

Lactic acid bacteria compositions for application in the meat industry

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Abstract

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Introduction. Despite a large number of the bacterial preparations used in the meat industry, development of new starters and study of their influence on development of undesirable microbiota are still vital.

Materials and methods. We studied the halo- and thermo-resistance of 8 collection strains of the lactic acid bacteria and the compositions made of these lactic acid bacteria. The antagonistic activity toward the indicator strains, isolated from the raw meat, and the collection bacteria strains was determined by the well-diffusion method.

Results and discussion. At the maximum NaCl concentration (10.0%) in the growing medium, the strains of *L. plantarum* 12 and 1005 were characterized by high growth rate, *L. delbrueckii s/sp. lactis* 013 and *L. casei s/sp. tolerans* 290 – by the average one. Thermo-resistant (that is able to grow quickly at the temperature ranged from 5 to 25 °C) were the strains of *L. plantarum* 12, *L. delbrueckii s/sp.lactis* 013, *L. acidophilus* 147 and *L. casei s/sp. tolerans* 187 and 290. The lactic acid bacteria showed the antagonistic activity to both, the strains isolated from the raw meat, and the collection strains of bacteria. Growth of some indicator bacteria was slowed down only, while that of others – completely inhibited. The best antagonists were the strains of *L. plantarum* 12, *L. delbrueckii s/sp. lactis* 013 and *L. casei s/sp. tolerans* 290, which completely inhibited the growth of *Bacillus sp.* 3, *Kurthia sp.*, *Planacoccus sp.* 1, *sp.* 2, *Micrococcus sp.* 2, *Sarcina sp.* and *Staphylococcus sp.*, isolated from meat and the collection bacteria, such as: *Planacoccus citreus*, *Escherichia coli* and *Salmonella enteritidis*.

Based on the strains of *L. plantarum*, *L. delbrueckii s/ sp.lactis* 013 and *L. casei s/sp. tolerans* 290 nine variants of compositions were made and their biotechnological potential was studied. All the compositions were able to grow even at 0 °C. The most stable was the starter made of *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12 at the ratio of 1:2, the growth rate of which at 5 °C was estimated as "exceptional". The lactic acid bacteria compositions significantly inhibited the growth of the indicator bacteria. The dimensions of the "no growth" areas for the bacteria isolated from meat ranged from 16 mm to 43 mm depending on the indicator strain and composition. The most sensitive bacteria from the collection ones were the gram-positive cocci *P. citreus* and *M. luteus*, for which the "no growth" area dimensions, depending on the composition, ranged from 34 mm to 42 mm and from 28 mm to 40 mm, respectively.

Conclusions. The results show an increase in the biotech activity of the lactic acid bacteria in the compositions. The most promising for testing in an industrial environment is a composition of *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12 at the ratio of 1:2.

Introduction

Providing the population with the high-grade whole food, meat and meat products in particular, is one of the priorities of the contemporary food industry. High nutrition and biological value of meat, the possibility to get a thousand of finished products different in the form, taste, flavor, succulence, color and consistency are determined by the heterogeneity of its structure, composition and high variability of its properties [1, 2].

Since meat is a favorable breeding ground, there is a high risk of the development, reproduction and accumulation of microorganisms in it [5, 6]. The sources of the microbial contamination can be exogenous and endogenous.

To maintain quality, prevent development of deficiencies and extend the storage life of meat, various types of processing are offered. One of the current trends is the biotechnological methods aimed at modification and optimization of the functional and technological properties of the raw meat, and improvement of its quality characteristics during storage [7, 8, 9]. For this purpose, use of the lactic acid bacteria seems most promising, in particular, the *Lactobacillus* genus bacteria, producing organic acids, enzymes and other bioactive substances which promote the antagonistic properties in respect of the undesirable raw meat microbiota [10]. There are works of the domestic and foreign scientists devoted to search for the promising lactic acid bacteria and making compositions (consortia) based on them, the so called “bacterial starters” [11, 12, 13]. However, in general they relate to use of starters in manufacture of the meat products. There are few works related to use of the microorganism cultures to improve the raw meat quality and extend its storage period. The issue of choice of the bacterial composition and its influence on the contaminating microbiota development is still vita [14].

Therefore, the purpose of this work is selection of the lactic acid bacteria strains and making the compositions suitable for bioprotection of the raw meat (having antagonistic activity to the collection bacteria strains and those isolated from the raw meat).

Materials and methods

We studied 8 collection lactic acid bacteria strains (*Lactobacillus plantarum* 12, 1005, *L. delbrueckii s/sp. lactis* 013, *L. acidophilus* 147, *L. gasseri* 149, *L. casei s/sp. tolerans* 187 and 290, *L. casei s/sp. rhamnosus* 283); the lactic acid bacteria compositions made; the indicator bacteria isolated from the raw material (*Bacillus sp.* 1, 2, 3 *Kurthia sp.*, *Planacoccus sp.* 1, 2, *Micrococcus sp.* 1, 2, *Sarcina sp.*, *Staphylococcus sp.*) and the collection strains of saprophytic (*Planacoccus citreus*, *Micrococcus luteus*, *Bacillus subtilis*, *Bacillus cereus*, *Bacillus megaterium*), opportunistic pathogenic (*Staphylococcus aureus*, *Escherichia coli*, *Proteus vulgaris*) and pathogenic (*Salmonella enteritidis*) bacteria.

To activate the lactic acid bacteria strains, inoculation to the liquid MRS medium enriched with 5% glucose solution was carried out.

Resistance of the lactic acid bacteria and their compositions to salt was determined by growth rate in the culture medium (MRS-broth) with introduction of sodium chloride at the concentrations of 2.5; 5.0; 7.5 and 10.0%.

Growth rate at the low above-zero temperatures was measured at 0, 5, 10, 15, 20 and 25 °C for 14 days.

The antagonistic activity was determined by the well-diffusion method. As the indicator bacteria strains, we used *Bacillus sp.* 1, 2, 3, *Kurthia sp.*, *Planacoccus sp.* 1, 2, *Micrococcus sp.* 1, 2, *Sarcina sp.*, *Staphylococcus sp.*, isolated from the raw meat and *P.*

citreus, *M. luteus*, *B. subtilis*, *B. cereus*, *B. megaterium*, *S. aureus*, *E. coli*, *P. vulgaris* and *S. enteritidis* as the collection ones. In the experiment, we used the daily broth cultures: the lactic acid bacteria were grown in the MRS-broth, and the indicator bacteria – in a nutrient broth. The results were taken in 24 hours by measuring the delay and growth inhibition areas for the indicator microorganisms. When determining the antagonistic activity, only the cases of complete indicator organism growth inhibition were taken into account. If the size of a “no growth” area ranged from 10 mm to 20 mm, the degree of activity was considered average, if it was greater than 20 mm – high.

Results and discussion

The biological methods to treat the raw meat for extending its storage life are based on use of the bacterial starters consisting of the specially selected species and strains of microorganisms, in particular, the lactic acid bacteria of *Lactobacillus* genus. In selection of the lactic acid bacteria strains to make starters with a high biotechnological potential, their value measures included: halotolerance, thermo-resistance and symbiotic nature of the relationship between the cultures and antagonistic activity against the opportunistic pathogenic and pathogenic microbiota [3, 9, 11].

In this connection, at the first stage of work we studied the resistance of 8 collection lactic acid bacteria strains to salt and low above-zero temperatures. The results showed that adding NaCl to the culture medium at the concentrations of 2.5 to 7.5% did not influence the bacteria growth, and their growth rate was estimated as "exceptional". A 10.0% salt concentration in the culture medium inhibited the growth of the strains under study. With such NaCl content, only two strains (*L. plantarum* 12 and 1005) showed high growth rate and two strains (*L. delbrueckii s/sp. lactis* 013 and *L. casei s/sp. tolerans* 290) – the average one (Table 1).

Table 1
Resistance of the lactic acid bacteria to NaCl and temperature

Strain	Growth rate at	
	10.0% of NaCl	5 °C
<i>L. plantarum</i> 12	high	high
<i>L. delbrueckii s/sp. lactis</i> 013	average	high
<i>L. acidophilus</i> 147	average	high
<i>L. gasseri</i> 149	low	low
<i>L. casei s/sp. tolerans</i> 187	low	high
<i>L. casei s/sp. rhamnosus</i> 283	low	average
<i>L. casei s/sp. tolerans</i> 290	average	high
<i>L. plantarum</i> 1005	high	average

Similar studies with respect to the growth potency at the temperature ranged from 5 °C to 25 °C showed that most significantly the lactic acid bacteria growth slowed at 5°C. The obtained results are listed in Table 1 showing the growth rate of the selected strains at the lowest of the above temperatures. Such strains as *L. plantarum*, *L. delbrueckii s/sp. lactis* 013, *L. acidophilus* 147, *L. casei s/sp. tolerans* 187 and 290 appeared to be thermo-resistant.

Determination of the lactic acid bacteria antagonistic properties showed that they were active against both, the strains isolated from the raw meat and the collection ones. At that, growth of some indicator bacteria was slowed down only, while that of others – completely inhibited. Thus, all strains of the lactic acid bacteria studied only slowed down the growth of *Bacillus sp. 1*, isolated from the raw meat, and the collection *B. subtilis* and *B. cereus*; while the growth of *Planacoccus sp. 2* (from meat), *Micrococcus sp. 2* (from meat) and *S. enteritidis* (from collection) was inhibited completely. It should be noted that size of the “stasis” and “no growth” areas was different and depended both, from strain of the lactic acid bacteria, and an indicator microorganism. The bacteria isolated from the raw meat and the collection bacteria appeared to be most sensitive to the metabolites produced by the three lactic acid bacteria strains: *L. casei s/sp. tolerans* 290, *L. delbrueckii s/sp. lactis* 013 and *L. plantarum* 12. The results of determination of the antagonistic activity of the lactic acid bacteria are shown in Table 2.

Table 2

Antagonistic activity of the lactic acid bacteria strains

Strain	Size of delay and lack of growth areas of the indicator bacteria (mm)									
	isolated from raw meat									
	1	2	3	4	5	6	7	8	9	10
A	25 [^]	26 [^]	23*	26*	25*	35*	27 [^]	24*	23*	30*
B	25 [^]	28 [^]	29*	30*	24*	33*	28*	31*	30*	40*
C	25 [^]	20*	28*	32*	20*	28*	28 [^]	23*	45*	41*
Strain	collection									
	11	12	13	14	15	16	17	18	19	
	A	27*	40*	25*	35*	20 [^]	29*	23 [^]	26 [^]	30 [^]
B	29*	-	23*	27*	-	24*	22 [^]	24 [^]	40*	
B	44*	34*	24 [^]	26*	21 [^]	28*	24 [^]	34 [^]	25 [^]	

Note: “[^]” – stasis; “*” – no growth; “-” – no effect.

A – *L. plantarum* 12; B – *L. delbrueckii s/sp. lactis* 013; C – *L. casei s/sp. tolerans* 290.

1 – *Bacillus sp. 1*; 2 – *Bacillus sp. 2*; 3 – *Bacillus sp. 3*; 4 – *Kurthia sp.*; 5 – *Planacoccus sp. 1*; 6 – *Planacoccus sp. 2*; 7 – *Micrococcus sp. 1*; 8 – *Micrococcus sp. 2*; 9 – *Sarcina sp.*; 10 – *Staphylococcus sp.*; 11 – *Planacoccus citreus*; 12 – *Micrococcus luteus*;

13 – *Staphylococcus aureus*; 14 – *Escherichia coli*; 15 – *Proteus vulgaris*; 16 – *Salmonella enteritidis*; 17 – *Bacillus subtilis*; 18 – *Bacillus cereus*; 19 – *Bacillus megaterium*.

To estimate the antagonist activity of *L. casei s/sp. tolerans* 290, *L. delbrueckii s/sp. lactis* 013 and *L. plantarum* 12 we considered only the cases of complete indicator organism growth inhibition (lack of growth). As seen from the data in Table. 3, the lactic acid bacteria strains isolated from the raw meat and the collection bacteria showed high antagonistic activity, therewith, the size of the “no growth” areas for the indicator bacteria growth was different (Table 3).

Table 3

Antagonistic activity of the lactic acid bacteria strains

Strain	Activity in relation to the indicator bacteria																		
	isolated from raw meat										collection								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	D	D	H	H	H	H	D	H	H	H	H	H	H	H	D	H	D	D	D
B	D	D	H	H	H	H	H	H	H	H	H	-	H	H	-	H	D	D	H
C	D	A	H	H	A	H	D	H	H	H	H	H	D	H	D	H	D	D	D

Note: "D" – stasis; "H" – high activity; "A" – average activity; "-" – no effect.

A – *L. plantarum* 12; B – *L. delbrueckii s/sp. lactis* 013; C – *L. casei s/sp. tolerans* 290.

1 – *Bacillus sp.* 1; 2 – *Bacillus sp.* 2; 3 – *Bacillus sp.* 3; 4 – *Kurthia sp.*; 5 – *Planacoccus sp.* 1; 6 – *Planacoccus sp.* 2; 7 – *Micrococcus sp.* 1; 8 – *Micrococcus sp.* 2; 9 – *Sarcina sp.*; 10 – *Staphylococcus sp.*; 11 – *Planacoccus citreus*; 12 – *Micrococcus luteus*; 13 – *Staphylococcus aureus*; 14 – *Escherichia coli*; 15 – *Proteus vulgaris*; 16 – *Salmonella enteritidis*; 17 – *Bacillus subtilis*; 18 – *Bacillus cereus*; 19 – *Bacillus megaterium*.

It is known that the starter multispecies are more active and resistant to the adverse environmental factors compared to the starters, made on the basis of certain cultures [5, 12, 13]. Therefore, considering the obtained results, three strains of the lactic acid bacteria – *L. casei s / sp. tolerans* 290, *L. delbrueckii s / sp. lactis* 013 and *L. plantarum* 12 – were chosen to make compositions (starters).

One of the important criteria for combining individual species into a multispecies starter is the compatibility of species and strains, i.e., first of all, they must not be reciprocal antagonists. The research of the intrageneric antagonism of the selected lactic acid bacteria showed no reciprocal growth inhibition.

So, to pursue further studies, we made 9 variants of the lactic acid bacteria compositions consisting of two lactic acid bacteria one-to-one: (1 – *L. plantarum* 12 + *L. casei s/sp. tolerans* 290; 2 – *L. plantarum* 12 + *L. delbrueckii s/sp. lactis* 013; 3 – *L. casei s/sp. tolerans* 290 + *L. delbrueckii s/sp. lactis* 013) и 1:2 (4 – *L. plantarum* 12 + *L. casei s/sp. tolerans* 290; 5 – *L. plantarum* 12 + *L. delbrueckii s/sp. lactis* 013; 6 – *L. casei s/sp. tolerans* 290 + *L. plantarum* 12; 7 – *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12; 8 – *L. casei s/sp. tolerans* 290 + *L. delbrueckii s/sp. lactis* 013; 9 – *L. delbrueckii s/sp. lactis* 013 + *L. casei s/sp. tolerans* 290) (Table 4).

Using starters in the meat industry, one shall take into account the temperature modes of production and storage of the raw meat.

Study of the growth rate of the lactic acid bacteria compositions at the temperature ranged from 0°C to 25°C showed that the effect of temperature on individual compositions was similar (Table 5). It was noted that the temperature of 10°C and 15°C had no effect on growth of the starters studied (growth rate was estimated as "very high"), at 5°C most starters (samples No. 2, 3, 4, 5 and 9) were characterized by "average" growth and development rate. Moreover, composition No. 7 consisting of *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12 at the ratio of 1:2 appeared to be so resistant to the above temperature, that its growth was described as "exceptional".

Table 4

Combinations of the lactic acid bacteria compositions

Strain	Combinations					
	1:1			1:2		
	<i>L. plantarum</i> 12	<i>L. casei s/sp.</i> <i>tolerans</i> 290	<i>L. delbrueckii</i> <i>s/sp. lactis</i> 013	<i>L. plantarum</i> 12	<i>L. casei s/sp.</i> <i>tolerans</i> 290	<i>L. delbrueckii</i> <i>s/sp. lactis</i> 013
<i>L. plantarum</i> 12	-	+1:1	1:1	-	1:2	1:2
<i>L. casei s/sp. tolerans</i> 290	-	-	1:1	1:2	-	1:2
<i>L. delbrueckii s/sp. lactis</i> 013	-	-	-	1:2	1:2	-

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Table 5

Growth rate of the lactic acid bacteria compositions at different temperatures

Number of composition	0 °C	5 °C	10 °C	15 °C
1	+	+++	++++	++++
2	+	++	++++	++++
3	+	++	++++	++++
4	+	++	++++	++++
5	+	++	++++	++++
6	+	+++	++++	++++
7	+	++++	++++	++++
8	+	+++	++++	++++
9	+	++	++++	++++

Note: "++++" – exceptional growth rate, "+++” – high, "++” – average, "+" – low.

It should be noted that even at 0°C weak growth of all the lactic acid bacteria compositions was observed. Comparing the results obtained in the study of the growth rate at low above-zero temperatures of individual lactic acid bacteria strains (Table 1) and their compositions (Table 5) one can assume that combinations of cultures in the starters increases their thermo-resistance.

One of the most important criteria put forward both, to individual strains of the lactic acid bacteria, and the starters, made of them, is the antagonistic activity [11]. Considering

that the strains of *L. casei s/sp. tolerans* 290, *L. delbrueckii s/sp. lactis* 013 and *L. plantarum* 12 taken individually were active antagonists to the indicator bacteria (both, the collection and isolated from the raw meat) (Tables 2, 3), and in view of the existing requirements, it was appropriate to determine whether the starter's composition and the ratio of the lactic acid bacteria in it influence the antagonistic properties. The results are presented in Table 6.

Table 6

Antagonistic activity of the lactic acid bacteria compositions

Number of composition	Size of delay and lack of growth areas of the indicator bacteria (mm)									
	isolated from raw meat									
	1	2	3	4	5	6	7	8	9	10
1	26 [^]	22*	30*	31*	21*	30*	22*	40*	32*	34*
2	27 [^]	23*	27*	31*	28*	28*	27*	42*	31*	39*
3	25 [^]	21*	29*	32*	25*	28*	29*	42*	34*	36*
4	25 [^]	22*	32*	30*	25*	29*	25*	40*	32*	36*
5	22 [^]	16*	30*	27*	26*	38*	27*	39*	32*	43*
6	26 [^]	21*	26*	29*	25*	26*	26*	34*	34*	43*
7	29 [^]	21*	32*	30*	27*	25*	27*	39*	32*	43*
8	24 [^]	23*	28*	30*	25*	26*	27*	33*	35*	40*
9	26 [^]	21*	30*	31*	27*	27*	27*	34*	34*	31*

Number of composition	Size of delay and lack of growth areas of the indicator bacteria (mm)								
	collection								
	11	12	13	14	15	16	17	18	19
1	34*	34*	21*	27*	-	24*	25*	24*	26*
2	40*	40*	26*	38*	-	23*	26 [^]	21*	29*
3	42*	42*	21*	32*	-	21*	24 [^]	23*	25*
4	40*	40*	23*	30*	-	22*	28*	24*	23*
5	40*	40*	25*	28*	-	24*	27 [^]	28*	27*
6	37*	37*	23*	34*	24 [^]	25*	27 [^]	23*	24*
7	42*	42*	26*	37*	23*	29*	29 [^]	29*	27*
8	38*	38*	19*	26*	23*	23*	26 [^]	25*	22 [^]
9	40*	40*	20*	24*	19 [^]	23*	24 [^]	26 [^]	24 [^]

Note: “[^]” – stasis; “*” – no growth; “-” – no effect.

1 – *Bacillus sp.* 1; 2 – *Bacillus sp.* 2; 3 – *Bacillus sp.* 3; 4 – *Kurthia sp.*; 5 – *Planacoccus sp.* 1; 6 – *Planacoccus sp.* 2; 7 – *Micrococcus sp.* 1; 8 – *Micrococcus sp.* 2; 9 – *Sarcina sp.*; 10 – *Staphylococcus sp.*; 11 – *Planacoccus citreus*; 12 – *Micrococcus luteus*; 13 – *Staphylococcus aureus*; 14 – *Escherichia coli*; 15 – *Proteus vulgaris*; 16 – *Salmonella enteritidis*; 17 – *Bacillus subtilis*; 18 – *Bacillus cereus*; 19 – *Bacillus megaterium*

Growth of the bacteria isolated from meat (except for *Bacillus sp.* 1) was significantly inhibited by metabolites. The size of the “no growth” areas for the indicator bacteria ranged from 16 mm (determined for *Bacillus sp.* 2 under the effect of starter No. 5) to 43 mm (determined for *Staphylococcus sp.* in the presence of starters No. 5, 6 and 7). The most resistant strain was *Bacillus sp.* 1, the growth of which by all the starters was delayed only.

Table 7

Degree of antagonistic activity of the lactic acid bacteria compositions

Number of composition	Size of delay and lack of growth areas of the indicator bacteria (mm)									
	isolated from raw meat									
	1	2	3	4	5	6	7	8	9	10
1	D	H	H	H	H	H	H	H	H	H
2	D	H	H	H	H	H	H	H	H	H
3	D	H	H	H	H	H	H	H	H	H
4	D	H	H	H	H	H	H	H	H	H
5	D	A	H	H	H	H	H	H	H	H
6	D	H	H	H	H	H	H	H	H	H
7	D	H	H	H	H	H	H	H	H	H
8	D	H	H	H	H	H	H	H	H	H
9	D	H	H	H	H	H	H	H	H	H

Number of composition	Size of delay and lack of growth areas of the indicator bacteria (mm)									
	collection									
	11	12	13	14	15	16	17	18	19	
1	H	H	H	H	-	H	H	H	H	
2	H	H	H	H	-	H	D	H	H	
3	H	H	H	H	-	H	D	H	H	
4	H	H	H	H	-	H	H	H	H	
5	H	H	H	H	-	H	D	H	H	
6	H	H	H	H	D	H	D	H	H	
7	H	H	H	H	H	H	D	H	H	
8	H	H	A	H	H	H	D	H	D	
9	H	H	A	H	D	H	D	D	D	

Note: “D” – stasis; “H” – high activity; “A” – average activity; “-” – no effect
 1 – *Bacillus sp.* 1; 2 – *Bacillus sp.* 2; 3 – *Bacillus sp.* 3; 4 – *Kurthia sp.*; 5 – *Planococcus sp.* 1; 6 – *Planococcus sp.* 2; 7 – *Micrococcus sp.* 1; 8 – *Micrococcus sp.* 2; 9 – *Sarcina sp.*; 10 – *Staphylococcus sp.*; 11 – *Planococcus citreus*; 12 – *Micrococcus luteus*; 13 – *Staphylococcus aureus*; 14 – *Escherichia coli*; 15 – *Proteus vulgaris*; 16 – *Salmonella enteritidis*; 17 – *Bacillus subtilis*; 18 – *Bacillus cereus*; 19 – *Bacillus megaterium*.

From the collection bacteria, the most sensitive to metabolites of the compositions were the gram positive cocci *P. citreus* and *M. luteus*, the size of the “no growth” areas of which, depending on the composition, ranged from 34 mm to 42 mm and from 28 mm to 40 mm, respectively. The least exposed to the starter effect were olm (*P. vulgaris*), probably, due to a short lag-phase of this microorganism, and hay bacillus (*B. subtilis*), may be due to formation of resistance to the adverse conditions.

The most active was composition No. 7, in the presence of which the growth of almost every indicator bacteria was inhibited completely, and its activity was rated as "high".

As can be seen from the data presented, the lactic acid bacteria compositions inhibited the growth and development of the indicator bacteria. The degree of the antagonistic activity of the compositions under study to most indicator organisms was high (Table 7), while the sensitivity of individual, both the collection, and isolated from the raw meat microorganisms, was determined by a specific starter.

Comparing the data obtained in studying the antagonistic activity of individual lactic acid bacteria strains and their compositions, in most cases we observed an increased activity of the latter, presumably, due to the synergy phenomenon, when the effect of the metabolites produced by bacteria in the starters exceeds the effect of each taken individually.

Thus, the results give evidence of promising starter use in the industry to extend the storage life of the meat and meat products. With a view to industrial testing, composition No. 7 has been selected, consisting of *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12 at the ratio of 1:2.

Conclusions

1. It is experimentally found that the strains of bacteria of *Lactobacillus* genus (*L. plantarum* 12 and 1005, *L. delbrueckii s/sp. lactis* 013, *L. acidophilus* 147, *L. gasseri* 149, *L. casei s/sp. tolerans* 187 and 290, and *L. casei s sp. rhamnosus* 283) are halo- and thermo-resistant, as well as antagonistically active against the bacteria isolated from the raw meat and the collection bacteria.
2. The choice of *L. plantarum* 12, *L. delbrueckii s/sp. lactis* 013 and *L. casei s/sp. tolerans* 290 to make the lactic acid bacteria compositions is proved.
3. It is shown that the biotech activity of the lactic acid bacteria in the compositions increased.
4. It is determined that the composition of *L. delbrueckii s/sp. lactis* 013 + *L. plantarum* 12 in the ratio of 1:2 is the most promising for testing in the industrial environment.

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