

Project title: IRN AP09058213 «Development of technology for meat products for child nutrition from non-traditional raw materials of the meat industry»

Relevance: The issue of rational nutrition of children is still extremely relevant and an effective factor that ensures the preservation of the life and health of children. Increasingly, there are pathological conditions associated with intolerance to certain components of food. An important role in the organization of rational nutrition of children is played by biologically complete products, which can be created only in the conditions of industrial production. With the annual increase in consumer demand for meat products, we still remain an import-dependent country. Given that camel and goat breeding are promising areas in animal husbandry, the industrial production of meat products from camel meat, goat meat is a new, previously unused direction in the industry. The trend to use low-fat hypoallergenic goat meat, camel meat, especially for baby food is growing all over the world. Therefore, the development of technology of meat products for baby food from camel and goat meat, of increased nutritional and biological value, with dietary properties is appropriate.

Purpose: development of technology for meat products of baby food from non-traditional raw materials of the meat industry, in particular, camel and goat meat

Expected results:

- the assessment of the state and prospects of using domestic non-traditional types of raw meat (camel meat, goat meat) will be given);
- a rational technological scheme for cutting camel and goat meat will be developed based on the study of the morphological and chemical composition of individual parts of the carcass;
- the nutritional and biological value, technological, microstructural indicators of camel and goat meat will be determined, depending on the age, breed and weight conditions of the animal;
- the technology of production of meat products for baby food from camel and goat meat, enriched with biologically active substances, as well as in the traditional way will be developed;
- the composition, properties of raw materials and patterns of formation of the specified quality indicators of meat products, their refrigeration processing and storage will be established;
- biochemical, microbiological and rheological changes in the production and storage of meat products will be established;
- a technological line for the production of products from camel and goat meat (dietary sausages, pates) will be developed);
- the economic efficiency of the technology of production and processing of camel and goat meat will be established and an application for obtaining security documents will be submitted;
- scientific publications will be published in the direction of the Project, including at least 2 (two) articles and (or) reviews in peer-reviewed scientific publications in the scientific direction of the project, indexed in the Science

Citation Index Expanded of the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 35 (thirty-five), as well as at least 3 articles or reviews in a peer-reviewed foreign or domestic publication recommended by committee for quality assurance in the field of education and science, at least 2 publications in Russian scientific publications included in the RSCI database, reports will be published in at least 8 conference materials, including 4 international ones. Based on the results of the work, an Implementation Report will be received indicating the achieved economic effect.

Achieved results:

- The characteristics of the goat and camel meat market and the analysis of the prospects for the development of the raw material base of the Republic of Kazakhstan until 2050 are given. Currently, the number of camels and goats in our country is increasing annually, as of January 2021, the figures are 256 thousand and 3 million 93 thousand heads, respectively. More than 8 thousand tons of goat meat and 4 thousand tons of camel meat were sold for slaughter. It should be noted that Kazakhstan shows a leading position in the export of lamb and goat meat outside the EAEU countries, which is 91.9%. In particular, supplies to the UAE for \$ 3.4 million, to Uzbekistan for \$ 1.6 million are provided, exports to Iran amounted to 112 thousand US dollars. Considering that from 2003 to the present, the indicators of the development of camel and goat breeding have doubled, as well as the growing interest of consumers primarily in healthy and proper nutrition, favorable conditions are emerging for the development of this market segment.

With an annual increase in the number of camels and goats in the country amounting to 6.6% and 7.1%, respectively, by 2050 the number will reach 491.5 thousand heads of camels and 6 million 278 thousand heads of goats. With the increase in livestock, it is expected to achieve meat production: camel meat 7.8 thousand tons, goat meat 17.1 thousand tons.

- The cutting of camel and goat carcasses is justified, taking into account the anatomical features of the carcass structure and indicators of nutritional and biological value. The cutting of the camel carcass is provided according to clear anatomical boundaries into 2 parts. Grade I includes cuts in which from 139 to 187 g of dietary protein per 1 kg of meat, and the protein quality index is from 1.5 to 2.0; in grade II cuts, the amount of dietary protein is 108 - 124 g, and the protein quality index is 1.3-1.4, Grade III, respectively, 30-78 g and 0.6-1.3. Butchering of goat carcasses: cuts are assigned to grade I, from 130 to 195 g of protein per 1 kg of meat, from 30 to 103 g of protein to grade II.

The proposed method allows you to introduce cuts of carcasses of slaughtered animals to retail and catering enterprises for further processing.

- Slaughter and determination of the yield of parts of the carcass of goat meat, camel meat for the production of meat products of baby food. As a result, 5 heads of 4-year-old camels with an average live weight of 520 kg and 5 heads of young animals with an average live weight of 380 kg were slaughtered. The average slaughter yield of adult camels of the Bactrian breed was $56 \pm 2\%$, young animals - $51.5 \pm 2\%$. Depending on the fatness and age of the slaughter animal, the average yield of veneered meat is 71%. When determining the yield of cuts to the

mass of camel carcasses, the following results were obtained: pelvic 28.1%; scapular 14.0%; dorsal 7.1%; lumbar 5.76%; thoracic 9.3%; costal 3.24%; cervical 13.1%; flank 4.1%; scapular 3.7%; shank posterior and anterior 5% and 4.9%, respectively. The meat content coefficient of camel cuts showed that the most full-bodied are: hip, neck, scapular. They have the best meat-to-bone ratio.

Also, 5 heads of Zaanen goats were slaughtered at the age of 8 months, the average live weight was 28 kg. The average slaughter yield was $44.1 \pm 2\%$. The average yield of veneered meat is 73.1%. Determination of the yield of cuts to the mass of carcasses, the following results were obtained: hip 32.1%; spinal-scapular 40.2%; lumbar 12.4%; cervical 3.1%; forearm 8.7% shank 3.5%. The meat ratio showed that the most complete are: hip, spinal-scapular, lumbar. They have the best meat-to-bone ratio.

- The effect of electrical stimulation on the rate of enzymatic breakdown of glycogen in camel and goat meat has been studied. The pH of electrostimulated goat meat during normal aging is reduced to 6, during mechanical processing of salted raw materials, the pH is 6.1. With normal exposure of salted raw materials, the pH drop is completed after 24 hours, whereas, during mechanical processing, this state is achieved in 12-13 hours. The corresponding result is also obtained when salting camel meat. The pH drop is completed by 48 hours, with electrical stimulation of meat raw materials by 24 hours. Thus, mechanical processing intensifies the process of salt redistribution, as a consequence leads to the extensiveness of glycolytic processes.

Depending on the duration of salting and the use of electrical stimulation, the consistency improves, which is confirmed by a change in the cut voltage of salted samples. Indicators of the goat meat cut-off voltage after 72 hours at the level of 245 kPa, samples after electrical stimulation 180 kPa, the consistency improves by 24.6%.

As a result of the conducted research, it was revealed that the removal of camel and goat meat should be carried out as soon as possible after slaughter. The soonest carried out ambassador contributes to the rapid stabilization of pH and improvement of VSS indicators.

- The protein content (19.44%) in camel meat with a low fat content (7.05%) allows us to conclude about a more optimal percentage of protein and fat. Analysis of the results of the determination of amino acids indicates that camel meat contains the same set of amino acids as beef. In terms of the amount of essential amino acids, camel meat is in no way inferior to beef.

Of the interchangeable amino acids, camel meat proteins are inferior to beef in terms of the content of aspartic and glutamic acids by 10-15%, while at the same time they exceed the amount of arginine by an average of 13%. Electrophoretic analysis of camel meat revealed 4 fractions in the range of molecular weights 99-220 kDa, 4 fractions in the range 55-95 kDa, 7 fractions in the range 26-50 kDa, 4 fractions in the range up to 25 kDa. The muscle tissue of camels contains phosphorus in large quantities - 234.5 mg%, which is slightly more than in beef, the phosphorus content of which is usually 198.0-210.0 mg%. As a result of the conducted studies, it was found that the calcium content in camel meat is 9.04

mg%, magnesium - 19.08 mg%, iron - from 1.48 mg%. The digestibility of camel meat was 13.2, in particular: for pepsin 6.0; for trypsin 7.2. Histological studies of camel meat showed that the boundaries between the fibers are pronounced, muscle fibers have a slightly wavy shape, uniform striation. The sarcomere length index is 3.1-3.2 microns.

When assessing the chemical composition of experimental samples of goat meat (Zaanenskaya, Alpine, Nubian), no abnormal deviations were detected, and all indicators were in the generally accepted contents of this type of animal muscle tissue.

The mineral composition showed that goat meat is rich in such elements as potassium - 1693.22-4125.83mg/kg; sodium - 852.27-1518 mg/kg, magnesium - 125.33-295.8 mg/kg; calcium - 79.27-160.79 mg/kg, iron 11.42-87.52 mg/kg

The vitamin composition of goat meat showed that the content of pantothenic acid (B5) was 0.53-0.62 mg / 100g, pyridoxine (B6) 0.52-0.64 mg/100g tocopherol 0.27-0.33 mg/100g.

The indicators of the mass fraction of goat meat proteins were 2.1 ± 0.3 - $2.4 \pm 0.4\%$. The study of the dynamics of changes in the composition of protein fractions based on the results of comparative studies of the ratio of sarcoplasmic proteins showed the content of water-soluble (1.75-4.06%), salt-soluble (1.75-2.44%), alkali-soluble (11.15-15.10%) proteins.

The salt-soluble fraction reflects the total changes in the state of protein fractions, the solubility of which was not the same for the rocks under consideration (the highest concentration was determined in the Nubian rock).

Studies of the amino acid composition have shown that goat meat contains amino acids such as arginine ($1,19 \pm 0,18$ - $1,38 \pm 0,21$), lysine ($1,40 \pm 0,21$ - $1,78 \pm 0,27$), glutamic acid ($1,87 \pm 0,11$ - $4,22 \pm 0,63$) and aspartic acid ($0,87 \pm 0,28$ - $2,32 \pm 0,35$), but at the same time, it was noted that the limiting essential amino acid in all three objects of study was determined to be an amino acid - leucine ($0,80 \pm 0,12$ - $0,84 \pm 0,13$).

The fatty acid composition of goat meat is well balanced. The amount of saturated fatty acids for the Zaanenskaya and Nubian breeds is almost the same – 55.1 and 54.91%, respectively, while the amount of saturated fatty acids in the Alpine breed was 46.68%, which makes the meat of this breed more valuable from the point of view of assimilation in the process of digestion in humans. It is also very important to note the content of omega-3 fatty acids. Omega-3 fatty acids were found in Alpine and Nubian breeds, their amount was 0.37% and 0.47%, respectively, which makes their fat more valuable in terms of biological value.

There were no significant differences in moisture binding capacity (WCC) (73.45; 74.42; 73.94%). In general, it is important to note that goat meat, which has a better ability to concentrate meat juice inside the muscle fiber, is more valuable in terms of its technological characteristics, and therefore it can also be recommended for the production of baby food.

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Information for potential users:

A technology for the production of meat products for baby food from camel and goat meat, enriched with biologically active substances, will be developed. When developing new types of meat products for baby food, the following indicators will be taken into account: the ratio of protein to fat, mineral composition, the presence of vitamins necessary during the development of the child's body.

Publications

1. Abdilmanov A.A., Makangali K.K. On the issue of the use of goat meat in the Republic of Kazakhstan. Materials of the International scientific and theoretical Conference "Seifullin Readings - 17: "Modern agricultural science: digital transformation", dedicated to the 30th anniversary of independence of the Republic of Kazakhstan, volume I, part II. - Nur-Sultan, April 24, 2021. - pp. 126-128.

2. Kakimov M.M., Tokysheva G.M. Monitoring of children's food production in the Republic of Kazakhstan. Materials of the International scientific and theoretical Conference "Seifullin Readings - 17: "Modern agricultural science: digital transformation", dedicated to the 30th anniversary of independence of the Republic of Kazakhstan, volume I, part II. - Nur-Sultan, April 24, 2021. - pp. 84-85.

3. Kakimov M.M., Tokysheva G.M., Makangali K.K. Prospects for the development of goat meat processing in the Republic of Kazakhstan // Science and Technology of Kazakhstan, 2021. - No. 2. -pp. 95-99.

4. Tokysheva G.M., Makangali K.K., Begaly M.N. The study of the nutritional value of camel meat // Innovations. The science. Education, 2021. - No.44. -pp.943-950.

5. A patent was obtained for a utility model "Method of cutting camel carcass of Kazakh Bactrian breed for industrial processing of camel meat" KZ U 6591 A22C 17/00 (2006.01), 2021.