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INFLUENCE OF ELECTRICAL AND PHYSICAL EFFECTS ON QUALITY OF RAW-SMOKED MUTTON PRODUCTS

Bolshakov A.S., Ryzhov S.A., Khamidov R.N.

Moscow State University of applied biotechnology, 33 Talalikhina str., 109316, Moscow, Russia
Agro-industrial complex "Cherkizovsky"

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Introduction, background

The experience of development of agriculture and processing industry of RF in recent time has shown that vertically integrated agricultural holdings and agro-industrial associations which raise their own animals, process them and supply products to final consumers have good prospects.

Based on this statement, the use of warm meat raw materials in meat products technology becomes real and timely.

Though lamb meat is a valuable dietetic product, it is insignificantly used for the production of raw smoked sausages.

Objective

Improvement of processing technology of raw-smoked lamb meat products using advanced methods of preliminary treatment of warm meat materials: electrical stimulation (ES) and electric massaging (EM).

Methods

Electrical stimulation was carried out immediately after primary processing of the animals by means of pulsed (0.3-0.4 sec with 0.5-0.6 intervals) of average voltage (220 V) current supply, of industrial frequency (50 Hz) during 3 minutes with the help of 10 electrodes, which were placed over the whole length of the side at a distance 0.1-0.2 m one from another, alternating null electrodes with the phase ones.

Electrical massaging was carried out by pulsed treatment of the stimulated raw materials using an electrode package in electrical massagers as under the conditions of electrical stimulation.

Results and discussion

According to shear stress the tenderizing effect of electrical stimulation is exhibited immediately after electrical treatment of lamb carcasses. Tenderization of lamb as registered after 2-3 minutes is associated with physical destruction of myofibrillas during electrical stimulation.

Cured products from warm meat have not sufficiently expressed flavour, therefore biochemical changes during curing of electrically stimulated meat were investigated. The content of glycogen immediately after stimulation decreases by 38-40 %, and the value of accumulation of reducing sugars during curing of stimulated warm lamb meat increases 3-fold as compared to the curing of unstimulated lamb meat.

A higher level of hydratation of macromolecules during curing of electrically stimulated warm lamb meat decreases aggregation of myofibrillar proteins. After keeping in brine the solubility of myofibrillar proteins of stimulated lamb is higher as compared to control ones by 25-28 %.

One of intermediate products of protein decomposition are free amino acids which play an important role together with reducing sugars in meat flavour formation. When curing electrically stimulated warm meat the rate of accumulation of free amino acids increases 4-6 times.

During electrical stimulation the rate of glycolysis increases 2-2.5 times, and the intensive enzymic decomposition of muscle fibers is going on at the background of their active contraction and physical destruction under the action of electric pulses, there are cracks in myofibrillas, destabilization of the structure and partial disruption of collagen bridges that in total provides a pronounced effect of tenderness increase. At the same time weakening of structure rigidity increases the penetrability of membranes of muscular tissue hence the rate of curing increases 1.2-1.3 times.

The investigations have shown that electrically stimulated lamb meat was more tender, aromatic, contained less organoleptically detected connective tissue, had lower shear stress values as compared to control samples.

It was found that different lamb meat muscles have different response to electrical stimulation. The results of the investigations on the influence of electrical stimulation on technological attributes of different muscles have shown that tenderizing effect depends on muscles location and their functional characteristics. Maximum tenderizing effect of electrical stimulation is exhibited in the muscles fulfilling dynamic function. For example, the shear stress of the samples from stimulated biceps femoris decreased by 23-25 % as compared to non-stimulated muscle, and in the samples from electrically stimulated gracilis muscle of the back-approximately by 18-20 %. Plasticity of these electrically stimulated muscles tended to increase.

Minimum effect of tenderization during electrical stimulation is revealed on biceps brachii muscle, fulfilling statodynamical function, with the shear stress in the samples from biceps brachii decreasing by 10-15 % as compared to non-stimulated, that is confirmed by its plasticity.

Muscles fulfilling static and dynamic function have short muscle fibers and contain much connective tissue. Therefore, these muscles are less subject to destructive changes during periodical contraction and relaxation under the action of electric signals.

It is interesting to note that electrical stimulation doesn't influence the sum of colouring pigments, but noticeably increases the concentration of oxymyoglobin. After treatment by electrical current of lamb carcasses the muscles acquire light-red colour.

Use of non-stimulated meat slightly increases the accumulation of nitrosopigments only during first two hours of sausages hanging, and electrical stimulation increases this index by 10-15 % at the whole stage of its holding. The accumulation of reducing sugars during electrical stimulation accelerates formation of sausages colour.

Increase in the rate of accumulation of nitrosopigments in a mince from stimulated meat contributes to the decrease of the level of residual nitrite in sausages by 0.5-0.7 mg%.

In current methods the intensification of meat ageing process (despite the inhibiting effect of sodium chloride and sodium nitrite and essential reduction of raw materials holding) is achieved through increase of activity of tissue enzymes during mechanical and electrical massaging.

The electrical treatment of previously cured raw materials increases the tenderizing effect of electrical stimulation.

Electrical stimulation of meat in warm condition essentially accelerates its ageing, and electrical massaging also increases the rate of redistribution of curing ingredients.

Use of warm lamb meat opens a possibility for improving a processing technology of the raw sausage "Sujuk" (GOST 16131-86).

The stimulated lamb carcasses come to deboning and trimming in warm condition. After mince preparation and mixing it with curing ingredients and prior to stuffing in casings, all the mass is subjected to electrical massaging in electrical massager. Then the products come through all the stages of technological treatment, according to the existing instruction on preparation of raw sausage "Sujuk".

The sensory evaluation of the samples manufactured from electrically stimulated and electrically massaged meat raw materials has shown that they have a more pronounced flavour, tender consistency and a lighter colour, as compared to control samples.

Results of production experiments show that using electrical stimulation and electrical massaging during raw sausage "Sujuk" production leads to reduction of the processes of thermal processing, including drying for attainment of standard moisture content of the ready product.

Conclusions

1. A possibility and usefullness of production of delicatessen raw products of type "Sujuk" from warm lamb meat using electrical and physical technological procedures was shown.
2. A sources saving technology of raw products having high food value and sensory attributes has been developed, ensuring essential reduction of duration of production cycle.

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