

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:

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. Over 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 mutton 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 development indicators 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 an increase in livestock, it is expected to achieve meat production: camel meat 7.8 thousand tons per quarter, 31.2 thousand tons per year, goat meat 17.1 thousand tons per quarter, 68.4 thousand tons per year.

The protein content (19.44%) in camel meat with a low fat content (7.05%) allows us to conclude that the percentage of protein and fat is more optimal. An 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.

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 amino acid leucine was identified as the limiting essential amino acid in all three objects of study ($0,80 \pm 0,12 - 0,84 \pm 0,13$). In terms of moisture binding capacity (WCC), there were no significant differences (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.

The results showed that the methanol extract of the garden purslane variety exhibits a strong antioxidant restoring ability: FRAP from 43.5 ± 1.0 mg GAE/g of dry matter. this proves a positive effect on increasing the shelf life of finished

products. In addition, purslane has high characteristics of the nutrient composition, which will positively affect the biological value of the finished product.

As a result of studying the physico-chemical parameters of experimental samples of finished products, the effectiveness of using goat meat, camel meat with the addition of purslane powder is justified. The composition of protein fractions of sausages has a positive effect on the moisture binding capacity of finished products from goat meat and chicken fillet, as well as from goat meat and camel meat by 78.16% and 78.65%, respectively. The cutoff voltage in was 31.4 kPa and 37.6 kPa. Sample 1 "Of goat meat and chicken fillet with purslane" has: humidity - 72.7%; fat - 8.1%; proteins - 13.41%; carbohydrates - 3%; The energy value is 139 kcal. Sample 2 "From goat and camel meat with purslane" has: humidity - 70.6%; fat - 6.7%; proteins - 15.31%; carbohydrates - 4.4%; energy value 139.5 kcal.

The results of the amino acid composition study showed that both samples contain a significant amount of linoleic acid (C18:2 ω 6), which is an essential polyunsaturated fatty acid, which is known to be beneficial for heart health and general well-being. Linolenic acid (C18:3 ω 3), another essential polyunsaturated fatty acid, is present in both samples, although in slightly smaller amounts. These fatty acids belong to the omega-3 and omega-6 family and play an important role in maintaining a balanced and healthy diet.

The results showed a balanced fatty acid composition of the studied samples of finished products, which has a positive effect on the growing body of children. The oxidation of lipids in sausages for 7 days showed that the addition of purslane powder to meat products slows down the oxidation process (from 1.8 meq/kg on day 1 to 5.4 meq/kg on day 7). According to GOST 31498-2012, the shelf life is 3 days, thus, based on the results obtained, the shelf life increased by 1 day and amounted to 4 days.

Sample 1 "Of goat meat and chicken fillet with purslane" has slightly better color stability (93.89%) than sample 2 "Of goat meat and camel meat with purslane" 91.69%. This indicates a fairly stable color formation in both samples, which is not a little important when storing consumer qualities.

It was found that poultry and goat meat products are characterized by a lower concentration of tyrosine due to the action of proteolytic enzymes (pepsin and trypsin) – from 624.6 mcg/ml (during the first three hours of hydrolysis) to 371.3 mcg/ml (during 6 hours of hydrolysis), against a sample prepared from goat and camel meat 674.2 when digested with pepsin and 377.3 when digested with trypsin, which indicates a high degree of digestibility of proteins of the finished product.

Goat meat and camel meat as the main raw materials have high nutritional value and high moisture binding capacity. This has a positive effect on the finished product. The addition of purslane powder in an amount of 1% by weight of minced meat has an antioxidant effect, which increases the shelf life. The data obtained allow us to recommend the developed meat products for the nutrition of school-age children.

Research team:

Project Manager: Kadyrzhan Makangali, PhD. h-index – 3, Scopus Author ID [57203767726](https://scopus.com/authid/detail.uri?authorId=57203767726), Researcher ID [AAR-1107-2020](https://orcid.org/0000-0003-4128-6482), ORCID <https://orcid.org/0000-0003-4128-6482>.

Members of the research team:

Gulzhan Tokysheva, PhD student, position in the project-senior researcher. h-index – 1; Scopus Author ID 57821670200, ORCID <https://orcid.org/0000-0003-3818-7635>;

Aknur Muldasheva, PhD student, position in the project-researcher. h-индекс – 1, Scopus Author ID 57212136590, ORCID <https://orcid.org/0000-0003-0116-0260>;

Kaldarbekova Madina, position in the project-researcher. h-index – 2, Scopus Author ID 57211610217;

Madina Begaly, Master's degree, position in the project-junior researcher. ORCID <https://orcid.org/0000-0002-0196-0535>;

Rustam Safoviddinzoda, production process engineer, position in the project-junior researcher.

Anel Kostanova, master's student, position in the project-laboratory assistant. ORCID [0000-0001-5682-2423](https://orcid.org/0000-0001-5682-2423)

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. Kakimov M. Monitoring the production of children's food in the Republic of Kazakhstan / M. Kakimov, G. Tokysheva // Materials of the International scientific and theoretical conference "Seifullin readings – 17: "modern agrarian 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.

2. Abdilmanov A. On the issue of the use of goat meat in the Republic of Kazakhstan / A. Abdilmanov, K. Makangali // Materials of the International scientific and theoretical conference "Seifullin readings - 17: "modern agrarian 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.

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. URL:

<https://cyberleninka.ru/article/n/perspektivy-razvitiya-pererabotki-kozlyatiny-v-respublike-kazahstan> (date of request: 10/30/2023).

4. Abdilmanov A. Prospects of using goat meat in the development of baby food products / A. Abdilmanov, G. Tokysheva // Materials of the international scientific and practical conference "Innovative development of food, light industry and hospitality industry" Dedicated to the 30th anniversary of independence of the Republic of Kazakhstan. – Nur Sultan, October 21-22, 2021. - pp.18-19.

5. Abdilmanov A. The study of goat meat in order to justify the production of baby food // Materials of the international scientific and practical conference "Seifullin readings - 18: "youth and science – a look into the future". - Astana, 2022. - pp.151-153.

6. Tokysheva G. The potential of goat meat as a nutrition source for schoolchildren / G. Tokysheva, K. Makangali, Ya. Uzakov, M. Kakimov, N. Vostrikova, M. Baiysbayeva, N. Mashanova // Potravinarstvo Slovak Journal of Food Sciences vol. 16, 2022, p. 398-410 (accessed: 30.10.2023). – DOI: <https://doi.org/10.5219/1763> . (Scopus, percentile 44).

7. Tokysheva G. Studying the physico-chemical properties of goat meat in order to justify the production of baby food products / G. Tokysheva, Ya. Uzakov, M. Kakimov, A. Abdilmanov, N. Vostrikova, K. Makangali // Bulletin of Almaty Technological University, Almaty, 2022; (3):pp.33-40. (COXON).

8. Tokysheva, G. Study of physical and chemical parameters of goat meat for use in the production of children's food / G. Tokysheva, K. Makangali // BIO Web of Conferences. 2023 Vol. 58, p. 01008). EDP Sciences. (date of application: 10/30/2023) - <https://doi.org/10.1051/bioconf/20235801008> .

9. Tokysheva G. Comparative analysis of camel meat / G. Tokysheva, K. Makangali, M. Begaly // Bulletin almanach science association France-Kazakhstan, 2023/1, -pp. 5-12.

10. Tokysheva G. Quality study of boiled and smoked goat sausage with the addition of vegetable additives / G. Tokysheva, K. Makangali, M. Begaly // Bulletin almanach science association France-Kazakhstan, 2023/1, pp. 13-19.

11. Tokysheva G. Research of qualitative indicators of goat meat grown in the Akmola region / G. Tokysheva, M. Kakimov, K. Makangali // Materials of the international scientific and practical conference "Seifullin readings - 19". - Astana, March 17, 2023. – pp.300-301.

12. Tokysheva G. Comparative analysers of the amino acid composition of goat meat of different breeds / G. Tokysheva, L. Namatulla, A. Amirkhan, K. Makangali // Materials of the international scientific and practical conference "Seifullin readings - 19". - Astana, March 17, 2023. - pp.302-303.

13. Tokysheva G. Comparative analysis of the fatty acid composition of goat meat / G. Tokysheva, D. Aiken, Sh. Beken, K. Makangali // Materials of the international scientific and practical conference "Seifullin readings - 19". – Astana, March 17, 2023. -Pp.304-305.

14. Tokysheva G.M. Studying the composition of protein fractions of goat meat / G. Tokysheva, A. Muldasheva, A. Kostanova, K. Makangali // Materials of

the international scientific and practical conference "Seifullin readings – 19. – Astana, March 17, 2023. - pp.305-307.

15. Muldasheva A.H. Investigation of the functional and technological properties of sausages for baby food from goat and camel meat using vegetable raw materials / A.H. Muldasheva // Journal of Agriculture and Environment. — 2023. — №9 (37). — URL: <https://jae.cifra.science/archive/9-37-2023-september/10.23649/JAE.2023.37.12> (date of request: 10/30/2023). — DOI: 10.23649/JAE.2023.37.12 (AGRIS).

16. Makangali K. The study of goat meat for justification in the production of baby sausages / K. Makangali, G. Tokysheva, M. Begaly // Journal of Agriculture and Environment. — 2023. — №9 (37). — URL: <https://jae.cifra.science/archive/9-37-2023-september/10.23649/JAE.2023.37.11> (date of application: 10/30/2023). — DOI: 10.23649/JAE.2023.37.11(AGRIS).

17. Makangali K. A study of the potential of goat meat as an ingredient for innovative children's sausages / K. Makangali, G. Tokysheva // Journal of Agriculture and Environment. — 2023. — №9 (37). — URL: <https://jae.cifra.science/archive/9-37-2023-september/10.23649/JAE.2023.37.10> (date of request: 10/30/2023). — DOI: 10.23649/JAE.2023.37.10 (AGRIS).

18. Makangali K. Enhancing sausage functionality products for school-age children: a study on goat and camel meat with natural purslane powder as an antioxidant additive / K. Makangali, G. Tokysheva, A. Muldasheva, V. Gorbulya, M. Begaly, S. Shukesheva, Zh. Nabiyeva // Eastern-European Journal of Enterprise Technologies. — 2023. -5 (11 (125)). doi: <https://doi.org/10.15587/1729-4061.2023.290091> (Scopus, percentile 40).

19. Makangali K. Method of butchering the carcass of a Kazakh Bactrian camel for industrial processing of camel meat / K. Makangali, Ya. Uzakov., G. Tokysheva, M. Kozhakhieva // KZ U 6591 A22C 17/00 (2006.01), 2021.

20. Makangali K.K. Method of producing sausages for school-age children from goat meat and poultry meat / K.K. Makangali, G.M. Tokysheva, A.H. Muldasheva, D.K. Aiken, M.N. Begaly // Application for a patent for a utility model, reg. No. 2023/1013.2 dated 10.10.2023.

21. Makangali K.K. Method of production of sausages for school-age children from goat meat and poultry meat / K.K. Makangali, G.M. Tokysheva, A.H. Muldasheva, L.M. Namatulla // Application for a patent for a utility model, reg. No. 2023/1024.2 dated 11.10.2023.