CONSUMERS ACCEPTABILITY OF SOME TYPICAL ITALIAN COOKED MEAT PRODUCTS CONTAINING ISOLATED SOY PROTEINS AS FUNCTIONS INGREDIENTS

E. Bianchi, A. Cantoni, E. Ratti, University of Parma

Up to now soy derivates have been considered almost exclusively as meat substitutes and many nutritional studies have been carried out in order to demonstrate that the difference between soy and meat proteins is minimum.

This concept has led to a partially incorrect evaluation of soy products that disregards several of their function properties. This is the case for certain high quality isolated soy proteins which are used, for their functional properties, in the industrial processing of several food products, especially those containing meat.

Isolated soy protein can be defined as the major proteinaceous fraction of the soybean, prepared by removing most of the non-protein components, and having a protein content not less than 90% (Nx6.25) on a moisture-free basis.

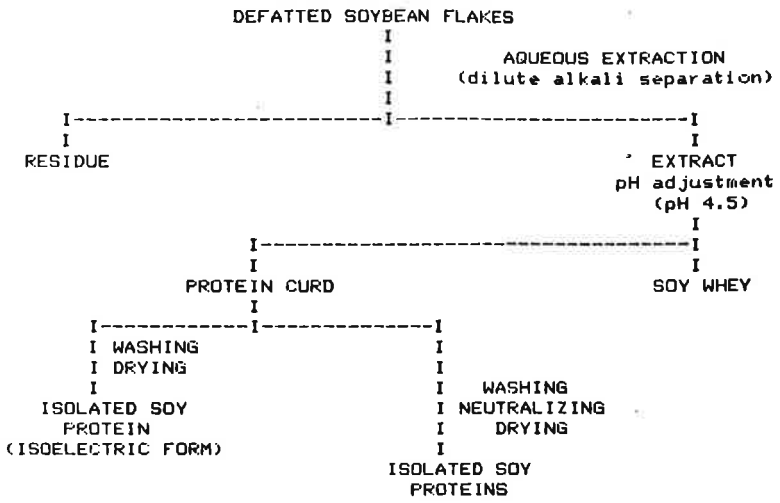
The figure below illustrates the processing procedure for isolated soy protein, which takes advantage of the fact that the major proteinaceous components have very low solubility at or near their isoelectric point, and are readily precipitated, washed, further processed and dried.

Recent technologies have permitted the production of isolated soy proteins with improved organoleptic characteristics. These products are available as light coloured powders containing practically no odour and with only a very slight hint of the typical taste of soy derived products.

Isolated soy proteins can be considered, from a functional point of view, comparable to certain other proteins, such as plasma proteins and caseinates.

The typical composition of isolated soy proteins can be summarised as follows (% on dry matter basis):

- Protein (Nx6.25) 91.5
- Moisture 5.5
- Fat (ether extract) 0.5
- Crude fibre less than 0.2
- Phosphorus 0.8
- Potassium 0.09
- Sodium 1.1
- pH 6.7 to 7.0



Production of I.S.P. from defatted flakes.

Microbiological standards can be defined as follows:

- Mesophilic aerobic spore total/g less than 30.00
- Salmonella/100 g none
- Yeasts and moulds/g less than 100

Several scientific studies shown that isolated soy protein's functional performance in meat product is evident even at low percentages of usage.

Their characteristics can be described as follows:

a. better consistency and elasticity;

b. increased adhesion and cohesion;

c. gel properties;

d. emulsion properties;

e. flavour enhancement;

f. better water retention;

g. film forming properties;

h. reduction of free water;

For most of the above functional properties, a use rate of 1-2% is enough to obtain commercially significant effects (depending on the formula).

As far as influences on the elasticity of the matrix to which ISP is added, are concerned, it is necessary to examine the intrinsic physical and physo-chemical characteristics of the protein itself and specifically to its behaviour in association with water.

Even at very low concentrations in the meat matrix, ISP dispersion can induce significant increases of elasticity in finished products ranging from ground meats to whole muscle meats. The cohesive and adhesive properties are the result of the tendency of protein molecules to associate with each other. This property is common to most pure protein preparations, and manifests itself most obviously during the formation of irreversible gels upon heating. In fact this protein gel binds together the various protein components which constitute the matrix in an emulsified system, or between whole bundles of muscle fibres in whole muscle products. The final result is a meat product with considerably improved consistency, produced by the integration of all the structural components in a compactly bound system.

Several trials have shown that the functional properties of isolated soy proteins are more similar to plasma proteins than to milk proteins (caseinates) tending to bind free water very effectively in its gel structure.

In any event, it must be borne in mind that ISP binds in the order of 4-5 times its weight

Tab. 1

	COOKED HAM					MORTADELLA					WÜRSTEL				
	0	0,5	1,0	2,0	3,0	0	1,0	2,0	3,0	4,0	0	1,0	2,0	3,0	6,0
pH	6,87	5,81	5,86	5,82	5,85	6,42	6,42	6,42	6,42	6,42	6,54	6,55	6,44	6,53	6,65
Moisture	72,03	71,92	70,86	71,67	72,15	51,95	51,46	51,35	51,34	51,85	63,69	63,81	64,18	65,64	67,48
Fat	9,67	9,67	9,83	7,99	7,08	32,04	32,12	31,83	31,79	30,50	18,62	18,72	17,55	16,47	13,52
Protein %	14,40	14,60	15,59	15,54	16,83	12,61	12,95	13,21	13,89	14,40	14,49	14,06	15,08	15,00	15,76
Ash	3,10	3,16	3,21	3,44	3,60	3,88	3,82	3,80	3,73	3,56	2,86	2,77	2,95	2,68	2,89
Chlorides	1,97	1,92	1,93	1,92	2,03	2,74	2,68	2,57	2,51	2,40	1,87	1,74	1,79	1,80	1,83
Total P_2O_5	0,482	0,493	0,508	0,505	0,550	0,450	0,450	0,459	0,464	0,470	0,500	0,491	0,512	0,502	0,536
NO_3 (ppm)	160	170	120	175	145	190	180	155	175	175	30	20	25	15	30
NO_2 (ppm)	30	55	45	35	30	<5	<5	5	5	<5	<5	<5	5	<5	<5
Dry matter % (residual)	27,97	28,08	29,14	28,33	27,85	48,05	48,54	48,65	48,66	48,15	36,31	36,19	35,82	34,36	32,52
Defatted dry matter %	18,30	18,21	19,31	20,34	20,77	16,01	16,42	16,32	17,27	17,65	17,69	17,47	18,27	17,89	18,00
Water/protein Rt.	5,00	4,93	4,55	4,61	4,87	4,12	3,97	3,89	3,70	3,60	4,40	4,54	4,26	4,38	4,28
Protein/ram Rt.	0,79	0,80	0,81	0,76	0,79	0,79	0,79	0,79	0,80	0,82	0,82	0,80	0,83	0,84	0,83
Polyphosphates	0,17	0,18	0,17	0,17	0,18	0,19	0,18	0,18	0,17	0,16	0,20	0,20	0,19	0,18	0,20

NB: Cooked hams were produced from frozen skinned hog hind quarters (normally called defatted).
Mortadella were produced from a brat with relatively high fat content (commercially established as of 2°nd quality).
Wurstel were produced from a brat to which 15 % ice was added as per usual production technology.

Tab. 2

COOKED HAM - 56 Questionnaires*

Sample identif.	Analyst expr. preference A	B	- EVALUATION - Very good/10	Good /8	Accept. /6	Not accept/4	Poor /2	Very poor/0	Total points	Mean Score
A control (= 0 %)	35	21	8	28	15	4	1	---		
	62,50%	37,50%	80	224	90	16	2	---	412	7,36
1 (=2,0%)	28	28	2	26	12	9	4	3		
	50,00%	50,00%	20	208	72	36	8	0	344	6,14
2 (=0,5%)	34	22	3	21	16	13	2	1		
	60,71%	39,29%	30	168	96	52	4	0	350	6,25
3 (=1,0%)	28	28	1	26	13	10	4	2		
	50,00%	50,00%	10	208	78	40	8	0	344	6,14
4 (=3,0%)	16	40	3	12	22	11	5	3		
	28,57%	71,43%	30	96	132	44	10	0	312	5,57
B (=3,0%)			4	17	13	10	8	4		
			40	136	78	40	16	0	310	5,54

MORTADELLA - 62 Questionnaires*

A (=4,0%)	14	48	1	15	26	12	4	4		
	22,58%	77,42%	10	120	156	48	8	0	342	5,52
1 (1,0%)	24	38	2	23	24	9	4	---		
	38,71%	61,29%	20	184	144	36	8	---	392	6,32
2 (2,0%)	28	34	5	25	22	7	1	2		
	45,16%	54,84%	50	200	132	28	2	0	412	6,64
3 (=3,0%)	32	30	1	15	32	9	1	4		
	51,61%	48,39%	10	120	192	36	2	0	360	5,81
4 (=4,0%)	41	21	5	16	21	13	4	1		
	66,13%	33,87%	50	128	126	52	8	0	364	5,87
B(control) (=0,0%)			15	31	15	1	---	---		
			150	248	90	4	---	---	492	7,94

WÜRSTELS - 67 Questionnaires*

A(control) (=0,0%)	54	13	17	30	16	2	1	1		
	80,60%	19,40%	170	240	96	8	2	0	516	7,70
1 (=1,5%)	36	31	5	24	21	10	6	1		
	53,73%	46,27%	50	192	126	40	12	0	420	6,29
2 (=0,0%)	55	12	9	34	21	---	1	2		
	82,09%	17,91%	90	272	126	---	2	0	490	7,31
3 (=3,0%)	10	57	---	12	29	17	3	6		
	14,91	85,09	---	96	174	68	6	0	344	5,13
B (=6,0%)			1	19	23	17	3	4		
			10	152	138	68	6	0	374	5,58

*Each panelist was asked in each case wheter the test sample was closer overall to the control or to the products with the higest level of ISP.

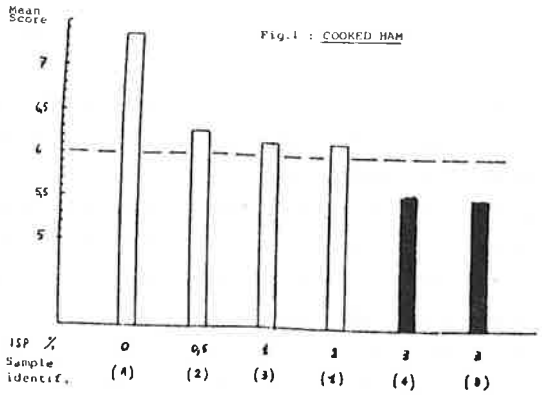
in added water, a negligible quantity compared with the 40-50% water found normally in many meat products.

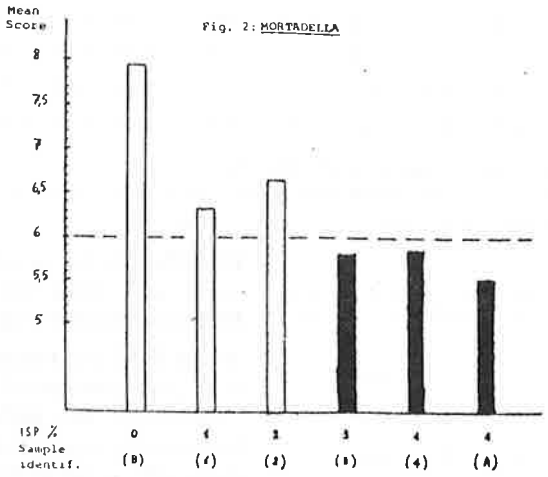
When the basic function properties of ISP are compared with those of caseinates, the difference in their behaviour are easier to explain, especially as far as film formation and flavour enhancement are concerned.

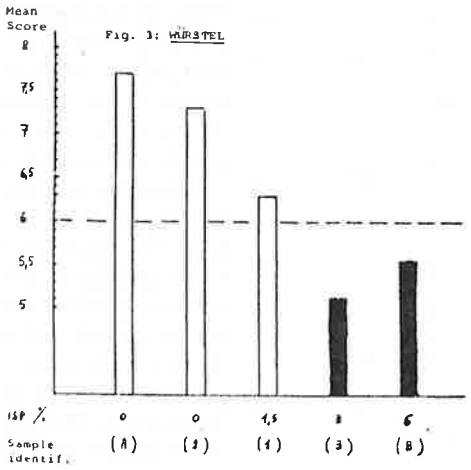
Flavour enhancement occurs because of the following processes: polar and non polar bonds are formed between certain of the flavour components and the protein. In addition, there is a purely physical absorption of flavour compounds onto the protein molecule. The result is that the kinds of flavouring materials used in the production of meat products are effectively fixed onto the protein, and, in consequence, are dispersed with more uniformity in the meat matrix. On heating, the product has a lower loss of volatile compounds, thus giving the impression of enhanced flavour to the consumer.

The ability of ISP to bind water in three-dimensional networks, reduces fluid losses on cooking, and hence reduces shrinkage and maintains succulence.

This is one reason that the gel formation property of ISP is so important. Another is that fat globules can be distributed within the three dimensional network to form stable emulsions even in the cold.







This emulsion stabilisation is possible because of the amphilphilic nature of the protein.

Effective emulsification of the fat reduces separation and fat loss on cooking, resulting in the end-product texture required by consumers.

Maintenance of texture is seen especially in such products as raw sausages, cooked sausages, cooked shoulders and cooked hams where ISP has influenced organoleptic acceptability of the finished products, improving their elasticity and succulence.

The binding "free water" by ISP tends to reduce bacterial activity, so that finished product shelf-life is improved. Reduction of water losses during cooking brought about by ISP water-binding means that processing temperatures and times can be increased. Under these circumstances, bacterial activity can be reduced to lower than normal levels, also giving the possibility for improved shelf-lives.

EXPERIMENTAL

Based on the above considerations, we thought it would be interesting to check consumers reactions towards some typical italian cooked meat products ("salumeria products") prepared with different percentages of isolated soy proteins.

Samples of mortadella, frankfurters and cooked hams were prepared using the following quantities of I.S.P. (PP 500E - Protein Technologies International) in the final product: 0, 5-1, 0-2, 0-3, 0-4%.

All samples were analyzed in order to determine their composition (Table 1) and then tasted by a group of 186 people randomly selected among normal consumers.

These people were asked to express their judgement according to a standard questionnaire.

Their results are listed in Table 2 and shown graphically in figures 1, 2, and 3.

CONCLUSIONS

The results of the palatability tests shown that samples with ISP at the lower usage levels (up to 2.0%) were always well accepted by consumers (Figures 1, 2 and 3).

That is to say, their mean scores were better than "acceptable", with good reproducibility between different trials. A more detailed examination of the figures reveals that many subjects made equal to, or better than evaluations than the control sample without added ISP.

This is almost certainly due to the fact that the ISP usage led to an improvement of the organoleptic characteristics of the product, in particular its structure and its consistency, as theoretical considerations about the effects of ISP would predict.