5:10 Effect of adding different proteins and their application procedure on some quality properties of canned whole meat cuts

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The progress of technical application possibilities and improvement of non-meat protein qualities enabled the proteins in question to be used even in first-class meat products, notably in whole meat cuts (ham, roast beef, steaks etc) as well. They were used in brines prepared for injecting and massaging of meat cuts with the purpose of using somewhat larger quantities of brine (i. e. water) in it, avoiding thereby a substantial reduction of proteins and helping preserve the wholesome technological and commercial properties of the finshed products. The available date indicate that for this purpose soybean preparations have been mastly used throughout the world, whereby the application of different kind of other protein preparations or their mixtures is technically possible. One of essential conditions required for their application in such sorts of meat products is that a large quantity of soluble proteins is contained in these preparations, their tolerance in regard to NaCl as well as their feeble gelatinized capacity, because the technique of brine injecting is overwhelmingly being used combined with the technique of a mechanical meat treatment in an appropriate massager.

In the whole cut meat products manufacturing there are two basic procedures of brine application. The first one consists of the complete brine injecting into meat cuts by means of a picle injector and by massaging it in a device designed for meat mechanical treatment whereas the second procedure requires a preliminary protein dispersion preparation which then is to be added to the mechanically processed meat where commonly composed brine has already been injected into.

It also should be emphasized that in practice both ways of application have some disadvantages and technical difficulties (solubility and setting down of proteins, appearance of larger or smaller cavities in the products etc). These technological disadvantages, which we have mentioned in our previous investigations are capable of reducing aesthetical and commercial quality of the product to a greater extent. But disregarding the used technique of application on the finished product quality (solubility, favor), the protein preparation characteristics are very significant.

Taking into account the mentioned facts we set ourselves the task to examine the application effects of five various types of protein preparations which were recommanded by the manufacturers. For this purpose we used two different procedures of their application to the whole cut pork. Doing this, under identical conditions, we examined the effect of both the procedures referred to and the individual preparations, one the quality of the product (canned ham), disregarding thereby preliminary requirements for the lowest possible guantities of the total of proteins to be contained therein.

Material and work technique

We used cooled pork ham from which the excessive fatty and connective tissued had been previously taken off. The following non-meat proteins were provided for examination by the manufacturers:

1. Soybean isolate PP 500E ("Purina Protein Europe") which, according to the analyses we performed, contained as much as 85.50 percent of proteins whereas NSI amounted to 57.63 percent.
2. Soy isolate SP6 ("British Arcady") which, according to the analyses we performed, contained as much as 84.10 percent of proteins whereas the NSI amounted to 30.55 percent.
3. Soy isolate U4-111 (Staley int") which, according to the analyses we performed, contained as much as 85.70 percent of proteins whereas the NSI amounted to 64.69 percent.
4. Functional soy concentrate Sta-Pro 3.000 ("Staley int") which, according to the analyses we performed, contained as much as 65.32 percent of proteins whereas NSI amounted to 44.39 percent; and
5. A mixture (of concentrates) prepared from dried blood plasma and soy flour (of the domestic brand "Agroexport") which, according to the analyses we performed, contained as much as 67.70 percent of proteins whereas NSI amonted to 64.69 percent.

Experiments were conducted in two separate series of test, depending on the brine (or protein preparations) way of preparation and application: in a series designated as A, comprising a preliminary injection of 50 kg of commonly composed brine (containing common salt, part of phosphates, dextrose, $NaNO_2$ and ascorbic acid) into 200 kg of meat using thereby a picle injector equipped with as much as 124 needlex, whereupon 40 kg of the prepared protein dispersion of each of the listed preparations containing a part of phosphate and a HVP as well was added to the meat previously injected in a massager. Within the B series the complete brine was prepared by dissolving individual ingredients in water (by observing the usual order) using thereby a mixer. After dissolving all of the ingredients the brine was vacuum-injected on an automatic line, type Langen B120/4-N into the previously prepared meat whereby the ratio was identical to that practiced within the series A. In compliance with the program scheduled the brine was automatically injected into the meat, that is 450 m^3 per each turnaby means of a total of 200 injections for 20 minutes. The mechanical treatment of meat in a massager took as long as 20 hours whereby the effective massaging time did not take 10 hours. The program performed on the Langen automatic line is so adjucted that it allows the vacuum-injecting operation to take 60 minutes out of the total of 20 hours of the curing process, with the tumbler revolving ten times a minut. Two percent of non-meat protein was injected into the meat applying both procedured. Each of the series included a control group of products consisting of 200 kg of thigh meat into which 90 l of brine was injected in the same way. The brine contained all the ingredients except the protein preparation on account of which the corresponding quantity of water was increased.

After the mechanical treatment was over the meat used in both the trial and control group of products (from both series) was stuffed on the automatic Langen line into the 14 lbs flat cans which were then sealed and cooked. As soon as stuffing and sealing were completed the products were heat treated in the same autoclave by applying the usual mode of pasteurization. Thereupon two samples of each of the trial and control groups were opened and examine 15 days after being manufactured. Sensory properties of the product were chemically evaluated at the same time whereby the assessors judged each of the by a joint mark. At the same time the amount of the separated gel was measured in each of the samples examined and expressed in percentage of the product's total weight. The chemical composition of the preparations used, including NSI, as well as the chemical composition of the product itself were determined by usual methods whereby two separate samples of each of the trial and control group of products were used for the purpose of examination.

Results and Discussion

Results obtained by evaluation of sensory properties of both trial and control products are shown in the table 1.

Table 1.

Properties evaluated	Number of points scored by properties of samples evaluated											
	Samples of production series A						Samples of production series B					
	1	2	3	4	5	6**	1	2	3	4	5	6**
Surface appearance	3.5	3.5	3.5	3.5	3.5	2.0	5.0	4.5	5.0	4.5	5.0	4.9
Cross-section appearance	3.5	2.5	3.5	3.0	3.5	2.5	5.0	4.5	5.0	4.5	5.0	4.5
Consistence	3.5	3.5	3.0	3.5	3.5	2.0	5.0	5.0	5.0	5.0	5.0	4.5
Cross-section color	3.5	3.5	3.5	2.5	4.0	3.0	4.5	4.5	4.5	4.5	4.5	4.5
Flavour	3.5	2.5	3.5	3.5	3.5	2.5	4.5	4.5	4.5	4.5	5.0	4.5
Aggregate mark	17.5		17.0		18.0		24.0		24.0		24.5	
for all the properties		15.5		16.0		12.0		23.0		23.0		22.0

The sensory properties were labelled with the following marks: 1 and 2 = unsatisfactory; 2.5 and 3.0 = barely satisfactory; 3.5 and 4.0 = good; 4.5 and 5.0 = very good

**6 = control products

It came to be obvious that the products from both series contained properties differing from each other whereby the properties of products belonging to the series B were more highly evaluated in each of the respects considered. The presence of the comminuted mass agglomerated as well as ham surface cavities, unsufficient cross-section consistence of the whole cuts, a larger number of small holes filled with gel, a more pronounced soy-related flavour along with a moist cross-section have resulted into the product properties of a significantly lower grade. Contrary to it, products belonging to the series B were marked by the properties of a much better sensory qualities including even the control group the hams of which had a slightly worse surface appearance and somewhat moister cross-section as compared with the trial group of products belonging to the same series.

Some products features of both series resulting from proteins applied are to be specially emphasized. The hams containing the isolate PP 500E and the mixture were distinquished by a better surface appearance, the most intense soy-relating flavour was detected in hams containing the isolate SP_6, the best flavour was characteristic for hams prepared with mixture, the wors cross-section color (for a nuance yellowish) was observed in hams containing Sta-Pro concentrate whereas the best and most stable color was displayed by the hams containing mixture. The isolate U_4-111 caused the product to have the moistest cross-section but the least pronounced soy-relating flavour among all the soy preparations used.

By considering the summary results referring to both series, the conclusion could be drawn that better results were obtained by applying plasma and soy flour mixture, isolate PP 500E and the isolate U_4-111, followed by slightly worse results obtained by using the izolate SP_6 as well as the functional concentrate Sta-Pro although so far the same production series was concerned, the differences were confined to nuances capable of being noticed by the professional assessors only.

The quantities of the separated gel in samples belonging to individual lots being given in percents of the total net weight of the products is shown in the table 2.

Table 2

Production series of hams	Quantities of the isolated gel (%) in hams of the group					
	1	2	3	4	5	6**
Series A	3.3	3.7	4.5	4.1	3.1	7.1
Series B	1.2	1.7	2.6	1.9	1.4	3.6

**6 = control products

It easily can be seen that the largest quantity of the separated gel was found in hams of the control samples whereas the lowest one in hams containing the isolate PP 500E as well as in the plasma and soy flour mixture. An average gel quantity difference monitored in the trial groups, as compared with the control ones, was as high as 2.60 percent.

The chemical composition of products is shown in the table 3.

Table 3.

Indices of the composition	Quantity of ingredients (in %) found in samples											
	Production series A						Production series B					
	1	2	3	4	5	6*	1	2	3	4	5	6*
Water	73.88	78.69	74.28	74.30	74.21	74.86	73.09	73.86	73.59	74.04	74.26	74.66
Proteins	15.85	15.76	15.83	15.41	15.39	14.14	15.64	15.73	15.81	15.31	15.42	14.10
Fat	7.62	7.47	7.20	7.47	7.39	7.25	8.12	7.61	8.02	7.45	7.12	7.66
NaCl	2.42	2.83	2.41	2.45	2.75	3.37	2.67	2.58	2.34	2.71	2.84	3.26

*6 = control products

The results indicate that the average increase of the proteins amount was in all the trial samples, as compared with the control ones, about 1.47 percent, being a bit higher in hams containing isolates (1.68%) and somewhat lower in hams with the functional concentrates and mixtures in brine (1.26%).

The fact that all the products of the series B had considerably better sensory properties, as compared with those of the series A, indicate that the automatic Langen line was considerably more suitable for the application of the non-meat proteins. Such a performance (and in particular injecting and massaging in a vacuum) made possible more effective penetration of the brine components into the meat depth as well as their being better owing to the proteins of the muscle tissue which considerably affected the products quality. The preparation of brine along with its being injected into the meat on a Langen line was technically simpler and, above all, continuous, following the phase the protein preparations were dissolved within, which also turned out to be advantageous.

Contrary to it, mechanical treatment of meat in classical massagers used to be performed by a slow mixing or by rubbing the meat against spoons and container walls as well as the individual cuts against eachother whereby the massaging effect was mainly confined to the surface of the meat cuts. The bigger the cuts are the greater's the possibility of preventing the brine ingredients penetrate into the depth of the meat and remain unbound to the mechanically in sufficiently prepared muscle tissue. This is why, in our opinion, it would be more advantageous to combine injecting the commonly composed brine by means of a picle injector and by adding dispersion with the mechanical treatment (i.e. by massaging) of meat in a vaccum tumbler. It is suggestible to have the meat thereupon put into massagers and let the curing process continue there up to a total of 24 hours. In that case, effects achieved by a mechanical treatment would be similar to those achieved by meat processing on an automatic Langen line. It is shown that the functional concentrates, and in particular the mixtures of the domestic brands have brought about good results in ham production due to the high solubility of proteins applied. The technique the brine was applied by was of a considerable importance for the quality of products as well as the solubility of the proteins used. The results indicate that if the minimally allowed protein quantity is not determined in the product, corresponding preparations with a smaller quantity of proteins can be used for ham manufacturing. By taking into account the quality of hams out of the series B (even the control samples) we think that it is possible to obtain appealing products on a Langen line even by using greater amounts of brine that contains proteins added.

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