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EFFECTS OF NON-MEAT PROTEINS ON THE GELATION OF EXUDATES FROM REFORMED MEATS

J.F KERRY[1], E. O' NEILL[2], D.J. BUCKLEY[1] AND P.A. MORRISSEY[3]

1.Department of Food Technology, University College Cork, Ireland.

2. Department of Food Chemistry, University College Cork, Ireland

3. Department of Nutrition, University College Cork, Ireland

Background

The mechanisms of binding among meat pieces is a complex phenomena attributed to heat - induced gelation of myofibrillar proteins (Asghar et al., 1985; Zeigler and Foegeding, 1990). Functional protein extraction and solublisation from meat is widely believed to be a crucial factor in the final determination of this meat binding quality (Schmidt and Trout, 1984; Siegal et al., 1979). Recent advances in membrane technology and a greater understanding of whey protein concentrates (WPCs) with respect to their structure and chemistry has made it possible to produce WPCs with enhanced functional properties. This broadens their scope for use in a wide variety of meat and other food products. Little information is available on the use of WPCs or on their molecular interactions within reformed meat systems. The addition of modified WPCs to reformed meat systems can alter both the physical and chemical composition of final meat products and meat binding exudates. Molecular studies using control stress rheology may allow one to more fully understand the sequence of events which lead to protein gelation in meat systems and moreover, the influence that these incorporated non-meat proteins may have on gelation.

Objective

The present work was carried out to determine the intermolecular interactions occurring between meat proteins and non-meat proteins in meat exudates after massaging. A non destructive rheological method (control stress rheology) was applied in order to determine these interactions

Methods

The following commercially available non -meat proteins were used: soya isolate (90.0 %), sodium caseinate (88.5 %) and whey protein concentrates (75.0 % WPC high gel; 75.5 % WPC regular; and 35.0 % WPC high gel). The powders were added to brine solutions to give a % residual powder level of 1.0 % for soya isolate and Na caseinate with 2.0 or 3.0 % powder in the case of the WPCs. Powders were hydrated in half of the brine water and mixed with the other half, containing the NaCl and curing salts prior to injection. Pork *M . semimembranosus* muscles were obtained 24 h *post mortem* , within a pH range of 5.6 - 6.0 and injected to a target level of 25.0 % brine inclusion. Injected meat was then cut into 8 cm cubes and massaged using a model system for 17 h at 10 revs / min with 20 mins on and 10 mins off for a total of 6800 revs. In all trials, test powders were compared to controls without added non - meat proteins. After massaging, meat exudates were collected and composite analysis determined. Heat induced gelation was performed using a control stress rheometer (Bohlin Instruments CS model). This method gives the viscoelastic properties of a protein gel as a function of temperature at a fixed frequency of 1.0 Hz. A 40 mm parallel plate was used with a gap setting of 1 mm. Measurements were made by applying a small amplitude oscillation to the material (0.005 strain units). Meat exudates were heated from 20.0 °C. to 80.0 °C at a rate of 1.0 °C / min, held at 80.0 °C for 30 min and cooled down to 20.0 °C at a rate of -1.0 °C / min. All results presented are recorded in terms of the storage or elastic component (G').

Results and Discussion:

All non-meat proteins were added at levels which were deemed to be commercially acceptable for the manufacture of reformed cured meat products. SDS PAGE electrophoresis of final meat exudates obtained after massaging showed the presence of the

added non-meat proteins. WPCs increased storage modulus (G') values at all levels of residual protein powder used, in both the heating and cooling cycles, when compared with the control exudates. Both the high and low gelling WPCs had similar G' plots at 2.0 and 3.0 % residual powder levels used on heating to 80 °C (Table 1). However significant gelation on heating this low gelling powder did not occur until a temperature of 68.0 °C was reached (Fig 1.). Compositional analysis of raw meat exudates (Table 1) showed a 1.0 to 4.0 % increase in protein concentration in test exudates over controls. When comparing these results with G' data, the WPCs were found to be very good gelling or binding agents. Na caseinate at a 1% residual level gave the lowest values for G' (Table 1). These results compare favourably with data from processing trials completed (values not reported), where 1.0 % sodium caseinate was found to be detrimental to meat bind. The use of 1.0 % residual Soy isolate increased G' of the final meat exudate.

Conclusion

Incorporation of non - meat proteins into reformed meat systems (with the exception of Na caseinate), increased the storage modulus (G') of meat exudates when compared to control samples. Compositional analysis of exudates indicated a 1.0 to 4.0 % increase in protein concentration on addition of non meat proteins. However, there was a four fold increase in G' values on the addition of WPCs. Soy isolate resulted in a two fold increase in G'. Na caseinate showed a decrease, interfering with gelation in meat exudates.

References:

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Protein Powder Type	%	G'(Pa) Heating	G'(Pa) Cooling	% Composition		
				Protein	Fat	Moisture
90% Soya	1	10500	27100	14.73	0.27	78.74
90% Na Caseinate	1	965	6810	15.55	0.33	79.10.
75% WPC HG	2	16700	29600	13.58	0.25	82.61
75% WPC LG	2	19000	23000	13.37	0.36	80.07
35% WPC HG	2	17200	26500	12.41	0.55	83.31
75% WPC HG	3	20100	39800	14.12	0.21	78.89
75% WPC LG	3	18300	24500	13.91	0.31	79.74
35% WPC HG	3	19800	35000	13.49	0.48	78.91
Control	-	4220	9990	11.47	0.19	83.10

Table 1. Table of final heating (80°C) and cooling (20°C) rheological data (G' values) for the gelled meat exudates and the compositional analysis for these unheated exudates.

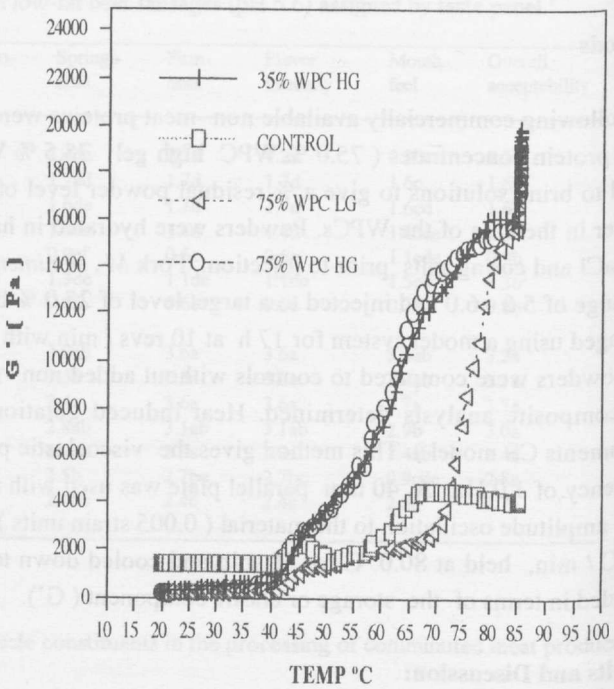

Fig 1. Plot of G' (Pa) v's Temp (°C) for control meat exudates containing no non-meat protein and samples containing WPC's at a 3% residual powder level.