Studies on the microflora in an accelerated technology for the production of raw-dried products from non-comminuted pork

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The manufacture of raw-dried products from non-comminuted meat is connected directly with the life activity of different groups of microorganisms (Leistner, 1957). Data in literature on the microflora growing during the ageing of products from non-comminuted meat are scarce and relate primarily to ageing in brine (Khorovits-Vlasova, 1957; Polymenidis, 1978).
The objective of the present work is to study the microflora participating in the ageing of raw-dried products from non-comminuted meat with an accelerated technology, and the possibilities of directing the ageing processes by introducing suitable pure bacterial cultures.

Material and Methods

Shaped pork from necks and M. longissimus dorsi was used in the experiments. The technological processing was done by the method proposed by Chakurov et al. (1979). Control samples processed by existing conventional technologies were used for comparison.
Microflora development during curing and ageing was followed, by determining the total aerobic counts of the microorganisms and also the changes in the counts of micrococci, enterococci, lactic acid bacteria, the Proteus titre and the coli-titre. Use was made of cultivation media and methods of isolating and differentiating the different groups of microorganisms, complying with modern requirements.
Some experiments applied Micrococcus strain M_4 and Lactobacillus strain L_{20}, isolated and selected in the Meat Technology Research Institute.
Analyses were made on the day of commencing the experiments and at intervals during ageing.

Results and Discussion

I. Changes in the microflora on the ageing of products manufactured using conventional technologies

The growth of microflora was followed during the ageing of products from non-comminuted meat, manufactured by conventional technologies. It was found in all the analyses, that lactic acid bacteria number usually 10^2-10^3 cells/g of product initially and they rarely reach 10^6 during ageing. Micrococci counts reach 10^5 (in isolated cases, 10^6 cells/g), from 10^3-10^4. Enterococci are seldom isolated, at the rate of up to 10^2 cells/g at the most. Yeasts number 10^3-10^4, sometimes reaching 10^5 cells/g, while some samples yield none of them at all. The coli-titre is 10^{-1}-10^{-2} in the beginning of ageing and drops to 10^{-1} or, more frequently, to nil, during ageing. Initially, the Proteus-titre is 10^{-1} and it decreases rapidly to nil in a few days.
These data indicated that micrococci participate in the most active way in the ageing of non-comminuted meats, followed by lactobacilli. Although that sometimes yeast numbers are not too small, yeasts cannot be considered to play an important role in ageing, since their numbers vary and even in their absence, a well ripened product is obtained.

II. Changes in microflora on the ageing of products obtained using an accelerated technology

These experiments followed the growth of the basic groups of microorganisms in meat products manufactured by a novel technology with an accelerated dry curing, while products manufactured from the same raw material but aged by the technology existing before, served as control. The results are shown in Table 1.
Fig. 1 presents growth curves of lactobacilli and micrococci during ageing by both technologies.
Lactobacilli numbers were found to be similar in the controls and the experimental variants. As is obvious in Table 1, micrococci numbers are higher in the experimental lots. One could presume that the conditions created in the accelerated technology facilitate their growth. The numbers of enterococci are not high and vary in the individual experiments: they may either reach 10^2-10^3 cells/g or may not be isolated. Results are similar for experimental variants and the control. The initial titre of colibacteria is 10^{-3}. It decreases till about the 6th day down to 10^{-1}, after which, no colibacteria are isolated from experimental variants or controls. Proteus bacteria are not isolated either.
The results of these experiments indicated that, in the ageing of rolls by the two technologies, the accelerated and the control one, microflora growth is similar. The faster growth and the higher numbers of micrococci in the experimental lots are important for the faster and better ageing in the initial days of manufacture. Enterococci seem not to play a substantial role.

III. Experiments with the application of pure bacterial cultures

The basic microorganism group found to participate in the ageing of products from non-comminuted meat are micrococci. Having in mind their importance established in the ageing of raw-dried sausages, and especially their catalase and nitrate reductase activities, we directed

Table 1. Changes in the basic groups of microorganisms during the ageing of pork neck meat (cells/g of product)

Microorganisms	Technology	Initial No.	Ageing (Weeks) 1	Ageing (Weeks) 3	Ready Product
Lactobacilli	Control	10^2-10^3	10^4-10^5	10^6-10^7	10^2
	Accelerated	"	"	"	"
Micrococci	Control	10^3	up to 10^5	10^6-10^7	10^4
	Accelerated	10^2-10^5	10^5-10^6	10^6-10^7	10^4
Enterococci	Control and Accelerated	10^2	10^3-10^4 or 0	about 10^1	10^1-10^2
Coli-titre	"	10^{-3}	10^{-1}	0	0
Proteus-titre	"	10^{-2}	0	0	0

ourselves towards experiments with the application of pure cultures from micrococci. Although that the numbers of lactobacilli in ageing raw products from non-comminuted meat are lower than those in ripening raw-dried sausages, we conducted experiments with the application of combined cultures from lactobacilli and micrococci. As a result, a better reduction in pH value was obtained, leading to the production of a better tenderness and faster drying. The experiments were conducted in different variants, using broth cultures and freeze-dried cultures. The best results were obtained using freeze-dried starter cultures from the strain L_{20} (lactobacilli) and M_4 (micrococci), applied in accordance with the requirements of Technological Instructions on the Application of Freeze-dried Starters (1979).

No substantial differences were observed in the microbiological pattern between the individual experimental variants. The influence of starter cultures was established by the distinct differences in the quality of experimental variants, compared to that of controls. These differences can be explained by the possibilities for the growth of definite numbers of microorganisms of a given species in definite conditions. With the introduction of pure cultures, ageing is directed by the participation of selected active microorganisms, while the action of stray ones is reduced.

Observations demonstrated that culture penetration deep into the meat is different. In comparative experiments it was found that microorganism growth is better in neck meat than in loin. This can be seen in Fig. 2, showing micrococci growth, and in Fig. 3, showing lactobacilli growth, during the ageing of products from loin or neck, under equal further conditions. The numbers of those microorganisms are higher on using pure cultures, which is better expressed in the beginning of ageing.

Conclusions

(1) The basic group of microorganisms playing an important role in the ageing of products from non-comminuted meat, are micrococci, followed by lactobacilli.

(2) In an accelerated technology of manufacturing products from non-comminuted meat, micrococci grow better. No substantial differences are observed in the numbers of the remaining groups of microorganisms between experimental and control variants.

(3) Better meat ageing is observed on using a combined freeze-dried starter culture of micrococci and lactobacilli.

References

Khorovits-Vlasova, 1957 (after Polymenidis, 1978)

Chakurov M. et al., 1979. A method of dry curing and ageing in the manufacture of meat products from non-comminuted meat (Patent - 43125) 1979 /In Bulgarian/

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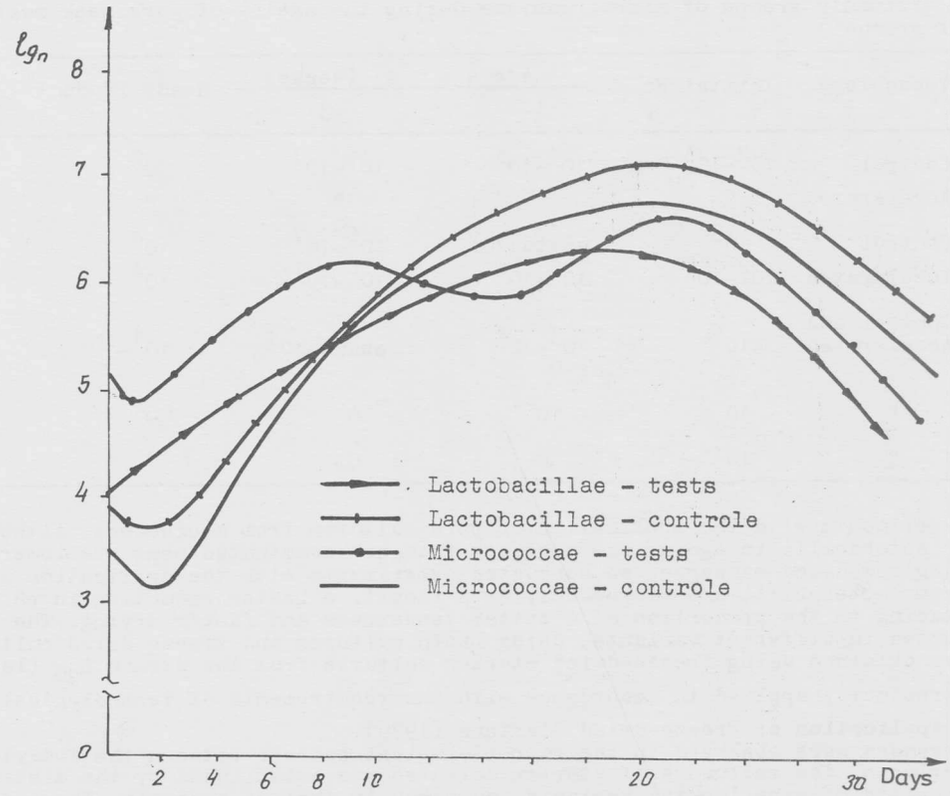

Fig.1 Development of micrococcae and lactobacillae during ripening of meat from pig necks after c lassical and speeded up technologies.

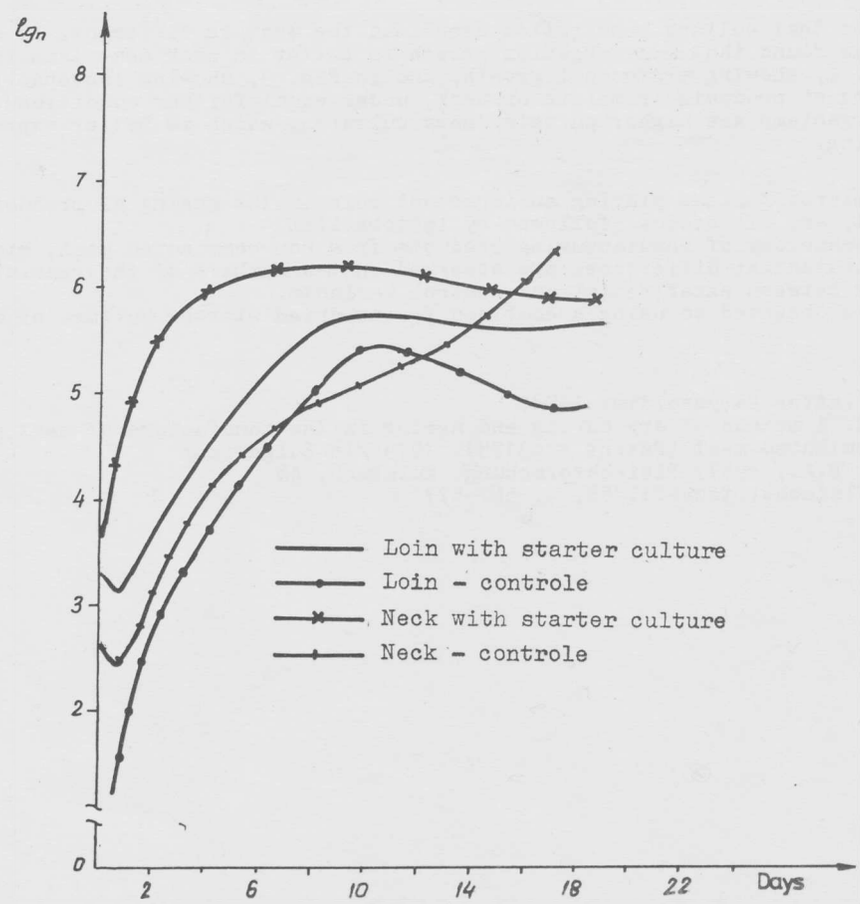

Fig.2 Changes in number of micrococcae during ripening of meat from pig ham and neck

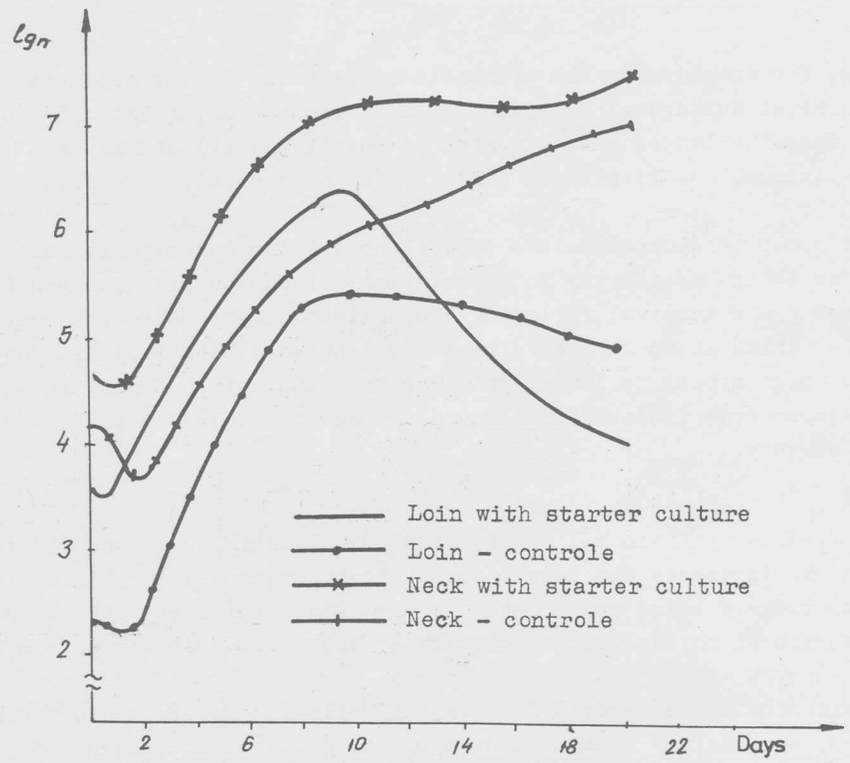

Fig.3 Changes in number of lactobacillae in ripening of meat from pig ham and neck