

FREEZING OF MEAT OF ASTRAKHAN LAMBS BY LIQUID NITROGEN

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SUMMARY: An opportunity by nitrogen freezing method of 3-days lambs carcasses discussed in the article

In Production: The region of Kazakhstan is a comparatively new and perspective area of breeding of Astrakhan sheep. Kazakhstan takes the first place by the total number of Astrakhan sheep in the former USSR and produces 36,3% of caracultcha fells.

The authors Bolshakov A.S, et al. 1983, Bolshakov A.S. et al. 1983 prove the expediency to utilize the carcasses of Astrakhan lambs aged no more than 15 days after taking off the fells for the food aims. But up to the present time such an utilization had no practical application. It is connected firstly with the fact that the slaughter of lambs usually takes place in the regions far from meat manufacturing plants, without any refrigerating equipment and as a result it is impossible to keep the raw material for its further processing. It should be also mentioned that the mass slaughter of lambs takes place within a short period of time - one or one and a half month.

The application of non-traditional cryogenic refrigerating technology using liquid nitrogen (in the regions of breeding and treatment of lambs) will make it possible to solve the problem of utilization of additional meat resources taking into account the seasonal prevalence of lambs' treatment.

The cryogenic method provides quick freezing, which allows to include the process of freezing into the general technological chain of lambs' slaughter.

Subject and Method Study of carcasses of 3-days Astrakhan lambs

The slaughter took place on a mechanized production line. When the fells were taken off the lambs, the entrails were taken out and the toilet was made. Then the carcasses were cut into back-lumbar, shoulder and spinal-costal parts.

In this paper there are presented the results of utilization of the back-lumbar and shoulder parts of the carcasses. After the primary treatment on the line one part of lambs was frozen by cryogenic method with liquid nitrogen in a three-zone experimental plant the other - in an air-freezing plant.

The samples were frozen down to -18°C in the centre, duration of freezing was 15 and 20 minutes for the nitrogen and air methods accordingly. Then the samples were packed in "polymeric film. Before the analysis the samples were defrozen under the temperature $2-4^{\circ}\text{C}$ during 24 hours.

The study of qualities of meat was made by the methods permitting to evaluate: ability to retain water - according to methods of Cray R. and Hamm R. modified by Volovinskaya V.P. and Kalman; B.Ya.

The hardness was determined by the device 'Instron'; pH - by PH-meter with glass electrode.

Mass losses during freezing were determined by the weight method on the base of difference of mass of the samples before and after defreezing; mass loss during boiling- by weight method on the base of differences of mass of the samples before boiling and after it. The samples of the back-lumbar and shoulder parts were put into a vessel with water in the ratio 1:1 and boiled under the temperature of 100°C during 40 minutes.

Results and Discussion

The quality of ready meat product is influenced by a number of before slaughter and after slaughter factors. One of the main factors is the age of animals. At the same time the after slaughter treatment the regime of freezing the biochemical state of meat at the moment of freezing influence greatly the qualitative values of meat. Along with such values of autolytical changes as the content of ATF and KF, the store of glicozen, the activity of myozine ATF, the important ides of glicolyze is the change of pH which may serve as a controller of autolytical values at the stazed of technological and refrigeratiry treatment of lambs' carcasses. As there is no data of the change of pH in literature for the meat under study, the authors made a series of tests to determine pH during the first hours after slaughter of the lambs investigated (Table 1)

Table 1

Change of qualities of lambs meat depending on the time, when samples were taken after slaughter.

Qualities under study	Strudied parts of lambs after slaughter, min			
	45		120	
	back-lumbar	shoulder	back-lumbar	shoulder
pH value	6,41+0,03	6,48+0,05	5,87+0,04	5,78+0,04
Mass losses during boiling, %	22,0+0,31	25,0+0,28	26,2+0,33	28,1+0,25
Hardness, %	4,23+0,18	4,20+0,21	7,10+0,31	7,23+0,28

The testing showed, that 45 min later after slaughter the value of pH in lambs' carcasses was at the level of 6,41-6,48 2 hours later after slaughter pH value achieved the meaining of 5,87-5,78.

The authors consid er Lori R.A.1973 (3) that the fall of pH is a reliable indez of the course of the glicolyze process.

Analyzing the data of testing (table 1) it is evident that during the first hours after slau slaughter there is an intensive course of autolytical processes a rapid glycolyze process, which provides for the lowering of pH value than 6,0in 2 hours after slaughter, when the temperature of the carcass exceeds 20°C.

Comparing the data obtained with the results of test of the authors (Oluzkiv et.al 1984)

following defreezing the muscular tissue is fixed on the bone and can not be separated from it. The results of study of meat of 3-days lambs frozen in air and in nitrogen are showed in Table 2.

Table 2.

Qualitative indices of defrozen shoulder part of carcasses of 3-days Astrakhan lambs depending on the way of freezing.

Indices	Before freezing	Way of freezing	
		air	cryogenic
Water entailed, % to meat	69,18±0,40	58,72±0,33	59,13±0,38
pH	6,48±0,03	5,82±0,04	5,80±0,05
Hardness %	4,20±0,18	4,80±0,28	4,52±0,31
Mass losses under freezing, %	-	1,64±0,12	0,85±0,15

The data showed is the final result of changes, which take place in the muscular tissue during the process of freezing and defreezing.

of cooling of 3-months and lambs, it is evident, that for the samples under study the value of pH 5,87 under the air temperature 15°C was achieved 8 hours later. At the same time there was determined the value of mass losses during the heat treatment of samples at the different stages of endurance of lambs carcasses after the slaughter (Table 1). The testing showed, that the value of mass losses during the heat treatment depended on the moment of taking of the samples for the study, and was the least (22-25%) for the samples, boiled 45 min later after the slaughter as this value was 26-28% in the sample boiled 2 hours later after the slaughter.

The data obtained accords to the results of determination of the tenderness of meat which was made using the method of Warner-Bratsler, where this index was evaluated by the 'efforts of cutting' (Table 1). The data obtained accords to the results of determination of the pH value mass losses under the heat treatment depending on the time of taking of samples for testing. Thus the minimal cutting efforts were determined for the samples taken 45 min after the slaughter. Later the value of effort of cutting was increasing in 1,7 times independently of the lambs' age and the parts of the studied carcass. So, the analysis of the obtained data leads to the following considerations.

The samples of meat with the intensive autolytical changes near to the initial stage of stiffness by the biochemical state, are taken for freezing at the end of the slaughter line. At the same time it should be mentioned that at the moment of freezing and the

According to the data obtained (Table) the value pH of the defrozen meat decreases in comparison with the initial value. It is evidently the result of the intensive glycolical transformation during defreezing. According to the data Pavlovsky P.E. Palmin V.V. 1975 the intensiveness of glycolical transformation in the defrozen muscles, frozen in the fresh-killed state is in 2-3 times higher, than in unfrozen, which is evidently the consequence of the going out of the enzymes from the structures. There were not determined any difference between the values of pH depending on the methods of freezing. The obtained facts prove, that in the given range of speeds of freezing the increase of process speed while-transition from the air to the cryogenic freezing doesn't influence substantially the course of glycolytic transformations during defreezing of meat and the fixed difference of the qualitative values of the qualitative changes of lambs' meat is determined by the speed of freezing.

The analysis of the test data shows, that the speed of freezing and the moving of pH value to the acid side influences the water entaining ability of meat. Thus the freezing of the shoulders part of 3-days carcasses of lambs in air decreases the water entaining ability by 15,1% while during freezing in nitrogen the change of this value was 14,5% relatively to the initial meaning (Table 2).

The data in Table shows that the freezing of meat immediately after its freezing is connected with the decrease of pH value reduction of water entaining ability as well as the decrease of its tenderness which revealed in the increase of the effect of cutting. So, for the shoulder part of carcasses of 3-days lambs, frozen in air the hardness of meat increased by 14,3% while for the samples, frozen in nitrogen-by 7,6% according to the initial meaning. The obtained data of determination of water entaining ability and the hardness of meat depending on the studied methods of freezing are co-ordinated with the results of determination of losses of meat juice during defreezing.

It is evident that the process of freezing in the studied range of speeds of freezing, combined with the further slow defreezing, makes it possible to minimize the undesirable effects connected with the possible occurrence of the effects of cold contraction while defreezing of samples, which records the authors conclusions (Honikal K.Q. 1979, Honikel K.Q. Hanom R. 1983)

Conclusions

On the base of obtained results of cryogenic frozen lambs carcasses quality the following conclusions were made:

- meat, frozen by cryogenic method, has the same quality indices as the meat frozen by the air method.

- application of cryogenic technology in the region of mass slaughter for the further processing, storage and realization, makes possible to solve the problem on utilization of additional meat resources taking into account the seasonal prevalence of mass slaughter of lambs.