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Development Of Technology Lamb Boiled In The Skin With The Use Of Milk-Protein Complex.

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ABSTRACT

The results showed that the use of milk protein product complex in the manufacture of lamb contribute to rise the content of essential amino acids in the product. Moreover, the digestibility of the products and balance of essential amino acids with respect to the reference value are improved

Keywords: lamb, milk-protein complex, food and biological value, chemical composition, amino acid composition, digestibility, microstructure.

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INTRODUCTION

Meat-processing industry in the country is given one of the leading directions of development of agriculture which consist in the population of basic foodstuffs. Indicator of consumption of meat and meat products containing high-grade animal proteins, is widely recognized in the world as the main criterion for the welfare of the people.

At the moment, the sheep as a manufacturer of raw materials for the meat industry, occupies the 4th place in the world. In practice, the current sheep is specialized in the production of meat lambs and lamb, characterized by good digestibility and dietary properties [1].

Despite of the positive properties of the lamb, the range of products is small. It's connected with technological properties of raw materials, in particular, with lamb stiffness and the difficulty of its processing. In the manufacture of products from lamb by traditional technologies it is not usually able to get a delicate and juicy product. And as a result, there's limited ability to produce competitive products of lamb.

In recent years, the world's attention attend to the use of biotechnological methods in the production of meat products. A promising direction in the development of biotechnological methods in the meat industry offers the creation of new technological solutions based on the targeted use of multi-component brines, whose composition is further administered a variety of components that provide on-the Management Board of the action of both the functional and technological properties of raw materials, and on the course of biochemical and diffusion -osmotic processes [2-4].

However, in the selection of feature-rich mixtures their viscosity properties and the possibility of chemical interaction must be taken into account.

The use of the multicomponent brines with mechanical action on the raw material leads to a change in such quality indicators as deliicacy, juiciness, taste and aroma, and opens up the possibility of extending the range and increasing the volume of production of meat products from lamb [5].

To generate the lamb roasted in the skin milk-protein complex (IBC) "100 Milan 'TU 9199-001-84711947-08 consisting of milk serum albumin and globulins, and connective tissue and egg proteins was used. As a result of comparative studies of functional and technological, structural, mechanical and histological characteristics of salted raw meat with different levels of content of milk-protein complex "Milan 100" as a part of brine at the final stage of the study the lamb production technology of lamb boiled in the skin has been developed, and the effect of MBC " Milan 100 "on the quality characteristics of the finished product has been studied[7].

As the prototypes three products with different content of milk-protein complex "Milan 100" as a part of the brine. Were developed the raw inject wash of with brines A (experiment 1) and B (Experiment 2) and C (Run 3), respectively at 10, 15 and 20% by weight of the original feedstock. 100 L A brine contained 3.16 kg MBC in Brine B - 6.19 kg of brine and C - 10.70 kg.

The number of milk-protein complex "Milan 100" as a part of the brine at different level of extrusion was calculated according to the protein content in the final product. Then the lamb was subjected to cyclic mechanical massaging depending on the level of the brine injection [8]. Before machining massager added 5 liters of brine were. After massaging prototypes milled were to Meal (20-25 mm), stirred in the mixer with spices formed, tied with rope, hanged, weighed on frame, subjected to heat treatment: roasting at 95 ± 5 ° C for 60 minutes, boiling at 80 -85 ° C to a temperature in the product 71 ± 2 ° C. After cooking the loaves were cooled until the temperature in the loaf was not above 8° C. For the comparative assessment of products made by the developed technology, produce lamb boiled in the skin was produced in accordance with current technology (lamb boiled in the skin TU 49 RF 419) (reference product). Finished products made from lamb, were subjected to research after cooling.

It is known that meat products are the major suppliers of plastic material, which is necessary to the human body to produce and upgrade the structural elements of cells and tissues. High food and biological value of meat proteins is due to their almost complete digestibility by enzymes of the gastrointestinal tract.

That is why meat products as the main source of protein, are of great importance in human nutrition. In this regard, we have studied the chemical composition of products from lamb produced in the traditional and developed technologies.

From the results of our research (Table 1) it is evident that the more milk-protein complex in a brine, the higher the moisture content in the test products.

Table 1 - Chemical composition and yield of finished products

Product	Content, %				Content NaCl, %	Eduction, %
	Moisture	Protein	Fat	Ash		
Control	66,83±0,12	18,15±0,12	11,09±0,12	3,93±0,03	2,22±0,05	84,7±0,42
Test 1	68,34±0,15	18,32±0,16	10,12±0,15	3,22±0,04	2,18±0,04	87,5±0,52
Test 2	69,57±0,21	17,40±0,14	9,05±0,12	3,98±0,03	2,12±0,07	91,6±0,58
Test 3	71,64±0,18	16,58±0,10	8,15±0,16	3,63±0,02	2,01±0,06	95,5±0,61

With increasing quantity of injected brine into raw meat from 10 to 20% by weight of the starting raw the moisture content in the test products is increased on 1.51 - 4.81%, in comparison with the control product.

This suggests that the introduction of the brine into the milk-protein complex, containing more than 60% of animal protein, promotes additional moisture retention in foods test products in comparison with the control ones.

With the increasing of the moisture content in the experimental products the quantity of proteins and fat significantly is reduced a bit. Thus, the test product (test 1) contains protein 0.57% less than the control, product in tests 2 and 3 this component is 1.32 and 2.14%, than the control product. Less respectively thus, with increasing of the moisture content in the test product protein fraction and the amount of fat reduce. Moreover, the mass fraction of fat in test products is 0.97 - 2.94% less than in the control product, which makes the product more diet.

It should be noted that, despite a slight decrease in the content of proteins in the experimental products, the level is more than 16.5%, with 20% of the extrusion level unsalted raw meat with brine (Experiment 3), which may indicate a relatively high nutritional value of finished products.

It is seen from the results of research that an increase of the moisture content in the test products reduces the amount of sodium chloride and increases output. The higher the extrusion of raw meat with brine containing MBC 'Milan 100 ", the higher the output. The introduction of the brine at level of 20% by weight of the unsalted raw the yield is 10.8% more than the control and product 3.9% more than a product containing brine in an amount of 15% by weight of the unsalted raw.

Important in assessing the biological value of the final product a quantity and ratio of essential and non-essential amino acids. Is important according to the experience of researchers [9] it is known that the quality of the meat and its biological value depends on the quantity of amino acids.

The amino acid composition of the experimental (experiment 3) and control products is presented in Table 2.

Table 2 - The amino acid composition of boiled lamb in the skin (mg / 100g)

Amino acids	Finished product	
	control	test
Essential	8,34 ±0,08	9,04 ±0,07
valine	1,05 ±0,01	1,04 ±0,04
isoleucine	1,03 ±0,03	1,01 ±0,02
leucine	1,52 ±0,04	1,76 ±0,01
lysine	1,44 ±0,02	1,64 ±0,05

methionone	0,95 ±0,05	1,11 ±0,04
threonine	0,66 ±0,07	0,73 ±0,03
tryptophan	0,69 ±0,01	0,72 ±0,02
phenylalnine	1,00 ±0,03	1,03 ±0,01
Interchangeable	13,29 ±0,05	13,37 ±0,04
aspartic acid	2,06 ±0,04	2,14 ±0,05
serine	1,10 ±0,02	0,92 ±0,03
glutamic acid	1,91 ±0,06	1,82 ±0,02
hydroxyproline	0,29 ±0,01	0,22 ±0,02
proline	1,28 ±0,07	1,23 ±0,05
cysteine	0,90 ±0,03	0,95 ±0,04
glycine	1,0 ±0,05	1,03 ±0,01
alanine	1,17 ±0,02	1,27 ±0,02
tyrosine	1,03 ±0,02	0,94 ±0,03
histidine	0,79 ±0,04	0,98 ±0,04
arginine	1,71 ±0,06	1,87 ±0,06
The amount of amino acids	21,63 ±0,09	22,41 ±0,08

From the data in Table 2 show that the test product where lamb is injected with brine in an amount of 20% by the weight of the unsalted raw (experiment 3), in comparison with the control product contains 8.4% more essential amino acids, including (in%) leucine 15.8;more lysine 13.9; methionine 16.8; threonine 10.6 and tryptophan 4.4. Among the essential amino acids in the test product is indicated a higher content of histidine and arginine, respectively, 24.0 and 9.4%. The presence of whey milk proteins in MBC «Milan 100» is an additional source of some certain amino acids in meat products, thereby it increases their bioavailability.

During the study a protein quality index of boiled lamb in the skin by the ratio of tryptophan to hydroxyproline is identified (Table 3).

Table 3 - The ratio of tryptophan to the hydroxyproline

Product	Amino acid, mg/100 g of product		Protein qualitative index
	tryptophan	hydroxyproline	
Test 3	0,72 ±0,03	0,22 ±0,05	3,27
Control	0,69 ±0,06	0,29 ±0,04	2,38

The data indicate that the introduction of the brine in lamb, milk-containing protein complex "Milan 100" reduces the proportion of connective tissue proteins in the product and thus enhances the quality indicator protein 0.89 U., And accordingly, increases the bioavailability of products [10].

Studies have shown the introduction of IBC 'Milan 100 "in brine helps to improve the color formation reaction. It is found that in the finished product the experimental nitrozopigment content (NO-pigments) is higher and stain is more resistant (Table 4).

Table 4 - The content of nitrosopigment and residual level of sodium nitrite in the final products

Product	The content NO-pigment, % of total pigments	The residual content of sodium nitrite, mg%	Colour fastness %
Control	76,55 ±0,34	3,10 ±0,04	71,03±3,12
Test 1	77,86 ±0,45	2,90 ±0,05	73,4 ±1,44
Test 2	79,44 ±0,61	2,61 ±0,07	74,7 ±1,56
Test 3	81,45 ±0,54	2,52 ±0,09	76,3 ±2,71

It should be noted that in all the investigated samples of finished products residual sodium nitrite did not exceed acceptable standards, and the residual sodium nitrite level in the test products was lower than in control products.

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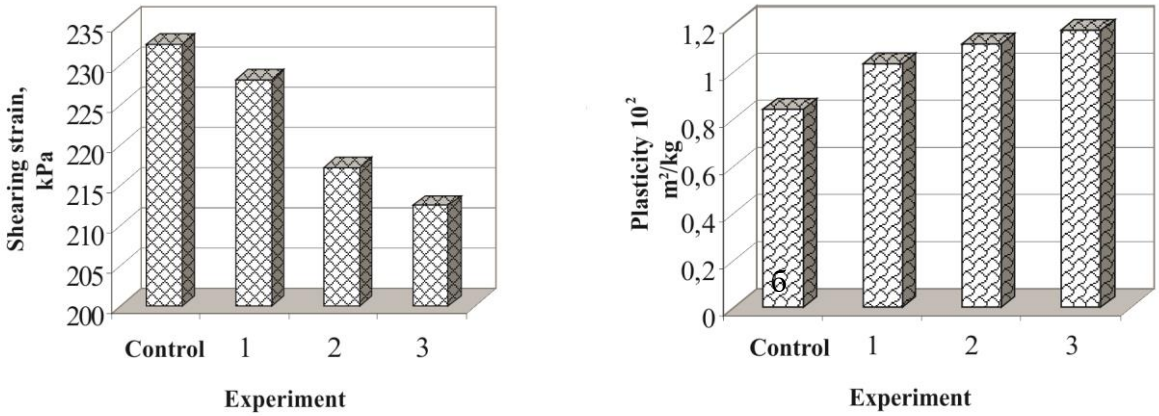
Analysis of the results of studies of the influence level of extrusion of brine on the colorimetric characteristics experienced finished products revealed that an increase in the number of indicator "reds" (a *), and the yellow color of the coordinate input in brine lamb with increasing index "lightness" (of L), at the same time increases (b *) remained virtually unchanged (Table 5).

Table 5 - Value of color indicators (La * b *) of finished products

Product	Color indicators				
	L (lightness)	a* (redness)	b* (yellwness)	S (saturation)	a*/b* (redness index)
Control	58,33±0,10	22,12 ±0,21	11,32±0,22	38,32 ±0,25	1,95 ±0,33
Test1	60,01 ±0,19	24,64 ±0,16	12,20 ±0,12	36,02 ±0,15	2,02 ±0,24
Test 2	62,56 ±0,13	25,43 ±0,21	11,96 ±0,41	34,41 ±0,19	2,20 ±0,15
Test 3	64,62 ±0,11	27,21 ±0,17	12,10 ±0,21	33,14 ±0,09	2,25 ±0,12

According to received information, at the maximum content of MBC "Milan 100" in the final product (Run 3), the value of "redness index" (a * / b *) is increased by 11.39% relative to the sample (experiment 1) containing the smallest number of MBC that confirms research materials of physical and chemical indicators, iwhich show a higher share of the resulting nitrozopigmentov.

It is believed that the products made by the developed technologies have more delicate texture compared to the control product made according to the conventional technology, as evidenced by the cutoff voltage value and ductility of boiled the lamb in the skin samples (Fig. 1).



a b

Figure 1 – Cut off voltage value (a) and ductility (b) of finished products

Confirmation of the high nutritional value of prepared lamb products is data characterizing their digestibility in vitro by proteolytic enzymes - pepsin and trypsin. On the basis of research results it is revealed that the experimental samples of finished products are better exposed to the enzymes of the gastrointestinal tract (Fig. 2).

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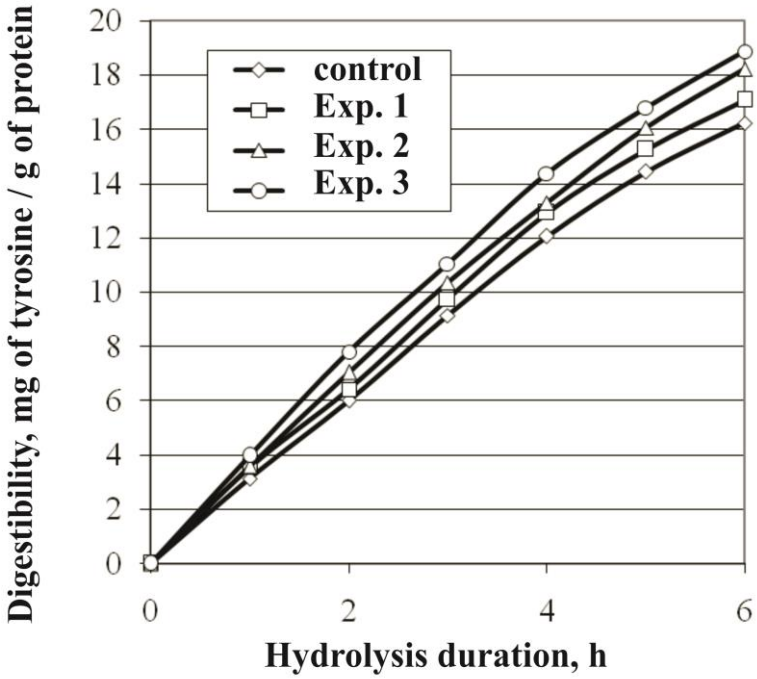
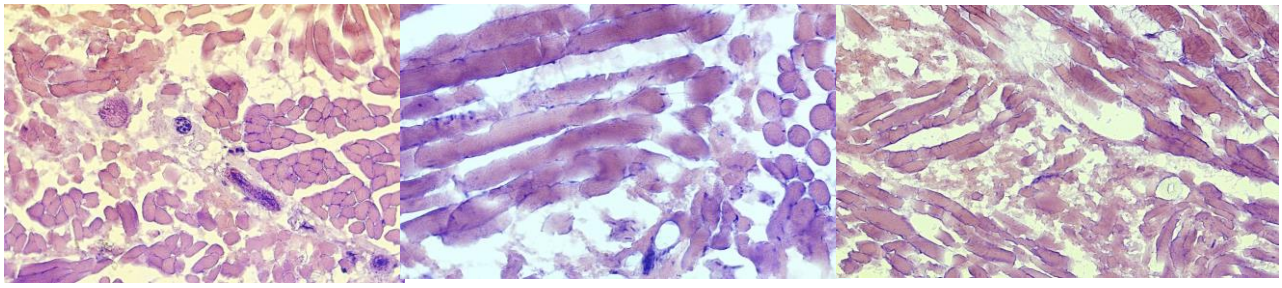


Figure 2 - The digestibility of finished products

Figure 2 shows that in a control sample of the final product the amount of tyrosine substances to 6h hydrolysis shooting was 16.23 mg / g of protein, whereas in experiments 1, 2 and 3 - 17.8; 18.21 and 18.87 mg of range/ g protein, respectively.

Digestibility finished products of prototypes increases by 9.67; 12.2 and 16.3% respectively experiment 1, 2 and 3 compared to control. Increased digestibility of experienced finished products is due to the presence ofdigestible whey proteins. In them these data suggest that the more content proteins of the milk whey in the product, the higher the digestibility.

Microstructural studies (Fig. 3) found that spraying the lamb with multicomponent brine leads to the accumulation of components ICB "Milan 100" in the field of injection. Subsequent cyclic mechanical massaging and heat treatment promotes the distribution of curing ingredients in volume, product which has a uniform compact mass, in which the proteins that make up the "Milan 100", combine with the structural elements of muscle tissue.



a b c

Figure 3 - The microstructure of the finished product, generated by the developed technology (Experiment 1) (a), (test 2) (b), (Experiment 3) (c) (longitudinal section x20)

These results support the use of IBC 'Milan 100 "as a part of multi-component brines.

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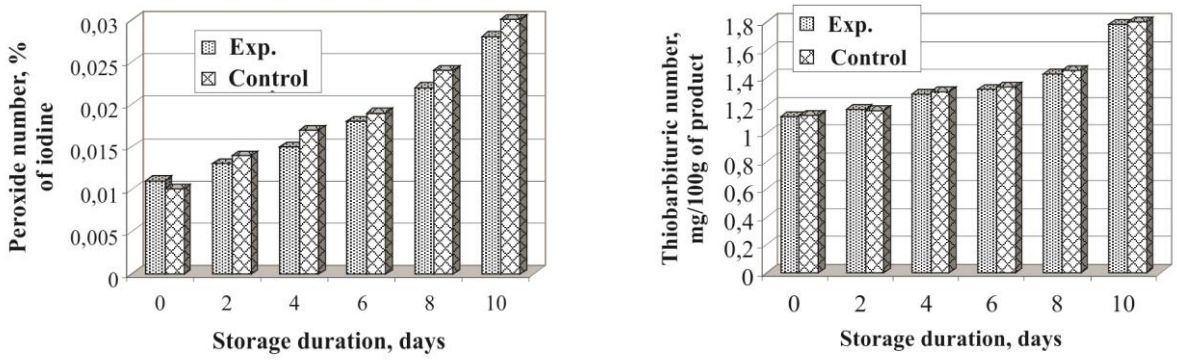
Study of oxidative changes in the fatty part of the product under the influence of MBC 'Milan 100 "found that with increasing duration of storage of finished products up to 6 days of peroxide value and thiobarbituric numbers (Fig. 4), both in experimental and in the control products vary slightly.



a B

Figure 4 - Changing the peroxide (a) and thiobarbituric number (b) of fat during storage of finished products

A marked increase of the peroxide numbers is observed in 6 days, and thiobarbituric numbers in 8 days of storage.

To establish the hygienic safety of the finished products which were stored for 3 days at a temperature of 2-4 0C, they were subjected to microbiological examinations (Table 6).

Table 6 - Microbiological indices finished products

Product	QMAFAnM, CFU/g no more	Product weight (g) which is not allowed			
		CGB (coliforms)	Sulphiteredusing	S.aurus	Pathogens in Vol. H. Of salmonella
Control	1,4·101	Not found	Not found	Not found	Not found
Test 1	1,2·101	Not found	Not found	Not found	Not found
Test 2	1,2·101	Not found	Not found	Not found	Not found
Test 3	1,1·101	Not found	Not found	Not found	Not found

The results of microbiological tests of finished products have shown that the total number of micro-organisms (QMAFAnM, CFU / g) does not exceed the permissible TR CU 021/2011 "On food safety" standards. However, health indicators experienced finished products, developed with the use of IBC 'Milan 100 "as part of brine, had the best performance in relation to the reference product. Microbiological indices of finished products, regardless of the introduction level of the brine did not exceed the permissible limits.

Based on the investigations, it can be concluded that the milk-protein complex "Milan 100" contributes to the increasing of the food and biological value of products from lamb, without compromising the organoleptic and microbiological parameters of finished products.

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