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Use of starter cultures in the production of raw-dried non-comminuted pork products

I. Influence of starter cultures upon the structural-mechanical properties of raw-dried non-comminuted pork products

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Introduction

Starter cultures are of great importance to the improvement of the quality of meat products and to the intensification of the technological process. A number of authors (7,8,9,10) point out that along with the intensification of the technological process and the inhibitory effect that they have upon the growth of undesired microflora, starter cultures favour the formation of a good structure. However, the studies that have been performed in this sphere by organoleptic testing of mainly comminuted meat products only contribute to characterization of the process of structure formation (7,9) and data on changes caused by starter cultures in the structural-mechanical properties of non-comminuted meat products are almost unavailable.

With regard to this, we set ourselves a task to carry out studies to find out the effect that strains 136 and 167 of starter cultures of Pediococcus sp. exert upon the structural-mechanical properties of raw-dried non-comminuted pork products.

Materials and Methods

The studies described in this paper were conducted on test and control samples of two types of raw-dried non-comminuted pork products: "Trakiya" produced from M.semitendinosus

and "Plovdiv" produced from muscles located in the lower part of the neck. The muscles from the right side of chilled carcass halves were used for the test samples and those from the left side for the control samples.

The main technological operations applied to the manufacture of the two types of pork products were curing and drying.

Both test and control samples were injected with a cure composed of: salt nitrate, nitrite and sugar (4-6% of the weight of the raw material) and then dry-cured at 4÷5°C for 2 days.

The test samples were prepared with starter cultures of Pediococcus sp. - strains 136 and 167 (1:1). The starter cultures were injected together with the cure in the form of 24-hour bouillon suspension in Hotinger yeast bouillon in inoculum level 10^6-10^7 viable cells/g product.

The drying proceeded for 20 days at 12°C, relative humidity of 72-75% and an airflow of 1,50m/sec. On the sixth day of drying the products were pressed one-sidedly at 2,2MPa.

The changes in the structural-mechanical properties were determined by the following indices: structural firmness, plastic firmness and tenderness of muscular tissue after Grau (1,2,4).

The test and control samples of the starting raw material were studied on the 2nd, 6th, 8th, 16th and 22nd days of processing. The experimental data obtained were processed by the variation-statistical method of least squares (3,4) and presented in tables by confidence interval $\bar{x} \pm tm$,

where:

$\bar{x}$ - is the mean value from n=33 measurements,

m - mean square error of the average result,

t - coefficient of Student for the accepted by us 95% confidence interval.

Results and Discussion

The data on the studies into the structural-mechanical properties of the test and control samples of the two pork products ("Trakiya" and "Plovdiv") are given in tables 1, 2 and 3.

Structural firmness g/cm^2 Table 1

Moment of study	Type of product	"Trakiya"		"Plovdiv"	
		test	control	test	control
1		2	3	4	5
Initial raw material		1490±218	1495±223	1832±215	1823±198
On 2nd day		2007±193	3215±247	2795±313	4178±377
On 6th day		5000±670	8210±572	7326±694	10274±599
On 8th day		7995±803	13902±669	16000±1119	23852±2081
On 16th day		20000±1199	30100±3714	36200±3000	49899±2854
On 22nd day		34759±3228	46873±5040	51227±4519	70000±618(

Plastic firmness g/cm^2 Table 2

Moment of study	Type of product	"Trakiya"		"Plovdiv"	
		test	control	test	control
1		2	3	4	5
Raw material		435±40	433±61	481±39	485±42
On 2nd day		501±50	662±38	599±37	715±64
On 6th day		794±71	1115±94	1398±107	2407±18
On 8th day		1077±139	2407±275	2620±298	4807±43

1	2	3	4	5
On 16th day	2882±360	4549±312	5200±702	6700±520
On 22nd day	3200±407	4998±670	5493±390	7100±501

Tenderness of muscular tissue after Grau cm^2/g Table 3

Moment of study	Type of product	"Trakiya"		"Plovdiv"	
		test	control	test	control
1		2	3	4	5
Raw material		5,94±0,36	6,02±0,46	8,69±0,38	8,64±0,46
On 2nd day		9,10±0,15	7,18±0,17	12,98±0,17	10,70±0,33
On 6th day		7,28±0,27	6,10±0,34	9,81±0,15	7,90±0,30
On 8th day		6,61±0,50	5,33±0,21	8,24±0,32	6,41±0,40
On 16th day		6,30±0,60	4,31±0,25	7,00±0,34	5,60±0,22
On 22nd day		6,01±0,20	4,15±0,17	6,94±0,37	5,20±0,29

The data on the changes in the structural firmness presented in Table 1 show a tendency towards a continuous increase in the values of the index from the beginning to the end of the technological process. In the test samples prepared with the starter cultures this increase is considerably lower than it is in the control samples of the two types of pork products whereas the differences in the values for the structural firmness after

curing are relatively lower for both the test and control samples and particularly well pronounced during drying.

The results obtained for the plastic firmness (Table 2) reveal a similar character and dynamics of changes as was the case with the structural firmness. The plastic firmness values increase during the technological process for both the test and control samples of the two pork products. The plastic firmness of the test samples, however, has lower values than those for the control samples.

The data on the tenderness of the muscular tissue after Grau are presented in Table 3. The changes in tenderness exhibit an increase in the index values after the curing process, which increase is especially well pronounced in the test samples of both products. During the drying process there occurs a decrease in the tenderness of the two kinds of samples, which has lower values for the test samples.

The increase in the tenderness of the test samples and the lower values for the structural and plastic firmness during curing are due to destructive processes which occur in the muscular tissue and mainly to a partial hydrolysis of the muscle proteins brought about by the injected starter cultures. This coincides with their vigorous growth in the first 2 or 3 days under the favourable conditions in the medium during the curing process - a higher aw value. Doubtless tissue ferments and available microflora also contribute to those destructive changes.

Such processes as structure tightening and shrinkage of muscular fibres of non-comminuted meat products, which occur during drying are another cause of an increase in the values for the structural and plastic firmness and a decrease in the values for the tenderness. These have also been confirmed by our studies. Evidently the lower values for the indices characterizing the structural-mechanical properties of the samples prepared with the starter cultures are due to a decrease in viscosity of the protein-salt solutions of the muscular tissue on the one hand, and on the other to their effect upon the firmness of

the intermolecular areas in the structural net. The structural changes in the test samples are more pronounced during drying due to the development of the starter cultures and the activities of their products.

It should be mentioned here that in both types of pork products prepared of raw material of different morphological properties, the same regularity of changes can be observed in the structural-mechanical properties.

In conclusion, the starter cultures used hasten the process of improving the structural-mechanical properties of the studied non-comminuted pork products. This fact is of great importance to practice since the use of starter cultures aids to intensify the technological process and to shorten the production cycle.

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