

LISTERIOSIS: TECHNOLOGICAL FACTORS AND SAFETY OF MEAT PRODUCTS DURING THEIR MANUFACTURE

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Background

In the world practice lack of *Listeria* (microorganism of *Listeria* species., in particular, *Listeria monocytogenes*) in meat production is considered one of the most important criteria of its safety.

Earlier it was considered, that listeriosis was dangerous only for animals, namely, for sheep, cattle, pigs. It was registered in 43 countries, including the Russian Federation. During the last 10-15 years, pathogen of listeriosis was acknowledged dangerous not only for animals, but also for people [1, 2]. In most developed countries it was introduced as the obligatory safety index during sanitary evaluation of meat and other food products.

Listeria were isolated from minced meat semifinished products, poultry meat, dry-smoked sausage, dry-cured loin, roll, and other products [3, 5].

In spite of the available publications, data on comprehensive investigation of the effect of technological factors of manufacture of meat products on viability of *L. monocytogenes* in the literature accessible for us [4, 6, 7], were not discovered. Particularly it concerns the Russian Federation, where the above problem is studied very insufficiently.

Objectives

The objective of this investigation was to establish dynamics of viability of *L. monocytogenes* under the influence of technological factors of manufacture of meat products. In this connection the influence of low positive ((4...6°C) and negative (minus 16...minus 18°C) temperatures; pickling processes, pH value, sodium nitrite, food phosphate (polyphan A), temperature factors (pasteurization regimes) depending on the content of fat and connective tissue in meat; spice emulsions (0.005 %); periods of storage of cooked, cooked-and-smoked and dry-smoked (dry-cured) meat products on viability of *Listeria* was studied.

Object and Methods

Basically accepted methods of investigations of the influence of physico-chemical factors on viability of microorganisms were used in this paper. As a test culture, was taken *Listeria monocytogenes* serovar 1/2 b strain. In the process of work model meat products (meat - beef and pork, beef-extract broth, sausage products) were used. Processing of experimental data with creation of a mathematical model was carried out, using Mathead 6 Plus system of mathematical processing in Windows-95 operation medium.

Results and their Discussion

According to the results of investigations carried out, *Listeria* have high resistance to the influence of different factors and procedures used in the technology of manufacture of meat products (Figs 1-6).

When studying the influence of low positive temperatures (4...6°C) on *L. monocytogenes* in beef meat, after 17 days of storage a 4-log reduction of the number of *Listeria*, as compared with the initial number (log 6), was registered.

When storing frozen meat (minus 16...minus 18°C) during 9 months, the number of *Listeria* actively decreased by 3 log cycles within the first 1.5-3 months, after which toward the end of the storage period their number reduced by 1 log cycle, as compared with 3 months (log 3). The full loss of viability of the pathogen was not established.

Influence of NaCl in the range of 2.5; 4.5; 10 % during 5 days at 4...6°C led to reduction of the pathogen of *L. monocytogenes* by 3 log cycles, 14 % NaCl concentration reduced the number of *Listeria* by 4 log cycles, as compared with the control (in the medium without NaCl).

pH values in the range of 7.2; 6.5; 5.5 didn't significantly influence the viability of *Listeria* at 4...6°C during 5 days.

The influence of food phosphate Polyphan A (0.3 %), sodium nitrite (0.005 %) at 4...6°C during 5 days reduced the number of *Listeria* by 1 log cycle after 2 days; later on, changes were not registered.

We also determined, that under the influence of temperatures of pasteurization regimes in our experiment, value D_T of *Listeria* decreases with the growth of the content of connective tissue in meat. Thus, compared with beef of superior quality ($D_{70C} = 10.89$ min; $D_{72C} = 7.93$ min), value D_T for beef with a 6 % content of connective tissue was $D_{70C} = 9.93$ min; $D_{72C} = 7.6$ min, and that with a 20 % content of connective tissue, $D_{70C} = 9.78$ min; $D_{72C} = 6.89$ min.

Fat had a protective effect on thermal stability of *Listeria*. Value D_T in pork with a 20 % content of fat amounted to $D_{70C} = 10.94$ min; $D_{72C} = 9.26$ min, and that with a 50 % fat content, $D_{70C} = 11.4$ min; $D_{72C} = 10.89$ min.

Utilization of emulsions (0.005 %) of black pepper, paprika, pimento, coriander, nutmeg, cardamom, and caraway didn't lead to significant reduction of viability of *Listeria* within 15 days at temperatures of cultivation of *L. monocytogenes* 4...6°C.

Garlic emulsion (0.005 %) reduced the number of microorganisms of this kind after 3 days by 2 log cycles, as compared with the initial content (log 6); however, subsequent storage till 15 days didn't significantly influence the viability of pathogen of listeriosis.

Influence of storage periods of meat products (cooked, cooked-and-smoked, dry-smoked sausage products) at 4...6 and 12°C was studied. It was observed, that during 15 days reduction of the population of the above microorganisms by several orders took place, however, their full inactivation was not marked.

Conclusion

High viability of *Listeria* under the influence of different technological factors during manufacture of meat products was revealed. Long-term storage of frozen (9 months at minus 16...minus 18°C) and chilled (17 days at 4...6°C) meat didn't lead to total destruction of *Listeria*. At the same time certain reduction of their number (by 4 log cycles) after 9 months in frozen meat and 17 days, in chilled meat, was registered.

Common salt only in concentrations of more than 10 % promoted reduction of *Listeria* content, however, total loss of viability of the investigated pathogen wasn't registered.

Ingredients (phosphates, sodium nitrite, spice emulsions) in concentrations permitted in Russia for usage in manufacture of meat products, as well as pH value in the limits of 5.5-7.2, didn't influence the viability of *L. monocytogenes*.

Listeria are comparatively stable to the effect of heat in pasteurization regimes. Their thermal stability increased with the growth of fat content, and under our experimental conditions, it decreased with the increase of the connective tissue amount.

Long-term storage of meat products (cooked, cooked-and-smoked, dry-smoked products), though promoted certain decrease of *Listeria* number, didn't totally depress them.

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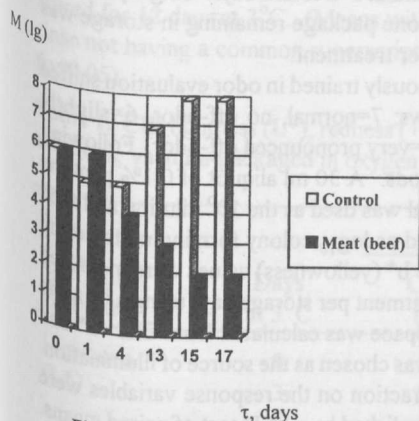


Fig. 1. Viability of *L. monocytogenes* at 4 ... 6°C in cooled meat (beef)

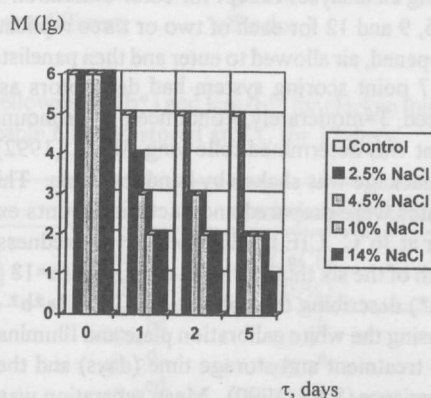


Fig. 3. Viability of *L. monocytogenes* at 4 ... 6°C in MPB depending on different concentrations of NaCl (0, 2.5, 4.5, 10, 14%)

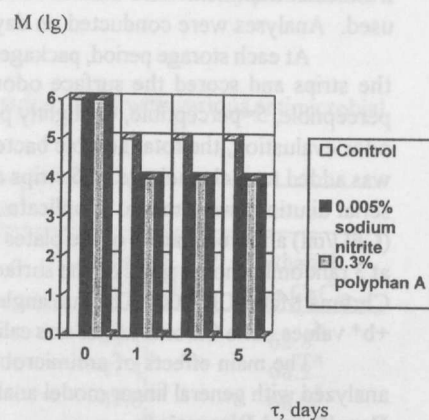


Fig. 5. Viability of *L. monocytogenes* at 4 ... 6°C in MPB with addition of sodium nitrite and food phosphates (Polyphane A)

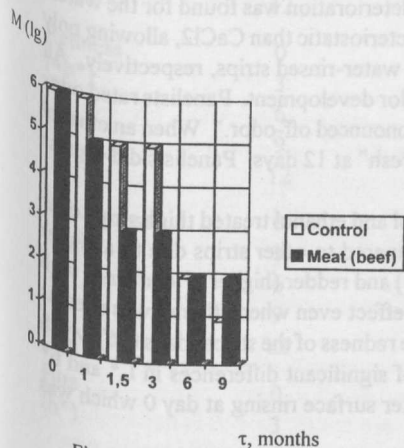


Fig. 2. Viability of *L. monocytogenes* at minus 16 ... minus 18°C in frozen meat (beef)

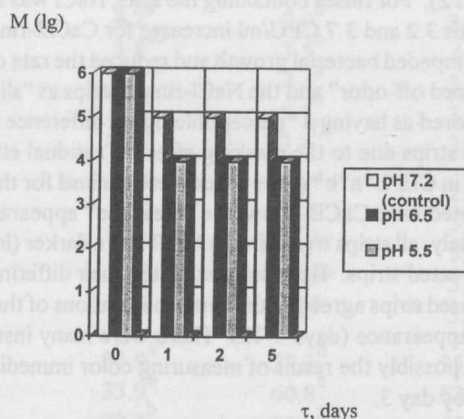


Fig. 4. Viability of *L. monocytogenes* at 4 ... 6°C in MPB depending on pH value

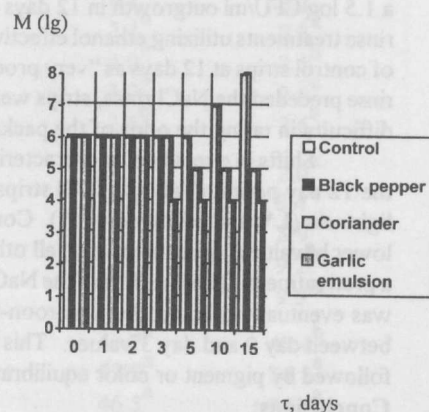


Fig. 6. Viability of *L. monocytogenes* at 4 ... 6°C in MPB with 1% of glucose depending on the term of effect of spices