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PROCESSING OF MEAT PRODUCTS FROM HERD HORSE BREEDING IN YAKUTIA AND THE REPUBLIC OF KAZAKHSTAN

ЯКУТИЯ МЕН ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ ТАБЫН ЖЫЛҚЫ ШАРУАШЫЛЫҒЫНЫҢ ЕТ ӨНІМДЕРІН ҚАЙТА ӨҢДЕУ

ПЕРЕРАБОТКА МЯСНОЙ ПРОДУКЦИИ ТАБУННОГО КОНЕВОДСТВА ЯКУТИИ И РЕСПУБЛИКИ КАЗАХСТАН

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Annotation. An important task facing productive horse breeding is production of high-quality meat at the lowest cost of labor and material resources. The meat of the herd horses of Yakutia and Kazakhstan, especially foals and young animals, has a high nutritional value compared to other horse breeds and is highly valued among the residents of the republics. *The goal* is to show the importance of research into the quality of horse meat and foal meat, the need to develop technologies focused on the consumer preferences of local residents. *Methods* – statistical, comparisons and generalizations, logical approach to presentation. *Results* – comprehensive

study of chemical composition, nutritional and biological advantages, organoleptic properties of horse meat, foal as a raw material for the production of meat products was carried out. The technological processes for preparing meat products, semi-finished products and offal, smoked and boiled products are scientifically substantiated. The practical significance lies in the development of a new range of meat products, semi-finished products from meat and internal organs, smoked-boiled and dry-cured products and technologies for their production. Indicators of the quality characteristics of processed horse meat and foal meat products have been determined. The developed nanotechnologies have been introduced into production in a number of processing enterprises in Yakutia and the Republic of Kazakhstan. Conclusions – today the world community is focused on healthy nutrition from environmentally friendly products. In this regard, horse meat and foal are the most cost-effective eco-products for both the Kazakh population and the people of Sakha. Experience and knowledge in horse breeding, accumulated over many centuries, are their national treasure, an invaluable wealth of the modern world. It is necessary to expand research into the nutritional, dietary and medicinal properties of horse meat and koumiss as natural products.

Аңдатпа. Өнімді бағыттағы жылқы шаруашылығының алдында тұрған маңызды міндет-ең аз еңбек пен материалдық шығындармен жоғары сапалы ет өндіру. Якутия мен Қазақстанның табын жылқыларының, әсіресе құлындар мен жас жануарлардың еті басқа жылқы тұқымдарымен салыстырғанда жоғары тағамдық құндылығымен ерекшеленеді және республика тұрғындары арасында жоғары бағаланады. *Мақсаты* - жылқы еті мен құлын етінің сапасын зерттеудің маңыздылығын, жергілікті тұрғындардың тұтынушылық қалауына бағытталған технологияларды әзірлеу қажеттілігін көрсету. *Әдістер*і – статистикалық, салыстыру және жалпылау, презентацияға логикалық көзқарас. *Нәтижелері* – ет өнімдерін алу үшін шикізат ретінде жылқы етінің, құлынның химиялық құрамын, тағамдық және биологиялық артықшылықтарын, органолептикалық қасиеттерін кешенді зерттеу жүргізілді. Ет өнімдерін, жартылай фабрикаттар мен қосалқы өнімдерді, ысталған-қайнатылған өнімдерді дайындаудың технологиялық процестері ғылыми негізделген. Практикалық маңыздылығы ет өнімдерінің жаңа ассортиментін, ет пен ішкі ағзалардан жасалған жартылай фабрикаттарды, ысталған-қайнатылған және шикізатталған өнімдерді және оларды алу технологияларын әзірлеу болып табылады. Жылқы еті мен құлын мяса қайта өңдеу өнімдерінің сапалық сипаттамаларының көрсеткіштері анықталды. Әзірленген нанотехнологиялар Якутия мен Қазақстан Республикасының бірқатар қайта өңдеу кәсіпорындарында өндіріске енгізілді. *Қорытындылар* – бүгінгі таңда әлемдік қауымдастық экологиялық таза өнімдерден дұрыс тамақтануға бағытталған. Осыған байланысты жылқы еті мен құлын – қазақ халқы үшін де, Саха халқы үшін де ең үнемді экөөнім. Көптеген ғасырлар бойы жинақталған жылқы өсіру тәжірибесі мен білімі олардың ұлттық қазынасы, қазіргі әлемнің баға жетпес байлығы болып табылады. Жылқы еті мен қымыз табиғи өнім ретінде тағамдық, диеталық және емдік қасиеттерін зерттеуді кеңейту қажет.

Аннотация. Важной задачей, стоящей перед коневодством продуктивного направления, является производство высококачественного мяса при наименьших затратах труда и материальных средств. Мясо табунных лошадей Якутии и Казахстана, особенно жеребятины и молодняка, отличается высокой питательной ценностью по сравнению с другими породами лошадей и высоко ценится среди жителей республик. *Цель* – показать значимость исследований качества конины и мяса жеребят, необходимость разработки технологий, ориентированных на потребительские предпочтения местных жителей. *Методы* – статистический, сравнения и обобщения, логический подход к изложению. *Результаты* - проведено комплексное изучение химического состава, пищевых и биологических преимуществ, органолептических свойств конского мяса, жеребятины как сырья для получения мясной продукции. Научно обоснованы технологические процессы приготовления мясных продуктов, полуфабрикатов и субпродуктов, копчено-вареных изделий. Практическое значение заключается в разработке нового ассортимента мясных товаров, полуфабрикатов из мяса и внутренних органов, копчено-вареной и сыровяленой продукции и технологий их получения. Определены показатели качественных характеристик продуктов переработки конины и мяса жеребят. Разработанные нанотехнологии внедрены в производство в ряде перерабатывающих предприятий Якутии и Республики Казахстан. *Выводы* – сегодня мировое сообщество ориентировано на здоровое питание из экологически чистых продуктов. В этом отношении конское мясо и жеребятина – наиболее экономически эффективная экопродукция как для казахского населения, так и народа Саха. Опыт и знания по разведению лошадей, накопленные за многие столетия, являются их национальным достоянием, бесценным богатством современного мира. Необходимо расширить исследования пищевых, диетических и лечебных свойств конины и кумыса как натуральных продуктов.

Key words: agricultural sector, horse breeding, productivity, meat products, horse meat, foal, processing technologies, food, dietary and medicinal value.

Түйінді сөздер: аграрлық сектор, жылқы шаруашылығы, өнімділік, ет өнімдері, жылқы еті, құлын, өңдеу технологиялары, тағамдық, диеталық және емдік құндылығы.

Ключевые слова: аграрный сектор, коневодство, продуктивность, мясная продукция, конина, жеребятина, технологии переработки, пищевая, диетическая и лечебная ценность.

Introduction. Horse breeding – a special pride, national heritage and traditionally traditional industry both in the Republic of Sakha (Yakutia) and Kazakhstan (figure 1,2). The material and spiritual culture of both peoples is fully connected with the cult of the horse.

Figure 1 -Kazakh horse with foal

As we have already noted, horse breeding in Kazakhstan, as well as in Yakutia, due to the existing historical conditions, national characteristics of the population, culture and life of the Kazakh people, horse breeding in Kazakhstan is an ancient branch of animal husbandry is a senile industry of animal breeding.

The Kazakh breed of horses is the national heritage of the Kazakh people, and its preservation is an important state event. The production of horse breeding products in the Republic of Kazakhstan is determined by the level of productivity of breeds used for this purpose.

Inadequate quality provision of the population of Russia and Kazakhstan with meat production has led to a deficit of animal protein (33%) in human nutrition, which is a serious justification for the development of scientifically based ways of correction of the diet, the search for new sources of protein, and the rational use of raw materials of animal origin.

Consumer preferences are determined by the tradition of the population and the development of herd meat breeding.

The population of Yakutia and Kazakhstan has long valued horsemeat for its high nutritional value and dietary properties.

It is well known that Yakutia ranks the 1st place in Russia in the number of herd horses. In the territory of Yakutia, 93% of the horse population of the Far Eastern Federal District is concentrated and 14% of the Russian Federation.

Figure 2- Yakut horse with foal

The production of meat products using horsemeat has its own traditions, primarily related to the specificity of this type of raw material. Production in large volumes of sausage products, canned goods, and smoked horsemeat was peculiar to the republics of Central Asia (Kazakhstan, Kyrgyzstan, Bashkortostan), where this type of meat raw material had its centuries-old traditions and conditions for development.

At the same time, the domestic market of Yakutia and Kazakhstan fully consumes all horse and foal meat produced [1].

Material and methods of research. Horsemeat and products from horsemeat and foal are produced according to the state standards of the Russian Federation and the Republic of Kazakhstan: GOST 10.76-74 Meat. horsemeat, supplied for export and CT RK 1099-2002 Meat. Horse Meat, supplied for export. Specifications; GOST 32225-2013 Horses for slaughter. Horse and foal in sides and quarters GOST 32226-2013 Meat. Cutting of horse and foal on cuts and ST RK UN EEC (1)-2012 Horsemeat. Carcases and cuts; GOST 32785-2014 Products from horsemeat. Technical conditions and ST RK 1303-2015

Meat and meat products. National horse products. General technical conditions.

GOST data determine the qualitative characteristics and safety indicators of horsemeat and foal used in the food industry, retail trade, public catering network.

Food products from horsemeat and foal can also be produced under technical conditions developed by manufacturers or specialized organizations. Requirements and peculiarities of TS development are regulated by GOST R 51740-2016 Technical conditions for food products. General requirements for development and design, ST RK 1081-2002 Procedure for development of technical instructions and formulations for food products. Main provisions and TR CU 034/2013 Technical Regulations of the Customs Union "On the safety of meat and meat products".

Organoleptic parameters are determined by tasting, physico-chemical indicators of meat products from foal and horsemeat determined on the basis of studies of biochemical composition on the infrared analyzer Spectra Star model 2200 of the firm Unity Scientific, calibrated based on standard chemical methods in YRIA (Yakutsk Research Institute of Agriculture).

Results and their discussion. Today the world community is focused on healthy nutrition from environmentally friendly natural products. In this respect, horsemeat and foal are the most economically efficient and environmentally friendly foods for both the Kazakh and the Sakha people.

Dietary value, qualitative advantages of horsemeat over other types of meat, high profitability of its production, low cost, prevalence in the nutrition structure of the population of the Sakha Republics (Yakutia) and Kazakhstan should contribute to increasing the production of this valuable food product.

To date, the number of horses of the Republic of Sakha (Yakutia) is 182.1 thousand heads, the Republic of Kazakhstan – 3 650.7 thousand heads.

Depending on the age of the animals, meat is divided into: horse - from adult horses (mares, merins and stallions) aged 3 years or older, young from 1 year to 3 years, foal - from foals up to 1 year with a living weight of at least 120 kg.

The Sakha people have been developing and applying horse breeding technology for several centuries, and have developed their breed of horses, highly adapted to the extreme conditions of the North, which other cultural breeds cannot withstand. The Republic of Kazakhstan has huge territories of natural pastures, which predetermine the development of the herding horse breeding.

Kazakh horses, due to their adaptive qualities, are better and faster profited during autumn feeding. Results of slaughter showed that the live weight of stallions 6-7 months before feeding was 194.6 kg, after feeding - 236 kg. Absolute weight - 41.4 kg, average daily weight - 690 g, weight of carcass 126 kg. Stallions weighed 330.8 kg before feeding for 18 months, after feeding - 368 kg, absolute increase - 37.2 kg. And the average daily weight of the carcass is 205.6 kg. The lethal output is 55.8%, the thickness of the kazy is 23.3 mm.

The Yakut horse is distinguished by a high killing exit and meat exit from the carcass. They produce an average carcass of 102.3 kilograms at 6 months of age, 165 kilograms at 2.5 years of age and 228 kilograms of full-time carcasses, and 55.5 per cent of the carcasses are killed. Depending on the nutritional category, the calorie content of 1 kg of Yakut horsemeat ranges from 1 922 to 2 724 kilocalories. At present, about 80% of the meat of the Yakut horse is produced from foals at the age of six months [2, 3].

Kazakh toad horses have a live weight of 218.1 kg in 6 months, 375 kg in 2.5 years and 456.2 kg in adults. At the slaughter weight of 6-month-old foals is 123.0 kg, 2.5-year-old stallions - 205.4 kg and adult mares - 253.2 kg. The lethal yield is 56.4, 54.8 and 55.5 per cent [4], respectively.

The relative content of bones in the carcasses of Kazakh horses of the zhabe type (table 1) was slightly higher in colts 2.5 years old (18.7%) in comparison with 6-month-old foals (18.1%) and adult mares (15.7%). For 1 kg of bones, pulp (meat ratio) was obtained from 6-month-old foals - 4.2 kg, from 2.5-year-old colts - 3.9 kg and from adult mares - 4.7 kg. In Kazakhstan, various food products are made from horsemeat. Dishes such as kazy, zhal, zhaya, chuzhuk, sur-et and karta are considered delicacy and are distinguished by high nutritional value and good taste [5].

From the data of table 1 it can be seen that the highest percentage of pulp yield of Yakut horses is observed in 6-month-old foals - 79.5%, in 2.5-year-old young animals - 68.0%, which is 11.5% lower than in 6 months.

Table 1 - Comparative data of quality indicators of horsemeat of Yakut and Kazakh toad type

Indicator	Yakut breed		Kazakh breed of zhabe type	
	kg	%	kg	%
Foals aged 6 months				
Pulp mass, %	75.2	78.4	94.0	76.4
Bones, %	16.6	17.3	22.3	18.1
Tendons, %	4.1	4.2	2.8	2.3
Internal fat, kg	incl.7.32**	-	1.8	1.5
Salo, %			2.1	1.7
Offspring at the age of 2.5 years				
Pulp mass, %	102.0	75.7	149.8	72.9
Bones, %	25.3	18.7	38.4	18.7
Tendons, %	7.6	5.6	5.2	2.5
Internal fat, %	incl.3.7**	-	7.0	3.4
Salo, %			5.0	2.4
Mares over 5 years old				
Pulp mass, %	166.9	83.9	188.2	74.3
Bones, %	25.4	12.8	39.8	15.7
Tendons, %	6.67	3.4	5.9	2.3
Internal fat, %	incl.12.55**	-	12.2	4.8
Salo, %			7.1	2.8
Note:** shows the average indicators of three types (root, Yan, Kolyma) of the Yakut breed of horses				

The chemical composition and energy value of meat of foals of the Prilensky and Kazakh breeds of the Zhabe type are presented in table 2.

Table 2 - Chemical composition and energy value of the meat of foals of the Yakut horse and the Kazakh breed of the Zhabe type

Cuts	Water,%	Protein,%	Fat,%	Carbohydrates,%	Cinder,%	Energy value in 100g
Meat of foals of the Yakut breed						
Neck	60.6±0.24	17.1±0,14	9.8±0.15	1.2±0.04	1.0±0.05	161.3±0.14
Scapular	64.4±0.06	15.9±0.08	9.7±0.21	0.8±0.03	1.0±0.05	154.4±0.08
Dorsal costal	67.4±0.17	17.6±0.19	13.5±0.14	1.3±0.04	1.1±0.03	196,7±0,19
Lumbar	64.2±0.19	16.2±0.05	10.5±0.15	0.9±0.04	1.1±0.03	162.5±0.05
Sacral part	64.7±0.10	17.7±0.16	14.5±0.13	1.3±0.05	1.4±0.30	206.3±0.16
Hip	67.5±0.07	17.6±0.18	13.1±0.03	1.1±0.03	1.0±0.04	192.8±0.18
Brisket	69.7±0.10	18.4±0.17	16.1±0.09	1.4±0.17	1.1±0.03	223.9±0.17
Meat of young Kazakh breed of zhabe type (2.5 years) by grades						
Outside grade (kazy+zhal)	34.8	12.9	51.6	-	0.7	22 323 kJ
I grade	60.1	18,2	20.6	-	1.1	11 154 kJ
II grade	67.5	21.0	10.3	-	1.2	7 621 kJ
III grade	72.1	21.5	5.2	-	1.2	5 720 kJ
Carcass average	58.7	21.8	18.4	-	1.1	11 656 kJ

The highest fat content in Kazakh horses of the zhabe type is observed in cuts of kazy and zhal (outside the variety) - 51.6%. Relatively little fat was contained in meat of grade II - 10.3% and grade III - 5.2%. In all varieties of meat, with an increase in fat con-tent, the percentage of moisture decreases, and the energy value increases [6, 7].

Assortment of meat products from horsemeat and foal meat. Meat products from horsemeat and foal meat in the Republic of Sakha are produced in accordance with the national standards of the Russian Federation (GOST) and regional technical specifications (TS):

- GOST 32225-2013 Horses for slaughter. Horse meat and foal in half carcasses and quarters. Technical specifications;
- GOST 32785-2014 Horsemeat products. Technical specifications;
- GOST R 55335-2012 Meat. Horsemeat for baby food. Technical specifications.

The laboratory for the processing of agricultural products of the FSBSI YRIA (Federal State Budget Scientific Institution "Yakut Research Institute of Agriculture named after M.G. Safronov") developed the following technical specifications (TS) and organization standard (STO): National semi-finished meat products from horse meat and foal meat TS and TI 10.13.14-001-03534081-2019; Smoked and boiled meat products from foals and horse meat TS and TI 10.13.14-002-03534081-2019; Yakut national semi-finished products from offal "Is uere", "Is mine" TS and TI 10.13.14-003-035344081-2019; Yakut nationnal meat product "Tansyk" TS and TI 10.13.13-014-03534081-2021; Semi-smoked horse sausages TS 10.13.14-015-03534081-2019.

A scheme of cutting Yakut horse carcasses has been developed, based on the research conducted by V.V. Gomboeva, D.A. Plotnikov. The cutting scheme meets the requirements of national traditions and provides cuts suitable for cooking national dishes: oyogos, saal, hol eta, yueler eta, kung eta, fillet "Khalakhatyy". The obtained data allow to give preference to certain parts of the carcass for the production of meat semi-finished products from foals during culinary processing.

The developed standard "National cutting of Yakut breed foals into cuts" (STO 01710620-001-2012), approved by the chairman of SPO "Kholbos" of the Republic of Sakha (Yakutia) for retail trade and public catering, is an innovative development for the consumer cooperation system of Yakutia [8].

Meat product "Amtan - As" OS (organization standard) 03534081-001-2021. This organization standard applies to meat products "Amtan as" from foal and horsemeat and fat (haha) without heat treatment, intended for direct consumption [9].

The modernness of our developments in production technologies is confirmed by patents of the Russian Federation: No.2538367 "Concentrate from Yakut horse fat - raw material for food additives", No.2568492 "Method of preparing smoked-boiled product “Zherebyatina (foal) Churapchinskaya", No.2568506 "Method of preparing smoked-boiled product “Zherebyatina (foal) Mugudaiskaya”, No.2743795 C1 “Method of preparing smoked-boiled product “Horsemeat and Megezhekskaya foal”, No. 2756533 C1 “Method of producing a semi-finished blood mixture from horse blood in food polyethylene films”.

In Kazakhstan, cutting of horse carcasses is carried out according to the RST 725-72, adopted for the state trading network. The zhal (fat crest) + kazy (posterior costal part) is classified as out of grade, the dorsal, lumbar and back parts are classified as grade I, the cervical, humeroscapular, anteriocostal parts and thighs are classified as grade II, the notch, knuckle and shank are classified as grade III.

Authors G.S. Zhumanbaeva and A.M. Agapkin determined the chemical composition of horse meat from different parts of the carcass and its caloric value [10].

Meat products from horsemeat in Kazakhstan are produced in accordance with the national standards of the Republic of Kazakhstan and technical specifications (TS):

●ST KR 1303-2015 National horse products. General specifications;

●ST RK 2123-2011 Canned meat. Stewed horsemeat. Specifications;

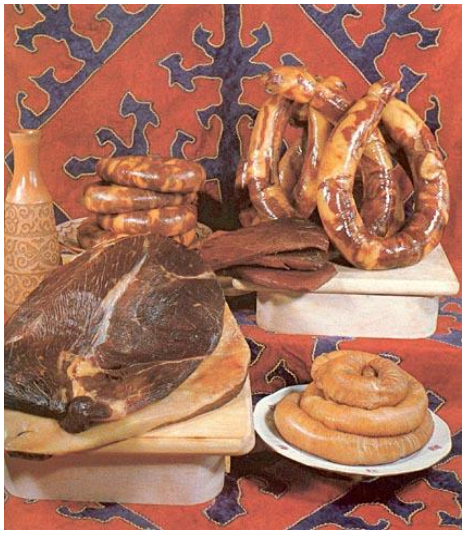
●ST RK 1353-2005 Halal boiled sausage. General technical specifications.

According to the results of many years of research by employees of the M.G. Safronov Yakut Scientific Research Institute of Agriculture, the following local products of Yakutia can receive the status of ecologically pure natural (organic) products: meat of Yakut horses, northern domestic reindeer and meat of Yakut cattle [11].

Organic products can be all categories of food produced in Kazakhstan. Price premium (surcharge) for organic products is proposed within 50% for meat and meat products. For niche categories of food products this figure may be higher [12].

In traditional Kazakh cuisine, horsemeat products were and are the most favorite: kazy, shuzhuk, zhaya, zhal, carta, etc., which are protected by patents of the Republic of Ka-

zakhstan, No.29358 «Method of production of dry-cured meat delicacies from horse meat», No.28790 «Method of production of canned goods «Dried horsemeat», No.28294 «Method of production of ham from horse meat and mutton for dietetic nutrition».



All produced types of horse meat products can be classified only as high-calorie food products, and in the considered aspect these products do not possess certain functionality. To expand the range of meat products produced on the basis of horsemeat and possessing a certain functionality for the human body, a new meat product - horsemeat roll enriched with functional ingredients of plant origin - was developed. For long-term preservation of the product the method of cold atmospheric drying with the use of heat pumps on the basis of refrigerating machines was chosen. The developed meat roll from horsemeat can be recommended for production as a functional meat product with a long shelf life [13].

Conclusions

1. The experience and knowledge accumulated over many centuries by the peoples engaged in herding horses are the national heritage of peoples, an invaluable wealth of the modern world [14,15].

2. There is a need to strengthen research into the nutritional, dietary and therapeutic properties of horse and kumys meat as environmentally friendly products.

3. The level of development of the industry depends on scientific and innovative potential, however, the application of organizational and economic approaches to enhancing innovative processes in herd horse breeding and related industries also plays an important role in view of the need for a sustainable increase in the efficiency of this subcomplex.

4. When creating an idea for marketing horse breeding products, it is necessary to determine a strategy for promoting your product, based on traditional and modern management principles.

5. The objectives of science in the field of productive horse breeding are the further successful development of the industry, the development and implementation of progressive methods of its management technology, which contribute to increasing the productivity of horses.

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