12	0.40	1.16	0.08	0.16	0.02
4	1	-	-0.43	0.02	0.01	0.04	0.05	0.02	1.18	0.05	0.25	0.01
5	1	+	2.47	0.05	3.13	0.03	-0.75	0.33	2.22	0.17	1.41	0.03
5	1	-	3.15	0.05	3.14	0.02	-0.04	0.34	2.35	0.14	1.81	0.03
6	1	+	2.34	0.03	3.39	0.04	0.35	0.02	2.22	0.03	1.41	0.03
6	1	-	2.26	0.02	3.38	0.04	0.36	0.11	2.37	0.03	1.81	0.03
1	4	+	5.55	0.08	6.57	0.05	3.24	0.12	2.20	0.20	3.18	0.04
1	4	-	4.22	0.06	7.13	0.05	3.29	0.05	2.21	0.12	2.42	0.03
2	4	+	5.50	0.08	7.16	0.03	1.24	0.09	3.22	0.29	3.15	0.05
2	4	-	6.05	0.03	7.57	0.04	1.26	0.04	3.36	0.22	3.47	0.02
3	4	+	6.28	0.08	7.65	0.05	1.21	0.04	3.45	0.24	3.62	0.06
3	4	-	6.45	0.04	7.94	0.02	1.24	0.03	3.44	0.12	3.70	0.02

Table 1b

Listing of commercial non-meat powders used in ham manufacture.

No.	Powder Type	Protein . Conc (%)	Supplier
	Whey Proteins		
1	High gel	35.0	Dairygold Foods, Cork Ireland.
2	High gel	75.0	M.D. Foods, Holland.
3	Regular	76.5	Alacen 132 New Zealand Dairy Board
4	Na caseinate	88.5	DMV Veghel, Holland.
5	Soya isolate	90.0	Protein International, Leper, Belgium.
6	Egg albumen	75.0	Lactosan, London, U.K.

Table 2

Mean (n=30) organoleptic scores and standard deviations (SD) for hams cooked at 80°C to a core temperature of 68°C containing added non-meat protein powders (P) at residual powder levels of 1 and 4%, in the presence and absence of phosphate (Phos). Results are presented juiciness (J), flavour (F), non-meat flavour (NMF), salt intensity (SI), Bind (B), colour (C), and meat odour (O).

Powder	Conc	Phos	J	SD	F	SD	NMF	SD	SI	SD	B	SD	C	SD	O	SD
Con		+	6.57	0.51	3.52	0.68	1.10	0.30	4.95	0.59	3.57	0.60	4.05	0.50	1.05	0.22
Con		-	5.62	0.67	3.86	0.79	1.05	0.22	4.90	0.77	3.38	0.59	3.62	0.59	1.19	0.40
1	1	+	5.67	0.73	4.29	0.72	1.10	0.30	4.14	0.36	3.38	0.50	4.67	0.58	1.05	0.22
1	1	-	5.67	0.48	4.52	0.68	1.05	0.22	4.19	0.40	4.29	0.72	4.52	0.60	1.05	0.22
2	1	+	5.76	0.44	5.76	0.70	1.57	0.51	4.19	0.40	4.67	0.66	5.33	0.66	1.62	0.50
2	1	-	5.95	0.67	5.76	0.94	1.38	0.50	4.57	0.60	4.86	0.48	5.76	0.44	1.29	0.46
3	1	+	5.57	0.51	5.48	0.98	1.14	0.36	4.48	0.51	4.67	0.58	5.10	0.62	1.71	0.46
3	1	-	5.67	0.73	5.76	0.77	1.14	0.36	4.62	0.59	4.43	0.51	5.24	0.62	1.33	0.48
4	1	+	3.10	0.30	3.43	0.51	4.57	0.51	3.19	0.51	1.95	0.38	1.76	0.83	4.48	0.60
4	1	-	3.14	0.36	3.38	0.67	5.19	0.60	3.24	0.44	1.95	0.80	2.81	0.51	5.05	0.74
5	1	+	4.10	0.30	3.81	0.68	4.76	0.70	3.76	0.89	1.29	0.46	4.71	0.72	3.90	0.83
5	1	-	4.05	0.50	4.67	0.58	4.71	0.85	2.90	0.54	4.48	0.51	4.81	0.51	3.76	0.83
6	1	+	4.05	0.22	5.14	0.79	4.90	0.77	3.90	0.62	4.76	0.77	4.38	0.50	4.24	0.89
6	1	-	3.71	0.46	5.52	0.81	4.48	0.51	4.71	0.46	4.71	0.56	5.38	0.74	4.24	0.94
1	4	+	5.43	0.51	4.29	0.56	1.05	0.22	3.81	0.51	5.67	0.48	5.62	0.97	2.43	0.51
1	4	-	5.48	0.60	4.67	0.48	1.10	0.30	3.10	0.44	5.00	0.71	6.62	0.50	2.33	0.48
2	4	+	4.48	0.51	3.38	0.50	3.81	0.40	2.71	0.64	4.67	0.48	3.76	0.83	4.48	0.51
2	4	-	4.57	0.60	3.43	0.51	3.71	0.56	2.71	0.56	4.62	0.74	4.00	0.84	4.24	0.94
3	4	+	4.19	0.40	3.33	0.48	4.14	0.48	2.86	0.48	5.14	0.48	3.62	0.74	4.19	0.87
3	4	-	4.05	0.22	3.00	0.00	4.38	0.50	2.52	0.51	4.19	0.51	3.57	0.75	4.76	0.83

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