Торайғыров университетінің
ҒЫЛЫМИ ЖУРНАЛЫ

НАУЧНЫЙ ЖУРНАЛ
Торайгыров университета

ТОРАЙҒЫРОВ УНИВЕРСИТЕТІНІҢ ХАБАРШЫСЫ

Химия-биологиялық сериясы

1997 жылдан бастап шығады

TORAIGHYROV UNIVERSITY

ВЕСТНИК ТОРАЙГЫРОВ УНИВЕРСИТЕТА

Химико-биологическая серия

Издается с 1997 года

ISSN 2710-3544

№ 1 (2022)

Павлодар

НАУЧНЫЙ ЖУРНАЛ
Торайгыров университета

Химико-биологическая серия
выходит 4 раза в год

СВИДЕТЕЛЬСТВО
о постановке на переучет периодического печатного издания,
информационного агентства и сетевого издания
№ KZ84VPY00029266

выдано
Министерством информации и коммуникаций Республики Казахстан

Тематическая направленность
публикация материалов в области химии, биологии, экологии,
сельскохозяйственных наук, медицины

Подписной индекс – 76134

https://doi.org/10.48081/RXEB7205

SRSTI 65.53.41

https://doi.org/10.48081/DAFG3241

M. B. Rebezov
K. G. Razumovsky Moscow State University
of Technology and Management,
Russian Federation, Moscow

THE CREATION OF A NEW TYPE OF MEAT PASTE WITH RADIOPROTECTIVE PROPERTIES

The paper is devoted to the study of properties and quality indicators of functional meat-based products, which reduce the risk of toxic poisoning of the organism by radionuclides and salts of heavy metals. Creation of new meat product with radioprotective properties, which is able to remove salts of heavy metals from an organism, strengthening its protective functions, is of interest as a priority direction in food industry. The article analyses the significance of developing meat products with radioprotective properties. The components and their useful properties are considered; the physico-chemical properties, microbiological indicators, amino acid composition, radiological indicators are determined and organoleptic evaluation of meat pastes is carried out. Production approbation of experimental samples of meat pastes was carried out.

The results of microbiological studies have shown that the number of mesophilic aerobic and facultative anaerobic microorganisms (QMAFAnM) grown on nutrient medium MPA does not exceed the confidence interval and amounts to 6.8 x 10 2CFU/g in canned meat "Meat Paste". According to data of radiological indices of canned products it can be concluded that radionuclide content meets the requirements of SanPiN of permissible levels and is at a safe level, which allows to consider ready products as radiologically safe raw materials.

Keywords: functional food, meat product, paste, NBK, technology, formulation.

Introduction

From the middle of the 19th century onwards, atomic bombs were built and the use of ionising radiation sources expanded into the biosphere, with the consequent release of large amounts of radionuclides. Once in the upper atmosphere, the

radionuclides began to spread rapidly across the globe, depositing on the surface of land, seas and oceans. This began to increase the background radiation in the environment. Living organisms became exposed to additional radiation as a result of human activities. For this reason radioprotectors, products with radioprotective effect, began to gain popularity. By radioprotectors we mean everyday foodstuffs containing essential amino acids, microelements, pectins; products with anticarcinogenic, antioxidant properties. Taking into account the sensitivity of the hematopoietic system to radiation, in order to stimulate hematopoiesis, it is necessary to add up to 110–120 g of animal protein (liver, meat, fish) to the diet, which is an additional source of protein [1].

The aim of the research: to create new types of meat pastes with functional purpose and to test them in production conditions and to evaluate the complex of qualitative indices.

Main tasks:

- to carry out research and development work on the selection of raw materials and component compositions for the design of new types of meat pastes of functional value;
- to simulate the formulation of a new type of meat paste with comprehensive analytical and experimental research;
- to carry out production testing of a new type of meat paste with radioprotective properties.

Materials and methods

Objects of research: raw meat (chicken meat, beef liver, ground beef category 1, beef trimmings, beef fat, NBK), protein PRO V-500, Prot 30.

In accordance with the experiment, a study was made of a set of qualitative indicators and safety indicators, using standard and original methods to obtain information on the composition and properties of research objects. The following methods were used in the work.

The research was carried out on the basis of sanitary and hygienic requirements for medicalprophylactic food products based on the following indicators:

Microbiological indicators:

– the number of mesophilic, aerobic and facultative-anaerobic microorganisms, coliforms pathogenic according to GOST 23392–78, GOST 21237–75. Standard methods for the study of microbiological indices in accordance with GOST 9959–81 were used in the research; GOST 10.444–85; GOST 9958–81, GOST 9225–84, GOST 10444.11–89, GOST 10444.5–85, GOST 30425, GOST RS0480–93.

Bacteriological parameters:

- freshness of meat. GOST 19496–93.

Physicochemical and organoleptic indices:

- pH determination. Meat products. On methodical recommendations of physical and chemical control in the meat industry. Kogan MB, Pozhariskaya LS, et al., M. 1971;

- determination of the moisture content in accordance with GOST 9793–74;

- determination of organoleptic parameters according to GOST 9959–91 meat products, GOST 7269–79 meat, GOST 9001.01.93.

Results and discussion

The objects of the research were raw meat (chicken meat, beef liver, ground beef category 1, beef trimmings, beef fat, NBK), protein PRO V-500, Prot 30.

In accordance with the aim and objectives of the article, the assessment of a set of qualitative indicators and the study of the influence of ingredient composition on the functional and technological characteristics of the product, using standard and original methods, which will allow to obtain information about the composition and properties of the objects of research.

Qualitative and safety indicators of developed meat products:

- determination of radionuclides.

In order to achieve the initial objective of the research work, an ingredient composition for a meat paste with anti-radiation properties has been selected.

Canned meat «Meat paste» is made of: beef, trimmings (beef trimmings) with beef fat, onion, NBK, salt, black pepper.

Beef meat, which is used as the main meat raw material, is characterised by its high protein content, which includes the essential essential amino acids and substitutable amino acids. Due to the binding of water and fat, the structural proteins of the muscle tissue form a structure in solution, which during heating turns into a quasi-solid state, which makes the consistency of the product elastic, strong, elastic and tender [2, 3].

Beef fat is an important ingredient in the paste recipe, affecting the consistency, taste and colour of the finished product. If there is a lack of fat in the recipe, moisture is cut off and broth and fat swellings form. The fat content should not exceed 30 % [4].

Beef trimmings are close to beef in chemical and amino acid composition, but due to the significant content of connective tissue and lymph nodes it is difficult to process. The use of meat trimmings in the production of paste is an opportunity to use raw materials that are rarely processed at enterprises [5, 6].

Phytoncides contained in onions are natural antibiotics and have a beneficial effect on digestion. As a result of adding vegetable raw materials to meat products, the cost of production is reduced, the acid-alkaline balance is levelled and a certain reserve of alkaline minerals is created in the body [7, 8].

NBK has bacteriostatic properties, regulates intestinal microflora, participates in the process of digestion, causes death and suppresses the development of putrefactive bacteria, normalises metabolism, and stimulates the body's resistance [9, 10]. Thus, our selected ingredient composition meets our initial requirements.

We have developed three variants of the canned meat paste recipe, which are shown in Table 1.

Table 1 – Recipes for tinned meat paste

Name of raw material	Content kg, per 100 kg of raw material		
	I variant	Option II	Option III
1 Beef cutlet category	55,00	65,93	60,00
2 Beef fat	15,9	14,07	10,00
3 Onions	5,00	4,9	4,9
4 Salt	1,01	1,01	1,01
5 Black pepper	0,1	0,1	0,1
6 Beef meat trimmings	19,00	10,00	20
7 NBK	4,003	4,003	4,003
Total	100	100	100

In recipe variant 1, the high amount of beef fat compared to the other variants led to an increase in the caloric content of the finished product and left an unpleasant aftertaste. In Variant 3 of the recipe, a low beef fat content was observed, which led to the loss of moisture and the formation of broth and fat edema. Variant 2 of the recipe has a sufficient amount of beef fat, which had a favourable effect on the oily consistency, colour and taste of the meat paste. The organoleptic and structural properties of the paste have improved thanks to the correct ratio and combination of Category I beef and beef by-products (beef trimmings) in Variant 2 of the recipe for meat paste.

Thus, we have picked up II variant of recipes of canned meat paste for industrial production. On the basis of the given data it is possible to draw a conclusion that recipe compositions of meat paste consist of ingredients which enrich them with radioprotectors, removing from an organism salts of heavy radioactive metals, and also component compositions which possess biocompatibility of ingredient composition and its parities, are bio-available.

Microbiological tests on the developed functional meat pastes were carried out to detect the number of mesophilic aerobic and facultatively anaerobic microorganisms (QMAFAnM), E. coli bacteria, *Staphylococcus aureus* and pathogenic bacteria from the genus *Salmonella.*

Microbiological indicators of canned meat "Meat paste" developed by us at Semipalatinsk meat canning plant LLP are presented in table 2.

Table 2 – Microbiological parameters of tinned meat paste

Name of indicators	Designation of the ND for the test methods	ND requirements	Actual results obtained
Microbiological indicators			
QMAFAnM, CFU/g, max.	GOST 10444.15-94	1 x 10^3	weighted average 6,8 x 10^2 (confidence interval 5.6 x 10 to 7.8 x 10^2)
Escherichia coli bacteria (coliforms)	GOST 31747-2012	in 1.0 g is not allowed	in 1.0 g not detected
S. aureus	GOST 31746-2012	0.1 g is not allowed	in 0.1 g not detected
Sulphite-reducing clostridia	GOST 29185-2014	0.1 g is not allowed	in 0.1 g not detected
Pathogens, including *Salmonella*	GOST 31659-2012	in 25 g is not allowed	in 25 g not detected
L. monocytogenes	GOST 32031-2012	in 25 g is not allowed	in 25 g not detected

According to the table 2, we can conclude that the number of mesophilic aerobic and facultatively aerobic microorganisms (QMAFAnM) grown on nutrient medium MPA does not exceed the confidence interval and is 6.8 x 10 2CFU/g, E. coli bacteria, Endo, Ploskirev or Levin in 1.0 g were not detected, *Staphylococcus aureus* coagulase- positive, sulphite-reducing clostridia in 0.1 g were not detected, *Salmonella* and *Listeria monocytogenes* bacteria in 25 g were not detected.

Study of radiological properties of meat paste. We determined the safety indicators of the developed canned meat «Meat paste», the results of which are shown in Table 3.

The radionuclide content is regulated in the raw materials and must not exceed the permissible levels set by SanPiN.

Table 3 – Radiological indicators of canned meat paste

Name of indicator	ND on test methods	Norms according to ND	Actual results obtained
Contents cesium137 Bq/kg	MWI 70-94/5.06.001- 98	no more than 160	less than 8
Strontium content-90 Bq/kg	GN IC VNII FTRI/RK NO. 000002	not more than 50	8,6

Analysis of the data in the table leads to the conclusion that the radionuclide content meets the requirements of SanPiN permissible levels and is at a safe level, allowing the finished products to be considered as radiologically safe raw materials.

The canned food «Poultry meat paste» and «Meat paste» developed by us, under production-industrial conditions at the enterprise LLP «Semipalatinsk meat cannery» have the following organoleptic indicators shown in the table 4.

Table 4 – Organoleptic evaluation of meat paste

Name of indicators	Characteristics and naming conventions
	«Meat paste»
Appearance	Paste well cooked, with homogeneously shredded meat
Taste, smell andcolour of products	Brown to grey-brown in colour. Taste and smell characteristic of the meat, with no extraneous flavours or odours
Consistency	Paste
Sectional view	Stuffing is homogeneous, evenly mixed

Thus, after tasting, it was observed that the product has a high taste quality, has a delicate pasty consistency, has a good biocompatibility of the ingredient composition and has a pleasant taste and smell.

Conclusion

In order to create new meat pastes of functional purpose under the State Programme of Industrial and Innovative Development of the Republic of Kazakhstan for 2015–2019 (SPIIR), new types of canned meat «Meat paste»

with anti-radiation properties were developed in the production and industrial conditions of Semipalatinsk meat canning plant LLP.

According to the results of the research work on the selection of raw materials and component composition for the construction of these types of meat pastes for functional purposes, we can conclude that the component compositions of meat pastes have a biocompatibility of ingredients and their ratios and are bioavailable.

The radionuclide content is at a safe level which allows the finished products to be considered as radiologically safe raw materials.

The functionality of the new foodstuff is mainly due to the additional sources of protein, of animal and plant origin, which have radioprotective properties and which are intended to compensate for the lack of energy, plastic and regulatory nutrients in the human body.

The new functional meat product has radioprotective properties and is recommended for both mass and special, therapeutic and prophylactic nutrition.

References

1 **Тытюк, Д. С., Табакаева, О. В.** Радиопротекторное питание как защита от ионизирующих излучений // VII Международная студенческая электронная научная конференция «Студенческий форум». – М., 2015. – С. 113–117.

2 **Морозова, Н. И., Мусаев, Ф. А., Прянишников, В. В.** Технология мяса и мясных продуктов. Инновационные приемы в технологии мяса и мясных продуктов. – Рязань : ПринТ, 2012. – Т. 2. – 209 с.

3 **Вершинина, А. Г., Каленик, Т. К., Самченко, О. Н.** Разработка мясорастительных паштетов для здорового питания // Техника и технология пищевых производств. – Кемерово, 2012. – Т. 1. – № 24. – С. 120–124.

4 **Сарафанова, Л. А.** Применение пищевых добавок в переработке мяса и рыбы // Мясные технологии. – 2015. – № 4. – С. 25–28.

5 **Сметанина, Л. Б.** Научное обоснование рационального использования ферментированного коллагенсодержащего сырья для производства мясных консервов // Все о мясе. – 2012. – № 5. – С. 20–26.

6 **Гиро, Т. М., Давыдова, С. В.** Функциональные мясные продукты питания с добавлением тыквенного порошка // Технология и продукты здорового питания : Материалы Межд. науч.-техн. конференции. – Саратов : Научная книга, 2009. – С. 23–25.

7 **Какимов, А. К., Есимбеков, Ж. С., Кабулов, Б. Б.** Роль функциональных продуктов в питании человека // «Инновационные подходы в технологии для повышения эффективности» межд. науч. практ.

конференция, посвященная памяти член-корреспондента КазАСХН, д.т.н., профессора Тулеуова Елемеса Тулеуовича. – Семей, 2016. – Т. 1. – С. 115–119.

8 **Шевченко, И. А., Магомедов, И. М., Вершинин, А. С.** Перспективы применения функциональных продуктов питания для профилактики и комплексного лечения сердечно-сосудистых заболеваний // Современные наукоемкие технологии. – 2004. – № 5. – С. 19–24.

9 **Абимульдина, С. Т., Кутепова, Г. Г., Климова, Н. И., Жумажанова, А. М., Аскарова, Л. И.** Пищевая добавка-корректор для мясных и молочных продуктов : патент № 22561 РК : МПК A 23L 1/32, A 23C 9/13 ; заявл. 04. 07. 2007, опубл. 15.06.2010, бюл. № 6.

10 **Стефанова, И. Л.** Функциональные продукты питания // Технологии и продукты питания. – 2010. – № 6. – С. 61–64.

References

1 **Tytyuk, D. S., Tabakayeva, O. V.** Radioproternoe pitanie kak zachita ot ioniziruuschih izluchenii [Radioprotective nutrition as protection against ionizing radiation] [Text] // VII International Student Electronic Scientific Conference «Student Forum». – Moscow, 2015. – P. 113–117.

2 **Morozova, N. I. Musaev, F. A., Pryanishnikov, V. V.** Tehnologiya myasa I myasnyh produktov. Innovatsionnye priemy v tehnologii myasa I myasnyh produktov [Technology of meat and meat products. Innovative techniques in the technology of meat and meat products] [Text]. – Ryazan : PrinT, 2012. – T. 2. – 209 p.

3 **Vershinina, A. G., Kalenik, T. K., Samchenko, O. N.** Razrabotka myasarostitelnyh pashtetov dlya zdorovogo pitaniya [Development of meat-vegetable pates for a healthy diet] [Text] // Equipment and technology of food production. – Kemerovo, 2012. – T. 1. – № 24. – 120–124 p.

4 **Sarafanova, L. A.** Primenenie pischevyh dobavok v pererabotke myasa I ryby [Application of food additives in meat and fish processing] [Text] // Meat Technology. – 2015. – № 4. – P. 25–28.

5 **Smetanina, L. B.** Nauchnoe obosnovanie ratsionalnogo ispolzovaniya fermentirovannogo kollagensoderjaschego syrya dlya proizvodstva myasnyh konservov [Scientific rationale for the rational use of fermented collagen-containing raw materials for the production of canned meat] [Text] // All about meat. – 2012. – № 5. – P. 20–26.

6 **Giro, T. M., Davydova, S. V.** Funktsionalnye myasnye prodykty pitaniya s dobavleniem tykvennogo poroshka [Functional meat food products with the

addition of pumpkin powder] [Text] // Technology and healthy food products : Materials of International scientific and Technical conferences. – Caratov : Scientific book, 2009. – 23–25 p.

7 **Kakimov, A. K., Esimbekov, Zh. S., Kabulov, B. B.** Rol funktsionalnyh produktov v pitanii cheloveka [The role of functional products in human nutrition] [Text] // "Innovative approaches in technology to improve efficiency" intergovernmental scientific and practical conference dedicated to the memory of KazASAAS corresponding member, Doctor of Technical Sciences, Professor Tuleuov Elemes Tuleuovich. – Semey, 2016. – T. 1. – P. 115–119.

8 **Shevchenko, I. A., Magomedov, I. M., Vershinin, A. S.** Perspektivy primeneniya funktsionalnyh produktov pitaniya dlya profilaktiki I kompleksnogo lecheniya serdechno-sosudistyh zabolevanii [Prospects for the use of functional foods for the prevention and comprehensive treatment of cardiovascular diseases] [Text] // Modern high-tech technologies. – 2004. – № 5. – 19–24 p.

9 **Abimuldina, S. T. Kutepova, G. G., Klimova, N. I., Zhumazhanova, A. M., Askarova, L. I.** Pischevaya dobavka – korrektor dlya myasnyh I molochnyh produktov [Food additive - corrector for meat and milk products] [Text] : patent 22561 RK : IPC A 23L 1/32, A 23C 9/13 ; application. 04. 07. 2007, publ. 15.06.2010, No. 6.

10 **Stefanova, I. L.** Funktsionalnye prodykty pitaniya [Functional food products] [Text] // Technologies and food. – 2010. – № 6. – 61–64 p.

Material received on 11.03.22.

**М. Б. Ребезов*
К. Г. Разумовский атындағы Мәскеу мемлекеттік
басқару және технологиялар университеті,
Ресей Федерациясы, Мәскеу қ.
Материал 11.03.22 баспаға түсті.

РАДИОПРОТЕКТОРЛЫҚ ҚАСИЕТТЕРІ БАР ЕТ ПАШТЕТІНІҢ ЖАҢА ТҮРІН ЖАСАУ

Мақала ағзаның радионуклидтермен және ауыр металл тұздарымен уытты улану қаупін төмендететін ет негізіндегі функционалды өнімдердің қасиеттері мен сапа көрсеткіштерін зерттеуге арналған. Ағзадан ауыр металдардың тұзын шығаруға қабілетті, радиопротекторлық қасиеттері бар, оның қорғау функцияларын нығайтатын жаңа ет өнімін құру тамақ өнеркәсібінде

басым бағыт ретінде қызығушылық тудырады. Мақалада радиопротекторлық қасиеттері бар ет өнімдерін әзірлеудің маңыздылығы талданды. Құрамдастар және олардың пайдалы қасиеттері қарастырылды, физикалық-химиялық қасиеттері, микробиологиялық көрсеткіштері, амин қышқылдық құрамы, радиологиялық көрсеткіштері анықталды және ет паштет құрамына кіретін органолептикалық бағалау жүргізілді. Ет паштеттерінің тәжірибелік үлгілерін өндірістік байқаудан өткізу жүргізілді.

Микробиологиялық зерттеулердің нәтижелері «Ет паштеті» консервілерінде ЕПА қоректік ортада өсірілген мезофильді аэробты және факультативтік-анаэробты микроорганизмдер (МАФАнМ) саны сенімді интервалдан аспайды және 6,8 х 102 КОЕ/г құрайды. Консервілердің радиологиялық көрсеткіштерінің деректері бойынша радионуклидтердің құрамы СанЕжН талаптарына сәйкес келеді және дайын өнімдерді радиологиялық қауіпсіз шикізат ретінде қарауға мүмкіндік беретін қауіпсіз деңгейде болады деген қорытынды жасауға болады.

Кілтті сөздер: функционалды тамақтану, ет өнімі, паштет, ТБК, технология, рецептура.

**М. Б. Ребезов*
Московский государственный университет
технологий и управления имени К. Г. Разумовского,
Российская Федерация, г. Москва.
Материал поступил в редакцию 11.03.22.

СОЗДАНИЕ НОВОГО ВИДА МЯСНОГО ПАШТЕТА, ОБЛАДАЮЩЕГО РАДИОПРОТЕКТОРНЫМИ СВОЙСТВАМИ

Статья посвящена исследованию свойств и показателей качества функциональных продуктов на мясной основе, которые снижают риск токсических отравлений организма радионуклидами и солями тяжелых металлов. Создание нового мясного продукта, который обладает радиопротекторными свойствами, способный выводить из организма соли тяжелых металлов, укрепляющий его защитные функции, представляет интерес в качестве приоритетного направления в пищевой промышленности. В статье проанализирована значимость разработки мясных продуктов,

обладающих радиопротекторными свойствами. Рассмотрены компоненты и их полезные свойства, определены физико-химические свойства, микробиологические показатели, аминокислотный состав, радиологические показатели и проведена органолептическая оценка входящие в состав мясных паштетов. Проведена производственная апробация опытных образцов мясных паштетов.

Результаты микробиологических исследований показали, что в консервах «Мясной паштет» количество мезофильных аэробных и факультативно-анаэробных микроорганизмов (КМАФАнМ), выращенных на питательной среде МПА не превышает доверительного интервала и составляет 6,8 х 102 КОЕ/г. По данным радиологических показателей консервов можно сделать вывод, что содержание радионуклидов соответствует требованиям СанПиН допустимых уровней и находится на безопасном уровне, позволяющего рассматривать готовые продукты как радиологически безопасное сырье.

Ключевые слова: функциональное питание, мясной продукт, паштет, НБК, технология, рецептура.

Теруге 11.03.2022 ж. жіберілді. Басуға 25.03.2022 ж. қол қойылды.
Электронды баспа
2,86 МБ RAM
Шартты баспа табағы 8,75.
Таралымы 300 дана. Бағасы келісібойынша.
Компьютерде беттеген А. К. Темиргалинова
Корректорлар: А. Р. Омарова, Т. К. Оразалинова
Тапсырыс № 3962

Сдано в набор 11.03.2022 г. Подписано в печать 25.03.2022 г.
Электронное издание
2,86 МБ RAM
Усл. п. л. 8,75. Тираж 300 экз. Цена договорная.
Компьютерная верстка А. К. Темиргалинова
Корректоры: А. Р. Омарова, Т. К. Оразалинова
Заказ № 3962

«Toraighyrov University» баспасынан басылып шығарылған
Торайғыров университеті
Павлодар мемлекеттік университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.

«Toraighyrov University» баспасы
Торайғыров университеті
140008, Павлодар қ., Ломов к., 64, 137 каб.
8 (7182) 67-36-69
e-mail: kereku@tou.edu.kz
www.vestnik-pm.tou.edu.kz