II. QUALITY AND SOME PHYSICAL AND CHEMICAL CHANGES OF CANNED HAMS PRODUCED BY DIFFERENT PROCEDURES OF CHILLING AND CURING

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The biochemical processes in muscles, are influenced by the treatment of meat post mortem what is reflected on the quality of final product. In the first part of this work (8) the influence of different procedures of chilling and curing on rates of biochemical processes and physical characteristics of muscle were investigated. In order to determine the influence of these procedures of chilling and curing of hams on quality of of canned hams these examinations were continued.

Many biochemical processes run in meat during processing provoking the increase of pH and decrease of WHC. Beside this konwn phenomenon Hoffman and Hamm (5) found that the amount of free SH groups in meat is lowering during processing owing to oxidation, but only at the temperatures higher than 70°C. According to Hamm and Deatherage (3) the number of negatively charged acid groups is increasing by denaturation of protein, but the number of positively charged groups doesn't change. Hoffman (4) cited the findings of Schweigert et al. that the amount of free amino acids doesn't decrease in pork when heated at the temperature lower than 100°C. However, Usborne et al. (9) quoted that the total of free amino acids doesn't decrease during processing of meat, but the amount of them is decreasing while amount of others is increasing. They concluded that the amino acids which are decreasing react with some compounds influencing the flavour of meat. It is known that amino acids react with carbohydrates at higher temperatures, and

Hoffman (4) quoted that they can react between each others, too. Dvorak and Irena Vognarova (2) mentioned that amino acids react with ion of nitrite when exposed to higher temperatures.

Barnett et al. (1) found that the increased amount of injected brine negatively changed the flavour of hams. Wirth (11) detected that in processed canned meat, when produced from insufficiently aged pork, the specific flavour will develop during the storage. Leistner and Wirth (7) mentioned that in semiperishable canned meat could not occur significant changes during the storage, because of its short keeping quality. Kassai and Karpaty (6) quoted that in canned hams produced from quickly chilled hams and from controls there was no changes of flavour and of consistence. Weiner et al. (10) detected that Prague hams, produced from in brine quickly chilled hams in have been of higher tenderness, and released less juice than controls. Wismer-Pedersen and Briskey (12) determined that the amount of released juice was somewhat lower in canned hams produced from quickly chilled hams than from controls.

Experimental

Material.

The canned hams investigated in this work have been produced from hams of pigs of the same breed and quality as in the first part of our work. Animals were slaughtered and dressed as was described in the first part of the work (8).

Methods.

Hams used for canned hams production were trimmed and then chilled and cured by Procedure I (right hams were h p.m. imerged into refrigerated brine and 24 h p.m. were pumped with 12+2% of brine (and by Procedure II)right hams were pumped 2 h p.m. with 12+2% of brine and then emerged into refrigerated brine (and by

ordinary procedure) the corresponding number of left hams were chilled at the halves in chilling rooms at 0° to 3°C/24 h, and then trimmed and cured in ordinary way) as described in the first part of the work (8).

From these cured and drained hams "Oblonge" type canned hams, weighing 12 lb, were produced. Cans have been pasterized for 245'/ 78°C and then stored at 8°C for 3 months.

From hams chilled and cured by Procedure I and those chilled by Procedure II have been produced 15 cans. The same number of cans has been produced from corresponding controls. Canned products were examined after the storage of 8,45 and 90 days (every time 1/3 of cans).

WHC was determined by two procedures, as follows: a) by measuring the amount of released juice during pasterization of cans. The obtained results have been expressed in percentage of net weight of product, and b) by determining the amount of "free water" in m. biceps femoris (m.B.f.) and in m. quadricept femoris (m.Q.f.). "Free water" was determined by compression of samples on filter paper by means of Höppler consistometer loaded with 12 kg/1'. The weight of samples was $0,5 \pm 0,01$ g. According to the difference between weight of filter paper before usage and after compression of samples percentage of "free water" have been calculated.

pH was measured in aqueous extract of two samples of m. semimembranaceus (m.sem.) with Phillips M 9400 potentiometer.

Tenderness of muscles was determined by measuring the force necessary to load the rod on apparatus to penetrate through the sample. Apparatus was used so that the plane end of rod, of 3 mm diameter, was put in touch with the surface of sample and then loaded continually adding the buckshot. The samples were cut in

size of 20x20x5 mm and placed in the niche of the same shape, wi the hole in the center. The thickness of the samples was always mm. After the loaded rod went through the sample, the loading wa stopped and the weight of used buckshot was determined. The weig of used buckshot in g representes the force necessary to push th rod through the sample. The results are expressed as the average values of 6 individual measurements.

Tenderness was tested by using the scale from 1 to 9, as fol lows: 1 - very coarse; 2,3,4 - not enough tender, 5 - moderately tender; 6,7,8 - tender and 9 - very tender.

Taste was scored by using the scale from 1 very to 4, as fol lows: 1 - very non specific, 2 - not sufficiently specific, 3 - sufficient specific, and 4 - very specific.

Juiciness has been tested by similar procedure, using the scale from 1 to 9, as follows: 1 - very dry; 2,3,4 - not sufficiently juicy, 5 - sufficiently juicy; 6,7,8 - juicy, and 9 - very juicy.

Tenderness, taste and juiciness have been tested always by the same three experts.

Results and discussion

By examination of canned hams 8 days after pasterization (8 days of storage) it was found that pH of m.Sem. was increased to about 6,3 in all groups. (Before the pasterization pH of this muscle has been 5,9 and 6,0). Determined after 45 and 90 days pH was similar, but in controls somewhat lower.

Determining the WHC according to the released juice in cans it was found that the quantity of released juice was in all samples of similar weight, regardless the procedures used for chilling and curing of the hams. Because of the small differences in quantities

of released juice in each groups of cans, the obtained results are given as the average values. These results were as follows: in cans produced from hams chilled by Procedure I and from controls the amount of released juice were 8,3 and 8,2%, and in the cans produced from hams chilled by Procedure II and the corresponding controls 9,0 and 8,8%.

The results obtained by measurement of "free water" were similar to the above cited, as far as differences are concerned, and showed that examined procedures of chilling and curing of hams didn't influence the WHC in final products.

Comparing the obtained results with those obtained by Wismer-Pedersen and Briskey (12) (quickly chilled hams pumped with 8% of brine), one can see that they found greater differences in quantities of releaseed juice (9,9 and 9,2). Kassai and Karpaty (6) found 10,5 to 14% of released juice in cans produced from quickly chilled hams, what was much higher than we did.

The obtained results show that the amount of free SH groups was not changed neither during pasterization nor during 90 days of storage, regardless to the procedure of chilling and curing of hams used for production of these cans (Table 1.).

Content of free SH groups in m.B.f. during chilling and curing of hams and storage of cans (mgSH/g protein)

Table 1.

Samples	During chilling and curing of hams in h p.m.			During storage of cans in days	
	n 8			n 5	
	2	30	90	8	90
Procedure I	4,36	4,06	4,13	4,23	4,25
Controls	4,36	4,22	4,30	4,40	4,18
Procedure II	4,42	4,26	4,29	4,38	4,30
Controls	4,42	4,36	4,39	4,29	4,34

Such results are in accordance with the findings quoted by

Hoffman and Hamm (5), who detected that temperature below 70°C doesn't change the amount of free SH groups. These authors found that the content of free SH groups was about 3,5 mg/g protein in meat treated by temperatures below 70°C.

Results of determination of amount of free amino N in m.B.f. during storage of hams are given in Table 2. From these results,

Amount of free amino N (% of total N)

Table 2.

Samples	Before paster.		After paster.		After 3 months storage	
	$\bar{x}$		$\bar{x}$		$\bar{x}$	
Procedure I	3,06	0,55	2,41	0,31	2,75	0,40
Controls	2,98	0,45	2,45	0,45	2,44	0,45
Procedure II	3,00	0,31	2,56	0,45	2,35	0,32
Controls	3,06	0,31	2,71	0,45	2,28	0,35

one can see that the amount of free amino B was reduced by pasterization, while during storage it didn't change, regardless to the procedures of chilling and curing of hams used for production of cans. The results show that there was no proteolysis in canned ha during storage.

The found reduction of amount of free amino N after pasterization can be explained partially by transition of amino acids fro muscles with released juice, and partially by the reaction with other compounds in cans.

In the m.B.f. and m.Q.f. from canned hams there were not foun significant changes of tenderness during the storage. Differences found in different time of measurements were small so that the obtained results in all three measurements are presented as average values (Table 3.).

Tenderness of canned hams after pasterization

Table 3.

SAMPLES	Examined muscle							
	m.B.f.				m.Q.f.			
	score		Shear force		score		Shear force	
	$\bar{x}$		$\bar{x}$		$\bar{x}$		$\bar{x}$	
Procedure I	6,8	0,55	1107	127	7,6	0,55	638	70
Controls	6,5	1,00	1096	142	7,2	0,63	634	81
Procedure II	6,4	1,26	1187	119	7,4	1,14	563	61
Controls	6,2	0,84	1167	114	7,4	1,48	552	53

According to the statistical interpretation of results there were no significant differences between results obtained by sensory testing and between those obtained by shear force (P 0.05).

From the results obtained in the firts part of the work (8) one can see that WHC of muscles from quickly chilled hams was noticeably higher than those obtained from controls, but under the influence of temperature of sterilization (105°C and 110°C) these differences disappeared. Similar results were obtained by measuring the tenderness of muscles in hams and in cans. According to these results on can conclude that the structure of proteins of muscles was changed during sterilization and pasterization, reducing the differences in muscles occured under the influence of different procedures of chilling and curing. Kassai and Karpaty (6) found no differences of tenderness between canned hams produced from quickly and ordinary chilled hams. However, Weiner et al. (10) have found that Prague hams quickly chilled in brine were more tender than controls.

By testing the flavour and juiciness of canned hams during the storage there were not found significant differences in results between different groups of cans. There were also no differences between the results obtained by testing of the cans of the same group in different time. Because of such findings the

results are given in average values (Table 4./.

Sensory evaluation of flavour and juiciness of canned hams produced from hams chilled anc cured by different procedures

Table 4.

Samples	Scores for flavour				Scores for juiciness			
	m.B.f.		m.Q.f.		m.B.f.		m.Q.f.	
Procedure I	3,3	0,45	3,3	0,50	6,8	1,00	7,3	1,10
Controls	3,1	0,31	3,1	0,31	6,1	1,10	7,3	0,89
Procedure II	3,1	0,31	3,3	0,45	6,1	0,45	7,0	1,00
Controls	3,1	0,31	3,3	0,50	5,9	0,45	7,1	1,05

By statistical interpretation of the obtained results was confirmed that differences in flavour and juiciness found between different groups of canned hams were not significant (P 0,05). Similar results were found by Kassai and Karpaty (6).

Quotation by Leistner and Wirth (7) that perishable cans don't change during storage are in accordance with these findings. Namely, the results presented in this work show that in canned hams there were detected neither development of significant biochemical changes nor changes in characteristics detected by sensory testing during 3 months of storage at 8°C. The findings are of particular interest because they confirmed that different procedures in chilling and curing, including curing immediately post mortem, don't influence the quality of final product.

References

1. Barnett, N.W., H.R. Nordin, H.D.Bird and L.J.Rubin; Fleischw., 3, 236, 1966
2. Dvorak,Z. and Irena Vognarova; J.Sci. Food Agr., 16, 305,1965.
3. Hamm, R. and F.E.Deatheage; Food Res., 25, 587, 1960.
4. Hoffman,K; Fleischw., 10, 1121, 1966.
5. Hoffman,K und R.Hamm; Fleischw.,9,1180,1939
6. Hoffman, K. and Gy.Karpaty; Ham curing with rapid cooling, Proc. IXth Eur.Meating of M.R.W., Budapest, 1963.
7. Leistner, L. und F.Wirth; Fleischw., 4,274, 1963.
8. Skenderovic, B. and S.Rahelic; Some physical and chemical changes of ham muscles of pigs chilling curing under different conditions, 16th Eur.Meating of M.R.W., 1970.
9. Usborne, W.R., J.D.Kemp and W.G.Moody; J. of Anim.Sci., 3, 590, 1968.
10. Weiner, P.D., D.H.Kropf, D.L. McIntosh and B.A.Koch; Food Techn.,21, 541, 1966.
11. Wirth, F.; Fleischw., 8, 853, 1966.
12. Wismer-Pedersen, J.and E.J.Briskey; Food Techn., 15, 232, 1961.