EFFECT OF SODIUM LACTATE ON STORAGE LIFE AND PHYSICAL-CHEMICAL CHARACTERISTICS OF GROUND BEEF

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Background

Security of safety, maximum preservation of nutritive value and quality of manufactured foodstuffs is a main trend in the concept of state policy of the Russian Federation in the field of healthy nutrition of population.

In modern food industry various means of foodstuffs quality stabilization find application. Utilization of food additives is one of the most effective and easily applied ways. Lately much attention is given to studying the effect of lactic acid salts on stability of meat products to microbial damage during storage and prolongation of their storage life. Sodium lactate, even in minimum concentrations, is known to slow down development of pathogenic microorganisms (listeria, spore forming clostridia, staphylococcus, salmonella, *Escherichia coli,* including *Escherichia coli* 0157:H7, etc.) in various kinds of meat products.

As showed works of foreign and Russian researchers, lactates have expressed bacteriostatic action, suppressing the growth of microorganisms and spores by specific action on cell metabolic processes. Alongside, they either intensify antioxidant functions, or they are such, forming complex compounds with metals and preventing development of oxidizing processes. Together with other additives they provide the required consistency, color and taste of the product.

The greater part of investigations carried out on studying the influence of sodium lactate was focused on heat treated products (cooked sausages, frankfurters, etc.). However, there are many technological procedures assuring long-term preservation of consumers' properties during manufacture of such products. Utilization of sodium lactate aimed at prolongation of storage life of cooled meat semiproducts seems more actual.

Various food acids, including the lactic one, or their mixtures, whose bacteriostatic action is based on medium pH reduction, are usually used for preservation of meat raw material quality. However, during manufacture of meat semiproducts pH decrease will be accompanied by loss of meat juice and marketable style. In this connection it is not recommended to use raw materials with PSE properties for manufacture of semiproducts.

Utilization of lactates in meat semiproducts allows to stabilize reproduction of pathogenic microflora without pH decrease, assuring high water-binding capacity of the product.

Objective

The objective of this study was to investigate the possibility of utilization of 40 % sodium lactate of Russian production in cooled meat semiproducts for prolongation of their storage life. At the same time bacteriostatic action of sodium lactate, its effect on organoleptic and physical-chemical properties (pH and water-binding capacity) during storage of meat semiproducts was studied. Sodium lactate introduction doses during manufacture of cooled chopped meat semiproducts aimed at prolongation of their storage life were also determined.

Methods

Experimental investigations were carried out on ground meat model samples manufactured from trimmed beef with mass share of connective and fat tissue not more than 3 % and pH level 5.5-5.6, ground in a chopper with the lattice hole diameter of 2-3 mm. 0, 2, 4 and 6 % of sodium lactate (samples Nos 1-4, respectively) were introduced into ground meat samples, mixed until total absorption of the introduced additive, packaged in polymer film bags and stored at (4±2) °C up to 6 days.

Ground beef samples for determination of microbiological, physical-chemical and organoleptic properties were taken on the 0, 1st, 3rd, and 6th days. Microbiological characteristics were determined by standard methods. Water mass share in the product was determined by the express-method in LPVMM-1 moisture gage, whose principle of work is based on the usage of microwave oven UHF-energy for drying the product simultaneously with its suspension. Water-binding capacity was determined by the pressing method according to R. Grau and R. Hamm in modification of V. Volovinskaya and B. Kelman. pH index was measured by the portable "Zamer" pH-meter. The mean arithmetic value of three-point sample measurements was assumed to be the result. Registration of sample temperature during storage was carried out by the portable "Zamer-1" thermometer with the measured temperatures range from –30 to +120 °C and measurement accuracy of ±0.5 °C.

Experimental data with test multiplicity n=3 were processed by mathematical statistics methods. When checking statistical hypothesis, level of confidential probability 0.95 was used.

Results and Discussion

Microbiological investigations confirmed efficient use of 40 % sodium lactate allowing to prolong storage life of cooled meat semiproducts. Yeast, molds, salmonella, sulfite-reducing clostridia, and staphylococcus were absent in all ground beef samples during the whole storage period. Total microbial number (amount of mesophillous aerobic and facultative anaerobic microorganisms) in samples Nos 2-4 corresponded to sanitary requirements of chopped meat semiproducts. However, sodium lactate was found to be less effective in respect of coliform bacteria (coliforms). In sample No. 2 coliforms were discovered already on the 1st, in sample No. 3, on the 3rd, and in sample No. 4, on the 6th day of storage.

Microbiological research data well agreed with organoleptic value of ground meat freshness. In samples No. 1 (control) and No. 2 obvious symptoms of meat raw material unfreshness (acid, slightly decomposed odor; the color of ground meat surface is brown, with grayish-dull shade) were marked on the 3rd day of storage. In samples No. 3 and No. 4 strongly expressed unfreshness symptoms were revealed after 3 days of storage. On the 6th day of storage freshness of sample No. 4 was characterized as doubtful (ground meat had slightly acid odor tinged with stuffiness).

During storage of all test samples color darkening both on the surface and inside the product was observed. Dose of introduction of sodium lactate affected initial color characteristics of ground meat: the more was sodium lactate content in ground meat, the darker shade had the sample after introduction of sodium lactate (the 0 day). However, in the process of storage samples No. 1 and No. 2 more quickly obtained darker coloring; color of No. 3 and No. 4 samples was stabilized and during the following day of storage changed insignificantly. It is marked, that sample No. 4 (with 6 % of sodium lactate) had expressed specific odor undesirable for cooled meat semiproducts.

pH index tended to growth with increase of introduced sodium lactate amount and duration of ground beef storage. Dynamics of pH index change during storage of model ground beef samples is shown in Fig. 1.

Similar changes were also observed when determining ground meat water-binding capacity (Fig. 2). Initial value of ground meat water-binding capacity when introducing sodium lactate increased from 72 % in No. 1 sample (control) to 88.7 % (No. 4 sample). In the process of model samples storage further increase of water-binding capacity was observed: on the 6th day maximum water-binding capacity (93.2 %) was marked in No. 4 sample (6 % of sodium lactate).

Conclusions

Based on investigations carried out, effect of Russian sodium lactate on cooled meat semiproducts was studied. The following was established:

- overwhelming effect of sodium lactate on development of undesirable microflora;
- increase of pH initial value resulting from introduction of sodium lactate and during storage;
- increase of water-binding capacity of model ground beef with increase of the introduced sodium lactate dose;
- possibility to prolong storage life of cooled ground beef with introduction of 40 % sodium lactate from 12 hours to 3 days at storage temperature of (4±2) °C.

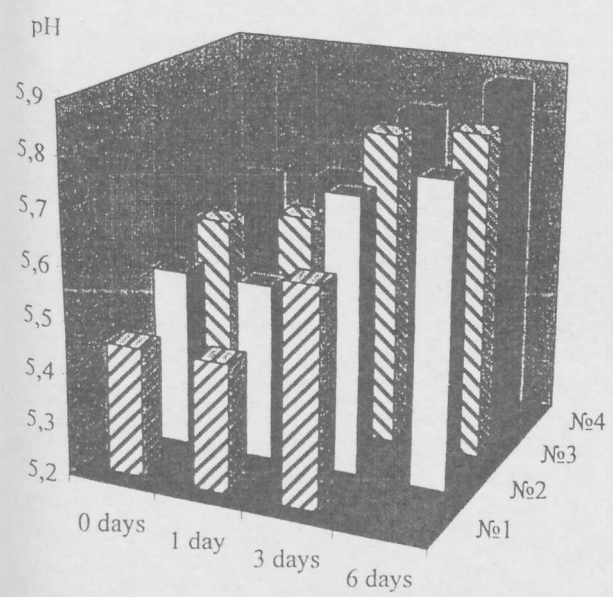

Fig. 1. Change of pH index during ground meat storage with different content of sodium lactate.

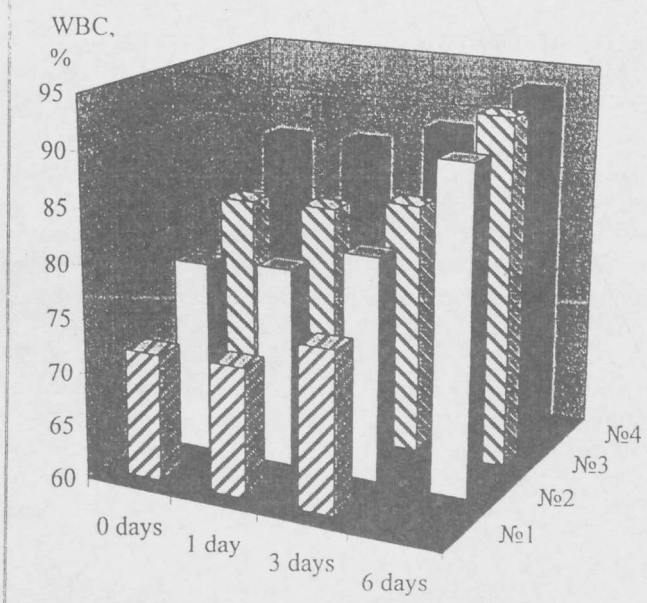

Fig. 2. Change of water-binding capacity during ground meat storage with different content of sodium lactate.