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PROCEEDINGS VOL. III

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EFFECT OF EXTRA PRESSURE DURING THERMAL TREATMENT ON PHYSICO-CHEMICAL AND HYSTOLOGICAL PARAMETERS OF HAM QUALITY

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SUMMARY: A study into ham products quality during thermal treatment as related to extra pressure value (0-0.8MPa) showed an interrelation between pressure value and organoleptical, physico-chemical, structuro-mechanical parameters and products yield. On the basis of results a new regime for ham products thermal treatment at variable value of extra pressure during heating, conditioning-chilling has been recommended.

INTRODUCTION: There is a tendency here and abroad to ham products manufacturing increase including products in polymer packs. For giving a desirable form for a product and for excluding "pockets" formation in meat block during thermal treatment subpressing of raw material is used. Besides there are data on the influence of extra pressure, during thermal treatment, on quality characteristics of a finished product including its yield (Belousov et al., 1975; Skalinskij and Belousov, 1978; Spirin and Vagin, 1980; Bouton et al., 1980).

However a unique opinion on the optimum value of subpressing extra pressure does not exist. That is why determination of relation between product's quality and extra pressure value during thermal treatment is of practical interest.

MATERIALS AND METHODS: M.L.dorsi (pH 5.8-6.0) of II grade pork chilled for 72hrs was used for study. Meat was cut into pieces of 300-350g and massaged for 15 min. in Laska mixer at brine (density of $1.16 \times 10^3 kg/cm^3$) addition of 13% by weight. Cured meat was left for ageing at 0-4°C. Ageing time was 24hrs.

Cured raw material was packaged into polyamide-polyethylene packs, sealed at residual pressure level of 0.002-0.003 MPa and heated in a specially designed equipment according to a step-by-step regime. Pressure level during heating and cooling varied from 0. to 0.8MPa. Tap water was used for cooling.

Quality parameters of tested samples were determined as folloing. Penetration degree change during thermal treatment, characterizing product's toughness, was fixed by a penetrometer MTIMMP according to a common procedure. WHC was measured by a pressing method. Mass fractions of dense and liquid parts was determined by test samples weighing before and after thermal treatment.

Samples for hystological analysis were selected before and after curing, and also after ham heating. Tests were made on pieces from samples core. These pieces were fixed in 4% paraformaldehyde solution, osmised and dehydrated according to a common procedure. The obtained material was introduced into a mixture of epoxide resines epone-araldyte.

Qualititative parameters of muscle fibers were studied on semi-thin slices stained by tolyidine blue. Slices were made strictly across the long axis of a fiber. By morphometry the following parameters were determined: fibers diameter, their perimeter, area of fibers slice and degree of muscle bundles apartness as relation of the whole bundle area to the total area occupied by muscle fibers.

Results were analysed using t-test(Avtandilov, 1980; Tokajev et al., 1988).

RESULTS: Changes of quality parameters of ham during thermal treatment are shown in Fig. 1,2,3 and in Table.

At increase of temperature up to 40°C and pressure to 0.8MPa penetration degree rises as intensively as higher the level of extra pressure (Fig.1). Further temperature increase to 80°C led to more than 2.8 times decrease of tested samples penetration degree as compared to the initial state. Besides, for the given temperature range the more intensive decrease of penetration degree was found at increase of extra pressure to 0.8MPa.

WHC changed similarly. At temperature range of 0-40°C WHC of samples treated at pressure of 0.8MPa was 9.1±0.3% higher that at absence of extra pressure. Besides at the given temperature range liquid phase separation did not occur. At further increase of temperature to 80°C and pressure value to 0.8MPa WHC lowered more than by 22.0±0.4%. Fraction of separated liquid phase was 43.7±0.6%. WHC and separated liquid phase fraction changed as intensively as more was the pressure value during thermap treatment.

An exception to the abovementioned character of changes of penetration degree, separated liquid phase fraction and WHC of samples is heat treatment at pressure of 0.1MPa when the degree of toughness and separated liquid phase increase was lower and of WHC rise higher than at heat treatment without extra pressure.

The given relations are in good correlation with the obtained data on changes of ham products yield depending on the values of pressure (Fig.2,3).

From the Fig. 2 it is seen that they yield of samples heat treated without extra pressure is by 4.5±0.7% lower than the value for ham products treated at extra pressure of 0.1MPa. It is explained, firstly, by the presence of "pockets" in meat block filled with liquid phase separated at heating and cooling. At samples slicing juice drips decreasing the actual yield of ham products. Pressure value decrease (0.08, 0.06, 0.04, 0.02 MPa) leads to increase of "pockets" number, their size and, therefore, volume.

The mentioned disturbances of compactness between separate pieces of muscle tissue not only decrease actual yield and organoleptical characteristics of a product but also lower binding of ham pieces during cutting.

Pressure value increase during thermal treatment from 0.1 to 0.8 MPa leads to decrease of ham products yield from 97.6±0.5% to 67.3±0.8% and increase of their toughness. The reason for these changes is compacting of muscle structure at extra pressure rise, the latter leading to extracting of loosely bound water.

At extra pressure value decrease during cooling there occurrs yield rise(Fig.3).

The samples treated at pressure value of 0.1MPa with it further decrease at cooling had better organoleptical characteristics and higher yield. That is why it is interesting to study muscle changes at the given conditions. For this purpose samples treated under pressure and heated were hystologically studied. Heating was performed at extra pressures of 0.05, 0.1 and 0.15MPa. At cooling stage pressure was lowered by 25,50 and 75%.

During thermal treatment at various extra pressure values there was a similar tendency in studied parameters change: increase of muscle fibers average diameter, their cross slice area, fiber perimeter and degree of apartness of a muscle bundle. And at decrease of subpressing pressure value the mentioned parameters change significantly as compared to the initial raw material (Table, Fig.4).

Similarly greater changes of tested parameters occur at decrease of pressure value during cooling.

Described dynamics of changes of muscle fibers structure, their quantitative characteristics and muscle bundles apartness during thermal treatment under pressure and the obtained data on change of samples penetration degree, yield and WHC testify to the following. At thermal treatment under pressure swelling of muscle fibers is as more intensive as pressure value is lower. Muscle apartness decreases. However, as it has been mentioned above heat treatment without extra pressure leads to deterioration of product organoleptical characteristics and its yield decrease. Therefore, it is necessary to treat sample so that to eliminate unfavourable changes taking place at extra pressure and not to allow excessive compactness of muscle structure causing mechanical extraction of water.

CONCLUSIONS: The obtained results testify to changes of quality parameters as related to extra pressure values at thermal treatment. Analysis of studies allow to recommend a regime of ham thermal treatment using pressure of variable values.

According to the regime the value of extra pressure at the 1st step of heating (tp 40°C) should be maintained at the level of 0.4-0.8MPa. At this time an increase of WHC and penetration degree occur. At the 2nd step (up to product readyness) it is necessary to decrease pressure value to 0.1MPa. Liquid phase separation is minimal in this case that positively influences juiceness and therefore product's yield.

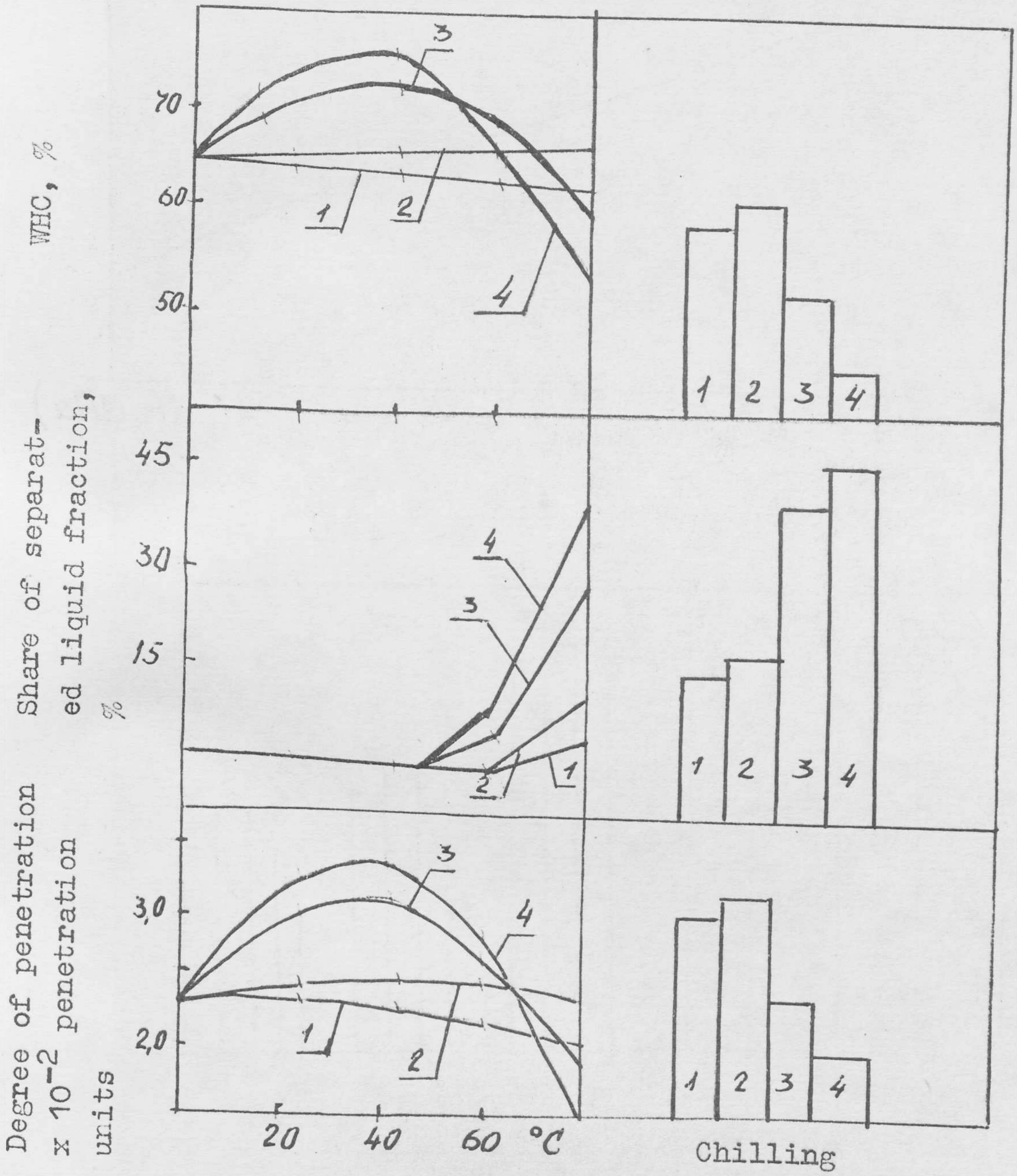

Fig.1. Change of ham quality parameters as related to pressure value during thermal treatment

1-4 - extra pressure value,P(0-0.8MPa, respectively

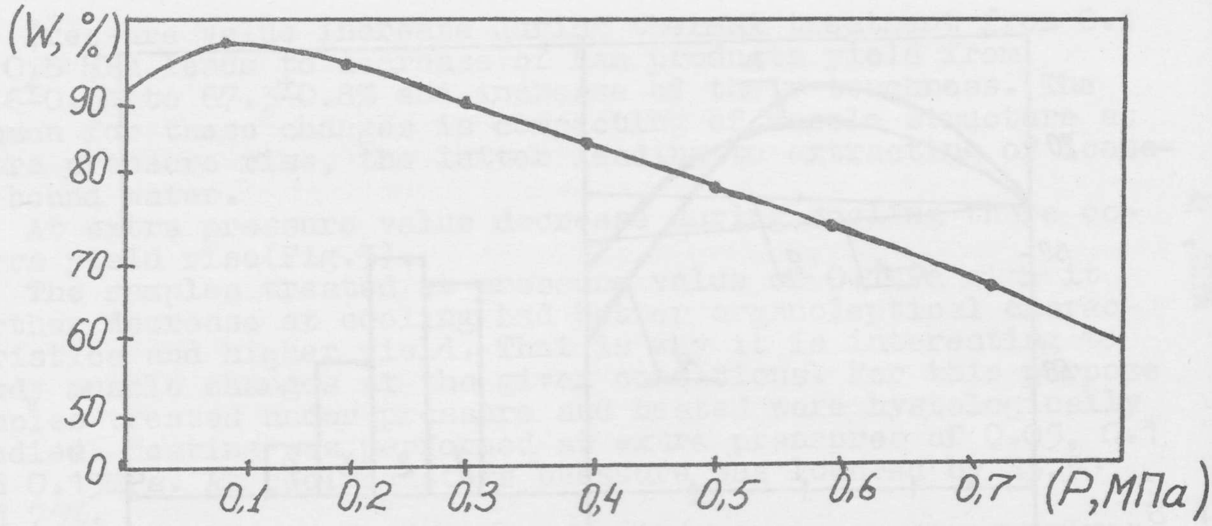

Fig.2. Change of ham products yield as related to extra pressure value during thermal treatment

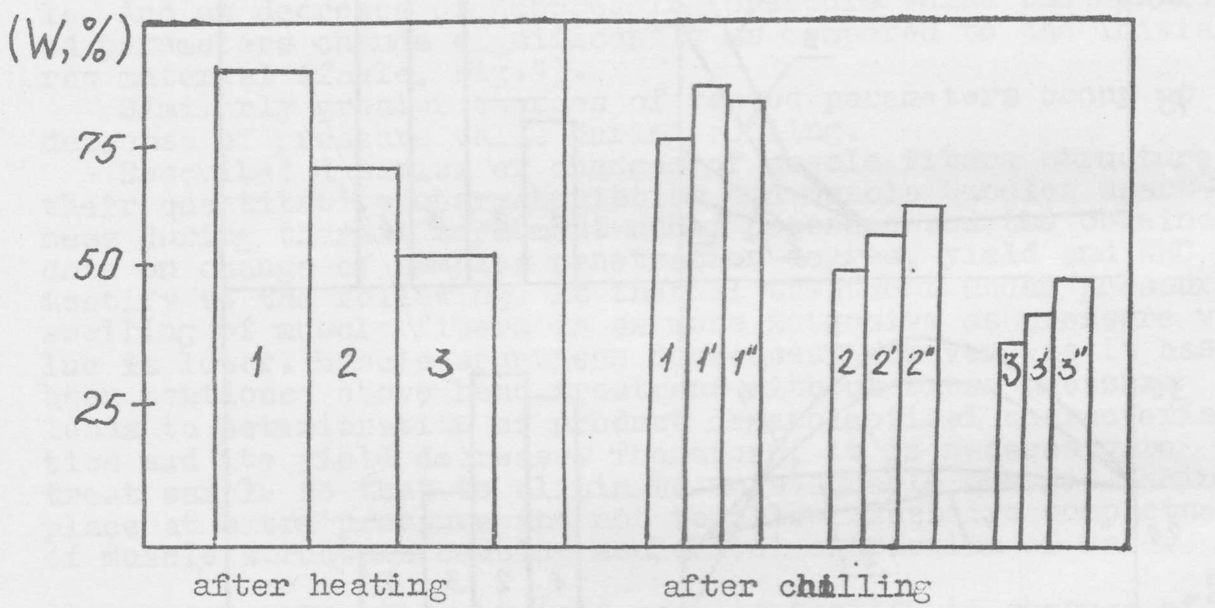

Fig.3. Change of ham products yield as related to extra pressure value during chilling

1-3 - pressure value, P(0.1-0.8MPa, respectively)

2',3' - pressure decrease at chilling by 50%

2",3" - pressure decrease at chilling by 100%.

Table. Change of quality parameters of muscle fibers at heat treatment under pressure

Parameters	Control (chilled pork)	Thermal treatment under pressure								
		P=0.5*			P = 0.1*			P = 0.15*		
	1	1**	2	3	1	2	3	1	2	3
Muscle fiber area, x 10^3 mcm^2	3.12 ± 0.35	3.14± 0.29	3.71± 0.30	4.35± 0à37	3.47± 0.31	3.63± 0.32	3.79± 0.34	3.03± 0.3	3.32± 0.27	3.58± 0.29
Muscle fiber perimeter, x10^2 mcm	2.13± 0.14	2.14± 12	2.4± .014	2.54± 0.18	2.26± 0.15	2.32± 0.16	2.47± 0.17.	2.19± 0.16	2.34± 0.19	2.52± 0.18
Muscle fiber average diameter, x10^1 cmc	7.07± 0.38	7.33± 0.77	7.5± 0.64	8.38± 0.71	7.35± 0.72	7.71± 0.66	8.14± 069	7.45± 072	7.57± 0.71	7.71± 0.68
Muscle fibers apartness	1.43± 0.12	1.20± 0.11	1.29± 0.14	1.35± 0.11	1.14± 0.10	1.17± 0.09	1.19± 0.09	1.17± 0.12	1.16± 0.11.	1.20± 0.10

* P - pressure value during heat treatment, MPa

**1-3 - pressure decrease during cooling (by 25,50 and 75%, respectively)

Pressure decrease at cooling allows to exclude water extraction from meat block and product toughness rise.

Test samples made according to the given regime had high quality characteristics.

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