INSTITUT ZA HIGIJENU I TEHNOLOGIJU MESA – BEOGRAD

INSTITUTE OF MEAT HYGIENE AND TECHNOLOGY – BELGRADE

ZBORNIK KRATKIH SADRŽAJA

BOOK OF ABSTRACTS

MEĐUNARODNO 54. SAVETOVANJE INDUSTRIJE MESA

INTERNATIONAL 54th MEAT INDUSTRY CONFERENCE

SAVREMENI TRENDOVI U PROIZVODNJI I PRERADI MESA

CURRENT TRENDS IN MEAT PRODUCTION AND PROCESSING

Vrnjačka Banja – Hotel "Zvezda"

18-20. juni 2007. godine

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INSTITUT ZA HIGIJENU I TEHNOLOGIJU MESA – BEOGRAD
INSTITUTE OF MEAT HYGIENE AND TECHNOLOGY – BELGRADE

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SADRŽAJ/*CONTENTS*

Strana

8. Pregled tendencija proizvodnje goveđeg, svinjskog i živinskog mesa u svetu, po kontinentima i pojedinim zemljama
   Review of World Trends in Beef, Pork and Poultry Meat Production by Continents and Some Countries
   T. Stamenković, Biljana Dević, D. Milićević

9. Proizvodnja svinjskog mesa u svetu i njene tendencije
   World Pork Production and its Trends
   T. Stamenković, D. Milićević, Biljana Dević

10. Obeležja proizvodnje goveđeg mesa u Republici Srbiji
    Characteristics of Beef Production in the Republic of Serbia
    B. Vlahović, Đ. Laćarac, G. Kunovac, M. Mažić

11. Savremeni načini snabdevanja i pripreme goveđeg mesa
    Contemporary Supply and Preparation of Beef
    S. Čepin

12. Uticaj kvaliteta polutki na prinos mesa razvrstanog po kategorijama za preradu i utvrđivanje kriterijuma za standardizaciju
    Influence of Carcass Quality on Meat Yield Classified by Categories for Processing and Defining of Criteria for Standardization
    Ljiljana Petrović, Tatjana Tasić, V. Tomović, Natalija Džinić, P. Ikonić, Jasmina Adamović, Nataša Petrović

13. Uticaj kvaliteta svinjskih polutki na ekonomiku poslovanja u veleprodaji mesa
    The Influence of Pork Carcasses Side Quality on Meat Market Economy
    Đ. Okanović, Ljiljana Petrović, Natalija Džinić, V. Tomović, V. Zekić, Nada Kurjakov

14. Faktori koji modifikuju sadržaj mutagenih supstanci u mesu
    Factors Modifying Contents of Mutagenic Substances in Meat
    R. Borisyuk, A. Shleykin

15. Histološke i histomorfološke karakteristike mišićnih vlakana pitomih svinja raznih rasa
    Histological and Histomorphological Characteristics of Muscle Fibres from Different Domestic Pig Breeds
    Vjera Pribiš, Lj. Lević, M. Popović, Dragana Plavšić

16. Epidemiologija *Escherichia coli* O157 u goveda/goveđem mesu od farme do viljuške: podaci iz literature
    Epidemiology of Escherichia coli O157 in Cattle/Beef from Farm to Fork: Literature Data
    I. Nastasijević, Radmila Mitrović, S. Bunčić

17. Nalaz salmonela u stočnom depou klanica za svinje
Examination of Salmonella spp. in the Lairage of Pig Abattoirs
N. Karabasil, Nataša Kilibarda, M.Ž. Baltić, Mirjana Dimitrijević, V. Teodorović

18. Meso pilića - namirnica ili prenosilac *Campylobacter jejuni*
Chicken Meat – Foodstuff or Campylobacter jejuni Vector
Snežana Ivanović, M. Žutić, T. Kočovski

II TEMATSKA OBLAST: Prerada i promet mesa
2nd THEMATIC TOPIC: *Processing and Trade of Meat*

1. Uticaj kombinovanog načina salamurenja na pojedine mišiće svinjskog trupa
Effects of Combined Brining on Particular Pork Muscles
A. Kuzelov, O. Kirovska Cigulevska

2. Naučno utemeljenje uslova za termičku obradu nove generacije paštete od prepeličijeg mesa u konzervi
Scientific Substantiation of Rational Conditions for Thermal Processing of New Generation Canned Pâté from Quail's Meat
A.B. Lisitsyn, Ludmila B. Smetanina, A.N. Zakharov, B.A. Lisitsyn

3. Nova tehnologija proizvodnje biljno-mesnih ekstrudata sa visokim funkcionalnim osobinama
New Technology of Production of Plant-Meat Extrudates with High Functional Properties
A.B. Lisitsyn, Valentina B. Krylova, Tatyana V. Gustova, Olga N. Novikova

4. Važniji parametri kvaliteta fermentisanih polusuvih kobasica proizvedenih sa masnim tkivom i biljnim mastima
Important Quality Parameters of Fermented Semi-Dry Sausages Produced with Pork Backfat and Vegetal Fat
D. Vasilev, M. Tubić, Snežana Saičić, Svetlana Nonković, Mirjana Milanović-Stevanović, I. Vuković

5. Važniji parametri kvaliteta i održivost fermentisanih kobasica za mazanje
Important Quality Parameters and Shelf-Life of Fermented Spreadable Sausages
D. Vasilev, M. Tubić, Snežana Saičić, Mirjana Dimitrijević, Mirjana Milanović-Stevanović, I. Vuković

6. Značaj aktivnosti vode i pH vrednosti u određivanju održivosti kobasica
The Importance of Water Activity and pH Values in Determination of Storage Life of Sausages
M.H. Iskakov, E.V. Fatyanov, Ch.K. Avylov

7. Upotreba *Lactobacillus sakei* I 151 u proizvodnji Sremske kobasice
   Usage of Lactobacillus sakei I 151 in the Production of Sremska Sausage
   Slavica Vesković Moračanin, D. Obradović, Dragica Karan

8. Prikaz nekih od parametara kvaliteta Sremske kobasice proizvedene sa *Lactobacillus sakei* I 151
   Overview of Some Quality Parameters of Sremska Sausage Produced with Lactobacillus sakei I 151
   Dragica Karan, Slavica Vesković Moračanin, Snežana Saičić

9. Hemijske karakteristike hemoglobinske frakcije dobijene iz krvi svinja
   Chemical Properties of Hemoglobin Fraction Obtained from Porcine Blood
   Vesna Matekalo-Sverak, L. Turubatović, Dejana Trbović, Jelena Babić, D. Milićević

10. Mogućnosti primene proizvoda Algel 55 za rekonstrukciju komadnog i mlevenog mesa i drugih sirovina u preradi mesa
    Possibilities of use of Product Algel 55 for Reconstitution of Meat Pieces, Ground Meat and Other Raw Materials in Meat Processing
    P. Modić, U. Spinetta, G. D'Avenia

11. Proučavanje mogućnosti upotrebe dihidrokvercetina za ujednačavanje kvaliteta kobasica proizvedenih uz korišćenje MDPM
    Study of Possibility of Dihidroquercetin Application for Stabilization of Sausage Quality Manufactured with the Use of MDPM
    Anastasiya A. Semenova, Tatyana G. Kuznetsova, Victoriya V. Nasonova

12. Nutrivni i senzorni kvalitet barenih kobasica izrađenih sa dodatkom prehrambenih vlakana
    Nutritional and Sensorial Quality of Cooked Sausages Made with Addition of Dietary Fibers
    Ljiljana Petrović, V. Tomović, Natalija Džinić, Biljana Pešović, P. Salitrežić, B. Šojić, Marija Jokanović

13. Problem genetski modifikovanih biljnih vlakana, potraga za alternativnim rešenjima
    Problem of Genetically Modified Plant Fibers, Search for Alternative Solutions
    Tatyana M. Geero, Olga I. Chirkova

14. Superkritični CO_2 ekstrakti iz biljaka kao aditivi u proizvodnji i preradi mesa
    Supercritical CO_2 Plant Extracts as Additives for Meat Industry
    Irena Žižović, Nada Aničić, Jasna Ivanović, S. Petrović

15. Sadržaj aditiva u nekim vrstama proizvoda od mesa
The Content of Additives in some Kinds of Meat Products
D. Jančić, Milena Đurišić

16. Aditivi i zdravstvena ispravnost hrane
Additives and Food Safety
D. Krstić, G. Golubović, Z. Basić, A. Ćulafić

17. Biološki ogled na infuzorijama u cilju određivanja toksičnosti fermentisanog pirinča
Biotesting of Fermented Rice on Infusoria for the Determination of its Toxic Properties
Anastasiya A. Semenova, L.A. Veretov, Elena G. Cheremnykh

18. Inhibitorni efekat ekstrakata začina na rast *Penicillium aurantiogriseum* i *Penicillium corylophilum*
Inhibitory Effect of Spice Extracts on Growth of Penicillium aurantiogriseum and Penicillium corylophilum
Gordana Dimić, Sunčica Kocić-Tanackov, Dragana Karalić

19. Ambalaža i zdravstvena ispravnost namirnica
Packaging Materials and Food Safety
G. Golubović, D. Krstić, Z. Basić, D. Ilić, A. Ćulafić

20. Uticaj pakovanja sa primenom vakuuma na senzorne i bakteriološke promene proizvoda od mesa u prometu
Effect of Vacuum Packaging on Sensory and Bacteriological Changes of Meat Products in Trade
T. Stamenković

21. Uticaj različitih smeša gasova na boju i mikrobiološku ispravnost junećeg mesa pakovanog u zaštitnoj atmosferi
Effect of Different Gas Mixtures on Colour and Microbiological Safety of Beef Packaged in Modified Atmosphere
M. Milijašević, B. Velebit, Jelena Jovanović

22. Monitoring tržišta mesnih proizvoda u Centralnom Federalnom regionu u Rusiji
Monitoring of Meat Products Market in the Central Federal Region of Russia
A.N. Zakharov, M.H. Iskakov, Galina A. Berlova, M.N. Smirnov

23. Nacionalni standardi za ekološki (organski) proizvedene mesne sirovine namenjene proizvodnji dečije hrane
National Standards for Ecological (Organic) Meat Raw Materials for Production of Child Nutrition Products
Aleksandra V. Ustinova, A.S. Dydykin, N.V. Timoshenko

III TEMATSKA OBLAST: Ispravnost i kvalitet mesa i proizvoda od mesa
3rd THEMATIC TOPIC: *Meat and Meat Products Safety and Quality*

1. Zdravstvena ispravnost mlevenog mesa na epizootiološkom području VSI "Kraljevo"
   Safety of Minced Meat in Epizootiological Region VSI "Kraljevo"
   P. Popović, D. Nenadić, Vesna Kaljević, Marija Vukašinović, A. Žarković

2. Analiza lipidnog sastava leskovačkog roštilj mesa
   Lipid Composition Analysis of Leskovac Grilled Meat
   Nada Nikolić, Z. Todorović, N. Radulović, M. Stanković, M. Lazić

3. Hemijski i senzorni pokazatelji kvaliteta proizvoda u tipu "pasterizovane konzerve od mesa u komadima"
   Chemical and Sensory Parameters of Quality of "Cooked Ham Type Products"
   D. Živković, Marija Perunović, Marijana Jovanović, Vesna Mladenović, Maja Lakić

4. Sadržaj ukupnog fosfora u proizvodima od mesa
   Total Phosphorus Content in Meat Products
   Snežana Saičić, Danijela Vranić, Dejana Trbović, Nataša Pavlov

5. Sadržaj nitrita i ukupnih fosfata u proizvodima od mesa različitih proizvođača sa teritorije Južnobačkog i Sremskog okruga tokom 2006. godine
   Contents of Nitrite and Total Phosphates in Meat Products of the Producers in Southern Backa and Srem Region in 2006
   Nadežda Prica, Jelena Petrović, Olga Rackov

6. Ispitivanje svojstava gotovih proizvoda od mesa proizvedenih u omotačima od selektivno propustljivog materijala
   Investigation of the Properties of Ready Meat Products Manufactured in Selectively-Permeable Casing Material
   Elena A. Evstafyeva, Praskovya M. Golovanova, Elena K. Zlobina, Olesya A. Sorokina, Ekaterina E. Timofeyeva

7. Upotreba histološke metode u proceni funkcionalnih svojstava preparata za salamurenje
   Use of Histological Method for the Evaluation of Functional Properties of Brine Preparations
   Anastasiya A. Semenova, Tatyana G. Kuznetsova, Elena K. Tuniyeva

8. Identifikacija sirovinskog sastava mesnih i biljnih proizvoda metodom PCR u cilju otkrivanja falsifikata
   Identification of Raw Materials Composition of Meat and Plant Products by Polymerase-Chain Reaction to Reveal Adulteration
   Tatyana A. Fomina

9. Utvrđivanje zastupljenosti *Lactobacillus sakei* u Sremskoj kobasici konvencionalnim metodama i PCR tehnikom
   Determination of Presence of Lactobacillus sakei in Sremska Sausage by Conventional Methods and PCR Technique
   Branka Borović, Slavica Vesković-Moračanin, Aleksandra Stjepanović

10. Razvoj brze metode za određivanje *Listeria monocytogenes* u hrani pomoću real time PCR
    Development of Rapid Method for Revealing Listeria monocytogenes in Foods by Real Time PCR
    Anna A. Braguta

11. Antimikrobna rezistencija zoonotskih patogena poreklom iz mesa živine
    Antimicrobial Resistance of Zoonotic Pathogens Originating from Poultry Meat
    Jelena Petrović, M.Ž. Baltić, R. Kljajić

12. Poređenje metoda uzorkovanja i ispitivanja mikrobiološkog statusa svinjskih polutki
    Comparison of Methods for Sampling and Testing of Microbiological Status of Pork Half Carcasses
    Tamara Šakota, Marija Škrinjar, Ljiljana Petrović, Jasmina Adamović

13. Izvori mikološke i mikotoksikološke kontaminacije na suvomesnatim proizvodima
    Sources of Mycological and Mycotoxicological Contamination of Smoked Meat Products
    Snježana Mandić, R. Grujić, Ljiljana Topalić-Trifunović, R. Đurica, Sandra Stojković

14. Značaj mikološke kontrole u pogonima za proizvodnju mesa i proizvoda od mesa
    Importance of Mycological Control in Plants for Production of Meat and Meat Products
    Snježana Mandić, R. Grujić, Ljiljana Topalović-Trifunović, R. Đurica, Sandra Stojković

15. Izolovanje i identifikacija kserofilnih plesni iz začina koji se koriste u industriji mesa
    Isolation and Identification of Xerophilic Fungi from Spices Used in the Meat Industry
    Vesna Janković, Marija Škrinjar, Jelena Vukojević, Branka Borović, M. Radmili

16. Proizvodnja aflatoksina B1 od strane plesni izolovanih iz začina koji se koriste u industriji mesa
Production of Aflatoxin B1 by Moulds Isolated from Spices for Meat Processing Industry
Lj. Šarić, Marija Škrinjar

17. Monitoring nakupljanja toksičnih elemenata (kadmijum, olovo) u organima i tkivima svinja iz regiona Rostov i Lipetsk Ruske Federacije
Monitoring of Accumulation of Toxic Elements (Cadmium, Lead) in Organs and Tissues of Pigs in Rostov and Lipetsk Regions of the Russian Federation
Yulia E. Kalinova, Irina M. Tchernoukha, Nataliya L. Vostrikova, Tatyana V. Ilyina, Olga N. Orlova

18. Određivanje metabolita nitrofurana u tkivima životinja i primarnim proizvodima animalnog porekla primenom tečne hromatografije sa masenom detekcijom (LC-MS/MS)
Determination of the Metabolites of Nitrofuran Antibiotics in Animal Tissues and Primary Animal Products by Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)
Valentina Batas, Aurelija Spirić, S. Janković, R. Petronijević, D. Milićević

19. Implementacija HACCP sistema u mesnoj industriji i klanici "Sveti Nikole", Republika Makedonija
Implementing of HACCP System in Meat Industry and Abattoir "Sveti Nikole", R. Macedonia
O. Kirovska Cigulevska, A. Kuzelov

20. Odgovornost proizvođača u integrisanom sistemu bezbednosti hrane
Responsibility of Manufacturers in the Integrated Food Safety System
Ružica Milovanović

21. Mikrobiološka slika prirodnih začina koji se koriste u mesnoj industriji
Microbiological Features of Natural Spices used in Meat Industry
Vesna Kalaba, S. Dojčinović, Lj. Kalaba

I TEMATSKA OBLAST
1st THEMATIC TOPIC

USLOVI ZA UZGOJ ŽIVOTINJA I PROIZVODNJA MESA
CONDITIONS FOR ANIMAL BREEDING AND MEAT PRODUCTION

I-1

UTICAJ MINAZELA NA PRIRAST JUNADI U TOVU

V. Dosković, Snežana Bogosavljević-Bošković, Vera Radović, R. Đoković

U radu su prikazani rezultati uticaja dodavanja zeolitskog preparata Minazel (ITNMS, Beograd) na telesne mase, ukupan i prosečan dnevni prirast junadi u tovu. U ogledu je bilo 22 junadi muškog pola, domaće šarene rase u tipu simentalca, podeljenih u dve ogledne grupe. Ogled ishrane je trajao 155 dana. Dnevni obrok junadi sastojao se od kabaste hrane (livadsko seno) i koncentrovane krmne smeše. Ogledna grupa (O-I, n=11) dobijala je preko krmne smeše Minazel u količini od 0,5%, a kontrolna grupa (K, n=11) je hranjena krmnom smešom istog sirovinskog sastava, ali bez zeolitskog preparata. U toku ogleda, junad su merena 1-og, 31-og, 61-og, 91-og, 121-og i 155-og dana tova. Prosečna telesna masa junadi na početku tova bila je 142,36kg/grlu (K), odnosno 142,45kg/grlu (O-I). Na kraju ogleda junad iz K grupe su ostvarila prosečnu telesnu masu 332,54kg/grlu i prosečan dnevni prirast od 1,227kg/grlu/dan, a junad iz O-I grupe 336,45kg/grlu i prosečan dnevni prirast od 1,252kg/grlu/dan. Ogledna grupa (O-I), koja je obrokom dobijala Minazel (0,5%) imala je veće telesne mase, veći ukupan prirast i veći prosečan dnevni prirast u svim oglednim periodima u odnosu na kontrolnu grupu (K). Utvrđene razlike u ukupnim prirastima (3,82kg/grlu) i prosečnim dnevnim prirastima (25gr/grlu/dan) između oglednih grupa na kraju tova nisu bile statistički značajne (P>0,05).

Ključne reči: junad, telesna masa, prirast, Minazel

AUTORI: Mr Vladimir Dosković, prof.dr Snežana Bogosavljević-Bošković, doc dr Vera Radović, doc dr Radojica Đoković, Agronomski fakultet, Čačak

EFFECT OF MINAZEL ON WEIGHT GAIN IN FATTENING BEEF CATTLE

V. Doskovic, Snezana Bogosavljevic-Boskovic, Vera Radovic, R. Djokovic

The paper presents results of the effect of Minazel zeolite supplements (ITNMS – Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade) on body weights and total and average daily gains in fattening beef cattle. The trial included 22 male beef cattle of Simmental type domestic spotted breed divided into two trial groups. The feeding trial lasted 155 days. A daily ration included fodder (meadow hay) and a compound feed concentrate. The trial group (0-I, n=11) was fed Minazel through the compound feed at the rate of 0.5 %, and the control group (C, n=11) was fed the compound feed having the same composition but without the zeolite supplement. During the trial, the cattle were weighed on the 1st, 31st, 61st, 91st, 121st and 155th fattening days. Average weight at the beginning of the fattening period was 142.36 kg/head (C) or 142.45 kg/head (0-I). At the end of the trial, the C group cattle and O-I cattle achieved an average body weight of 332.54 kg/head and 336.45 kg/head and an average daily gain of 1.227 kg/head/day and 1.252 kg/head/day, respectively. The trial group (O-I) fed Minazel supplements (0.5%) had higher body weights, higher total gains and increased average daily gains in all the trial periods compared to the control (C). The

established differences in total gains (3.82 kg/head) and average daily gains (25 gr/head/day) between the trial groups at the end of the fattening period were not statistically significant (P>0.05).

Key words: beef cattle, body weight, weight gain, Minazel

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I-2

UTICAJ Se RAZLIČITOG POREKLA U ISHRANI SVINJA NA TEHNOLOŠKA I NUTRITIVNA SVOJSTVA *M. SEMIMEMBRANOSUS**

Ljiljana Petrović, V. Tomović, Natalija Džinić, P. Ikonić, Tatjana Tasić, Dragica Vidarić, Marina Vukić-Vranješ, Jasmina Kusturin

U ovom radu komparativno su ispitana tehnološka i nutritivna svojstva *M. semimembranosus* (SM) sa polutki svinja hranjenih smešama komponovanim na uobičajeni način sa dodatkom neorganski vezanog selena (I grupa) i organski vezanog selena (II grupa) u količini od 0,2 mg/kg hraniva.

Tehnološki kvalitet SM ispitan je određivanjem pH_i, pH_k, $boje_k$, sposobnosti vezivanja vode (SVV_k) i gubitka mase ceđenjem za 48 i 120 sati. Nutritivni kvalitet SM utvrđen je određivanjem sadržaja vode, proteina, slobodne masti, relativnog sadržaja proteina vezivnog tkiva u proteinima mesa (RSPVT u PM) i sadržaja ukupnog pepela.

Analizom dobijenih rezultata zaključeno je da je neorganski vezan selen u ishrani svinja ispoljio veći uticaj na kvalitet mesa nego organski vezan selen. Naime, prosečan kvalitet ispitanih SM I grupe (n = 18) bio je CČN (normalan), a II grupe (n = 19) BČN (bledi, čvrsti, nevodnjikavi). Izvor selena uglavnom nije ispoljio značajan uticaj na nutritivni kvalitet.

Ključne reči: ishrana, neorganski i organski Se, kvalitet mesa

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INFLUENCE OF DIFFERENT ORIGIN Se IN PIG NUTRITION ON TECHNOLOGICAL AND NUTRITIVE PROPERTIES OF *M. SEMIMEMBRANOSUS*

Ljiljana Petrovic, V. Tomovic, Natalija Dzinic, P. Ikonic, Tatjana Tasic, Dragica Vidaric, Marina Vukic-Vranjes, Jasmina Kusturin

Technological and nutritive characteristics of *M. semimembranosus* (SM) from carcasses of pigs fed different types of feed were investigated. The mixtures were prepared in the usual way with addition on inorganically (I group) and organically bound selenium - Se (II group), 0.2 mg/kg of feed.

pH_i, pH_u, $colour_u$, water holding capacity (WHC_u) and drip loss after 48 and 120 hours were determined as parameters of technological quality. The nutritive quality was obtained by determining the content of water, proteins, free fat, relative content of connective tissue proteins in meat proteins (RCCTP in MP) and total ash content.

The inorganically bound Se in feed had a stronger effect on meat quality compared to organically bound Se. Namely, the average quality of SM of the I group (n = 18) was RFN (normal), and of the II group (n = 19) PFN (pale, firm, nonexudative). No significant effect of Se on nutritive quality was determined.

Key words: nutrition, inorganic and organic Se, meat quality

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I-3

MOGUĆI RIZICI UPOTREBE KARBADOKSA U ISHRANI SVINJA I UČESTALOST POJAVE NJEGOVIH REZIDUA U ORGANIMA SVINJA

Jelena Babić, Tatjana Radičević, S. Stefanović, S. Janković i M. Milijašević

Karbadoks je sintetski antimikrobni lek koji pripada grupi kinoksalin-dioksida. Veoma je aktivan protiv *Brachyspira hyodysenteriae,* uzročnika dizenterije svinja kao i protiv *Salmonella*, *Campylobacter, Escherichia coli, Proteus, Psuedomonas, Staphyloccocus* vrsta, uzročnika gastroenteropatija svinja. Kao dodatak stočnoj hrani, osim zbog njegovog antimikrobnog dejstva, karbadoks je korišćen i kao stimulator rasta za povećanje prirasta i poboljšanje iskorišćenja hrane kod svinja. Karbadoks i njegovi metaboliti, pre svega dezoksikarbadoks, smatraju se karcinogenima i mutagenima (WHO/JECFA 1990, 2003). Na osnovu eksperimenata i podataka o toksičnosti, Evropska unija je u decembru 1998. godine zabranila upotrebu karbadoksa kao stimulatora rasta u ishrani svinja (Commission Regulation (EC) No 2788/98 od 22.12.1998., OJ L347).

Posle oralne primene, u tkivu životinja mogu da se dokažu rezidue karbadoksa i njegovi metaboliti – dezoksikarbadoks, kvinoksalin – 1,4 – di – N – oksid – 2 – karboksaldehid i kvinoksalin-2-karboksilna kiselina (QCA). QCA je najpostojaniji metabolit karbadoksa i označena je kao marker rezidua za karbadoks.

Na 36-om sastanku JECFA (Joint FAO/WHO Expert Committee on Food Additives) 1990. godine predložene su maksimalno dozvoljene količine (MDK) za QCA, i to: u jetri svinja 30μg/kg i mišićnom tkivu 5μg/kg. Međutim, 2003. godine, na 60-om sastanku JECFA, nakon novih toksikoloških podataka i dokazane karcinogenosti dezoksikarbadoksa, komitet je odlučio da povuče MDK za QCA kao marker rezidue za karbadoks.

U oviru Nacionalnog Programa za kontrolu i sistematsko praćenje rezidua u životinjama i proizvodima animalnog porekla, određuje se prisustvo metabolita karbadoksa, kvinoksalin2-karboksilne kiseline u jetri svinja metodom gasne hromatografije sa masenom detekcijom (GC/MS), koja se propisima EU prihvata kao konfirmativna (potvrđujuća) metoda.

Ključne reči: karbadoks, QCA, GC/MS

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POSSIBLE RISKS OF USING CARBADOX IN SWINE NUTRITION AND THE OCCURRENCE OF CARBADOX RESIDUES IN SWINE ORGANS

Jelena Babic, Tatjana Radicevic, S. Stefanovic, S. Jankovic and M. Milijasevic

Carbadox is a synthetic antimicrobial drug which belongs to the group of quinoxaline-dioxide. It is very efficient against *Brachyspira hyodysenteriae* that causes dysentery in swine, and against

Salmonella, Campylobacter, Escherihia coli, Proteus, Psuedomonas, Staphyloccocus, the species which cause gastroenteropathy in swine. As feed additive, besides its antimicrobial effect, carbadox is also used as growth promoter to increase the rate of weight gain and to improve feed efficiency in swine. Carbadox and its metabolites, above all desoxicarbadox, are considered to be carcinogenic and mutagenic agents (WHO/JECFA 1990, 2003). On the basis of experiments and toxicity data, EU banned the use of carbadox as growth promoter in porcine feed in December 1998 (Commission Regulation (EC) No 2788/98 dated December 22nd, 1998, OJ L347).

After oral administration of carbadox, its residues and its metabolites – desoxicarbadox, quionoxaline–1,4–di–N–oxide–2–carboxaldehyde and quionoxaline–2–carboxylic acid (QCA) can be found in animal tissue. QCA is the most persistent metabolite of carbadox and was designated as the marker residue for carbadox.

At the 36th JECFA Meeting (Joint FAO/WHO Expert Committee on Food Additives) held in 1990, the Committee recommeded Maximum Residue Limits (MRLs) for QCA of 30µg/kg in swine liver and 5µg/kg in muscle tissue. However, at the 60th JECFA Meeting in 2003, due to new toxicity data and proven carcinogenity of desoxycarbadox, the Committee decided to withdraw MRLs for QCA as residue marker for carbadox.

Within the National Programme for Control and Systematic Monitoring of Residues in Live Animals and Products of Animal Origin the residue of carbadox metabolite - QCA is determined in swine liver using gas chromatography mass spectrometry (GC/MS), method that has been accepted by the EU as a confirmative method.

Key words: carbadox, QCA, GC/MS

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I-4

EFEKTI DODAVANJA FITAZE U HRANU PILIĆA U TOVU NA ODABRANE PARAMETRE KLANIČNIH OSOBINA MESA

Vera Radović, Snežana Bogosavljević-Bošković, V. Dosković

U poslednje vreme nameće se novi pristup u vezi sa problemom upotrebe mineralnih izvora fosfora u ishrani živine. Cilj je smenjenje nivoa mineralnih izvora P, ili potpuno isključenje iz obroka životinja. U takve formulacije obroka dodaje se enzim fitaza.

Cilj ovoga rada bio je da se ispitaju efekti dodavanja enzima fitaze u smeše za ishranu pilića u tovu sa različitim nivoom mineralnog izvora P (dikalcijum-fosfat), na odabrane parametre klaničnih osobina mesa (udeo i prinos pojedinih kategorija mesa obrađenih trupova pilića).

Ogledom je bilo obuhvaćeno 220 pilića, provenijence *Arbor Acres*, podeljenih u dve grupe (po 110 pilića u grupi). Prva grupa je bila kontrolna bez dodatka enzima fitaze. Druga grupa je bila ogledna, koja je u smešama za ishranu dobijala enzim fitazu (0,1%), uz dvostruko manju zastupljenost DKF.

Na kraju tova (42 dana) izvršeno je žrtvovanje po 14 pilića (7 muških + 7 ženskih) iz svake grupe.

Dobijeni rezultati su pokazali da se dodatkom enzima fitaze (0,1%) u smešu za ishranu pilića, uz dvostruko niži nivo DKF, postižu pozitivni efekti u pogledu proizvodnih performansi: završnih TM, a u skladu sa tim i boljim prinosom i udelom mesa I i II kategorije. Razlike srednjih vrednosti između ispitivanih grupa bile su statistički značajne. ($P<0,05$).

Ključne reči: pilići, fitaza, fosfor, kategrije mesa

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EFFECTS OF ADDING PHYTASE INTO THE DIET FOR FATTENING CHICKENS ON THE SELECTED PARAMETERS OF DRESSING TRAITS OF MEAT

Vera Radovic, Snezana Bogosavljevic-Boskovic, V. Doskovic

Since recently, the new approach, considering the problem of using mineral sources of phosphorus in chicken diet, has been implemented. The aim is to decrease the level of mineral sources of P or their total elimination from animal diets. These kinds of diet formulations are added with phytase enzyme.

The main purpose of this paper was to study the effects of adding phytase enzyme into composition of diets for fattening chicken with different levels of mineral sources of P (dicalcium phosphate) on

selected parameters of dressing traits of meat (share and yield of some meat categories in dressed carcasses).

The experiment included 220 Arbor Acres chickens divided into two groups (each group contained 110 chickens). The first group was the control one, without addition of phytase enzyme. The second group was the experimental, which received phytase enzyme (0.1%) with double less share of dicalcium phosphate in diets.

At the end of fattening period (42 days) 14 chickens (7 female+7male) out of each group were sacrified.

The obtained results showed that by addition of phytase enzyme (0.1%) to the compositions for chicken feed mixtures with double lower level of dicalcium phosphate, positive effects, considering production performances, are accomplished: final body weights, and considering that, also the better gain and share of meat of the first and the second category. The differences of mean values among the examined groups were statistically significant ($P<0.05$).

Key words: chickens, phytase, phosphorus, meat categories

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I-5

ZAČINSKO BILJE KAO DODATAK U ISHRANI BROJLERA I SENZORNI KVALITET MESA

Tatjana Savković, Natalija Džinić, S. Tojagić

U radu je ispitivan uticaj začinskog bilja na senzorna svojstva mesa brojlera. Začinsko bilje pod komercijalnim nazivom je proizvod koji predstavlja koncentraciju biljnih eteričih ulja (karanfilić, rtanjski čaj i majčina dušica). Začinsko bilje je dodavano u hranu za brojlere tokom celog perioda tova. Na osnovu dobijenih rezultata došlo se do zaključka da dodavanjem začinskog bilja u hranu za piliće dolazi do pozitivnih senzornih svojstava mesa, a ujedno je dokazano da je i u laboratorijskim uslovima moguća kontrola patogenih mikroorganizama jer obroci nisu u sebi sadržali antibiotike.

Ključne reči: začinsko bilje, brojlersko meso,kulinarna obrada, senzorna svojstva

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AROMATIC HERBS AS SUPPLEMENT IN BROILER'S NUTRITION AND SENSORIC QUALITY OF MEAT

Tatjana Savkovic, Natalija Dzinic, S. Tojagic

The influence of aromatic herbs on sensory properties of broiler meat was investigated. Aromatic herbs, under the commercial name, is the product that represents concentrated etheric oils (cloves, savory, thyme). This product was added to broiler's feed during the whole period of fattening. On the basis of the obtained results, we came to the conclusion that addition of etheric oils of aromatic herbs to broiler's feed resulted in positive sensory properties of meat. At the same time, it was proved that in laboratory conditions it was possible to control pathogenic microorganisms since feed did not contain antibiotics.

Key words: spices mixture, broiler's meat, cooking, sensoric properties

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I-6

UTICAJ DUŽINE TRANSPORTA SVINJA NA KVALITET MESA

M. Stojanovski, S. Presilski, Gordana Dimitrovska

Predmet rada je uticaj dužine transporta svinja na kvalitet mesa i pojava BMV mesa. Ispitano je 40 svinja sa dve farme različite udaljenosti. Svinje sa farme A udaljene su od klanice 18 km, a svinje farme B 63 km. Prosečna telesna masa svinja iznosila je 109 kg. Uticaj dužine transporta svinja i vremena odmora na kvalitet mesa bio je praćen preko određivanja pH vrednosti mesa, i to: 45 minuta i 24 časa nakon klanja. Kod svinja sa farme A pojava BMV iznosi 25%, a sa farme B 40%. Na osnovu dobijenih rezultata, utvrđena je pojava BMV mesa, što ukazuje na to da dužina transporta ima uticaj na ovu pojavu.

Ključne reči: dužina transporta, kvalitet mesa, BMV meso

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EFFECT OF TRANSPOTRATION TIME ON MEAT QUALITY OF PIGS

M. Stojanovski, S. Presilski, Gordana Dimitrovska

The subject of this paper is the influence of pig's transportation time on the quality of pork, and appearance of the PSE meat. Total of 40 pigs from two farms on different distances were tested. The pigs from the farm A were 18 km far from the butchery, and the pigs from the farm B 63 km. The average body mass of pigs was 109 kg. The influence of the pig's transportation time and the rest time on the quality of meat was examined by determination of pH-value of meat 45 minutes and 24 hours after slaughter. In pigs from farm A, occurrence of PSE was 25%, and from farm B 40%. On the basis of the obtained results, appearance of PSE meat was established, which indicates that transportation time had influence to this occurrence.

Keywords: transportation time, meat quality, PSE meat

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I-7

ISPITIVANJE ZAVISNOSTI IZMEĐU SADRŽAJA SKATOLA U MASNOM TKIVU I STEPENA IZRAŽENOSTI POLNOG MIRISA U SIROVOJ SLANINI MLADIH NERASTOVA

N. Parunović

U ovom radu određivan je sadržaj skatol ekvivalenta u uzorcima masnog tkiva mladih nerastova, ispitivan je stepen izraženosti polnog mirisa u sirovoj slanini, kao i korelaciona zavisnost između sadržaja skatola u uzorcima masnog tkiva i stepena izraženosti polnog mirisa u sirovoj slanini mladih nerastova.

Sadržaj skatola u masnom tkivu mladih nerastova kreće se od 0 do 1,567 µg/g masnog tkiva. Prosečan sadržaj skatola u masnom tkivu mladih nerastova bio je 0,296 µg/g, a mere varijacije ukazuju na to da je sadržaj skatola veoma varijabilan (Cv je 101,28%).

Prosečne ocene organoleptičkog ispitivanja intenziteta polnog mirisa u sirovoj slanini mladih nerastova kretale su se od 1,55 do 4,33 (9 ocenjivača). Ukupna prosečna ocena intenziteta polnog mirisa sirove slanine mladih nerastova bila je 2,89±0,57. Mere varijacije, odnosno koeficijent varijacije (Cv = 19,73%, Iv = 2,77) govore da ocene intenziteta polnog mirisa sirove slanine mladih nerastova značajno ne variraju.

Koeficijent korelacije između sadržaja skatola i organoleptičke ocene intenziteta polnog mirisa u uzorcima sirove slanine mladih nerastova je Rxy = 0,77 (srednja korelaciona zavisnost).

Od ispitanih uzoraka, 43,33% je sa mirisom koji je moguće identifikovati.

Ključne reči: skatol, sirova slanina, mladi nerastovi

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INVESTIGATION OF CORRELATION BETWEEN SKATOLE CONTENT IN FAT TISSUE AND INTENSITY LEVEL OF SEX ODOR IN RAW FAT OF YOUNG BOARS

N. Parunovic

Skatole equivalent content was determined in samples of fat tissue from young boars. The intensity of boar taint in the raw fat, as well as correlation between skatole content in samples of fat tissue and intensity of boar taint in raw fat of young boars, were investigated.

Skatole content in fat tissue of young boars ranges from 0 to 1.567 µg/g fat tissue. Average contents of skatole in fat tissue of young boars was 0.296 µg/g fat tissue, and variation measures indicate that the skatole content is very variable (Cv = 101.28%).

Average evaluations of organoleptic examination of boar taint in raw fat of young boars ranged from 1.55 to 4.33 (9 evaluators). Total average evaluation of the intensity of boar taint of raw fat of young boars was 2.89±0.57. Measures of variation, or variation coefficient (Cv = 19.73%, Iv = 2.77) show that evaluation of the intensity of boar taint in raw fat of young boars do not vary significantly.

Correlation coefficient between the skatole content and organoleptic evaluation of the intensity of boar taint in raw fat of young boars is Rxy = 0.77 (medium correlation).

Among the examined samples, 43.33 % have the odour which can be identified.

Keywords: skatole, raw fat, young boars

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I-8

PREGLED TENDENCIJA PROIZVODNJE GOVEĐEG, SVINJSKOG I ŽIVINSKOG MESA U SVETU, PO KONTINENTIMA I POJEDINIM ZEMLJAMA

T. Stamenković, Biljana Dević, D. Milićević

Proizvodnja mesa zavisi od prirodnih odlika zemljišta i klimatskih prilika određenog podneblja naše planete, kao i stečenih navika stanovništva za korišćenje pojedinih vrsta mesa u ishrani.

U periodu od 1972. do 1978. godine, u svetu se najviše proizvodilo govеđe meso, da bi od 1978. godine pa nadalje proizvodnja svinjskog mesa preuzela vodeću ulogu. Ona je 1978. godine iznosila 50.313.000 tona, a govеđeg i telećeg mesa 48.655.000 tona. U 1995. godini, proizvodnja svinjskog mesa bila je 83.170.000 tona, živinskog mesa 53.910.000 tona, a govеđeg i telećeg mesa 53.217.000 tona. Ovaj redosled je zadržan do 2005. godine, u kojoj je proizvodnja svinjskog mesa iznosila 102.523.000 tona, živinskog mesa 81.005.000 tona, a govеđeg i telećeg mesa 60.239.000 tona.

U Evropi se od 1972. do 1998. godine najviše proizvodilo svinjsko meso, znatno manje govеđe meso, a najmanje živinsko meso. U 1998. godini usledila je promena u redosledu proizvodnje mesa. U toj godini proizvodnja svinjskog mesa je zadržala vodeće mesto sa 23.002.000 tona, drugo mesto je pripalo živinskom mesu sa količinom od 10.690.000 tona, a treće govеđem i telećem mesu sa 9.046.000 tona. U 2005. godini, proizvodnja svinjskog mesa u Evropi je povećana na 25.627.000 tona. U istoj godini proizvodnja živinskog mesa je iznosila 13.285.000 tona, a govеđeg i telećeg mesa 11.399.000 tona. U Severnoj i Srednjoj Americi, od 1972. do 1990. godine, najviše se proizvodilo govеđe i teleće meso, zatim živinsko meso, a najmanje svinjsko meso. Od 1991. do 1995. godine, najveća proizvodnja je pripadala živinskom mesu, potom govеđem i telećem, a najmanja svinjskom mesu. U 2005. godini, proizvodnja živinskog mesa je iznosila 23.049.000 tona, govеđeg i telećeg mesa 14.972.000 tona i svinjskog mesa 12.755.000 tona. U Aziji, od 1972. do 2005. godine, bila je najveća proizvodnja svinjskog, potom živinskog, a najmanja govеđeg mesa. U 2005. godini, proizvodnja svinjskog mesa je iznosila 58.439.000 tona, živinskog mesa 27.533.000 tona, a govеđeg i telećeg mesa 13.264.000 tona. U Južnoj Americi, Africi i zemljama Okeanije, od 1972. do 2005. godine, najzastupljenija je proizvodnja govеđeg, potom živinskog, a najmanja svinjskog mesa. U Južnoj Americi, 2005. godine, proizvodnja govеđeg i telećeg mesa je 13.421.000 tona, živinskog mesa 12.754.000 tona i svinjskog mesa 4.372.000 tona. U Africi, 2005. godine, proizvodnja govеđeg i telećeg mesa iznosi 4.314.000 tona, živinskog mesa 3.448.000 tona i svinjskog mesa 809.000 tona. U zemljama Okeanije, 2005. godine, proizvodnja govеđeg i telećeg mesa je 2.868.000 tona, živinskog mesa 932.000 tona i svinjskog mesa 526.000 tona.

U pojedinim zemljama proizvedene količine određenih vrsta mesa su različite. U 2005. godini, bilo je više grupa različitih redosleda proizvedenih količina govеđeg, svinjskog i živinskog mesa. Od najveće proizvedene količine mesa određene vrste prema manjoj, u pojedinim zemljama, navodimo sledeće grupe redosleda: govеđe, svinjsko i živinsko meso (Ruska Federacija); svinjsko, govеđe i živinsko meso (Nemačka, Italija, Srbija i Crna Gora i Kanada); svinjsko, živinsko i govеđe meso (Španija, Francuska, Belgija, Holandija, Poljska, Slovenija, Hrvatska, Japan i Kina); živinsko, govеđe i svinjsko meso (SAD, Brazil i V. Britanija); i govеđe, živinsko i svinjsko meso (Australija i Bosna i Hercegovina).

Ključne reči: goveđe i teleće meso, svinjsko meso, živinsko meso, svet, kontinenti, zemlje, tendencije proizvodnje

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REVIEW OF WORLD TRENDS IN BEEF, PORK AND POULTRY MEAT PRODUCTION BY CONTINENTS AND SOME COUNTRIES

T. Stamenkovic, Biljana Devic, D. Milicevic

Meat production depends on the natural characteristics of soil and climate conditions of certain parts in our planet, as well as the acquired habits of the inhabitants for using certain meats in their nutrition.

In the period from 1972 to 1978, beef meat was the most produced in the world, whereas since 1978, production of pork meat have taken the lead. In 1978 it reached 50.313.000 tons, while beef and veal hit 48.655.000 tons. In 1995 pork production was 83.170.000 tons, poultry meat 53.910.000 tons, and beef and veal 53.217.000 tons. This order was unchanged until 2005, when pork production amounted to 102.523.000 tons, poultry meat 81.005.000 tons, and beef and veal 60.239.000 tons.

In Europe, in the period from 1972 to 1998, the most produced was pork, much less beef, and the least was produced poultry meat. In 1998, this order of production levels changed. In that year, pork production kept the leading position with 23.002.000 tons, the second position belonged to poultry with the amount of 10.690.000 tons, and the third position belonged to beef and veal with 9.046.000 tons. In 2005, pork production in Europe increased to 25.627.000 tons. In the same year, poultry production amounted to 13.285.000 tons, and beef and veal 11.399.000 tons. In the Northern and Central America, in the period from 1972 to 1990, the most produced was beef and veal, followed by poultry and the least produced pork meat. From 1991 to 1995, the most produced was poultry meat, then beef and veal, and the least produced was pork meat. In 2005, poultry meat production amounted to 23.049.000 tons, beef and veal 14.972.000 tons and pork 12.755.000 tons. In Asia, from 1972 to 2005, the most produced was pork meat, followed by poultry, and the least produced was beef meat. In 2005, production of pork meat amounted to 58.439.000 tons, poultry meat 27.533.000 tons, and beef and veal meat 13.264.000 tons. In South America, Africa and Oceania, in the period from 1972 to 2005, the most produced was beef, then poultry, and the least produced was pork meat. In the South America, in 2005, production of beef and veal was 13.421.000 tons, poultry meat 12.754.000 tons and pork meat 4.372.000 tons. In Africa, in 2005, production of beef and veal amounted to 4.314.000 tons, poultry meat 3.448.000 tons and pork meat 809.000 tons. In the countries of Oceania, in 2005, production of beef and veal was 2.868.000 tons, poultry meat 932.000 tons, and pork meat 526.000 tons.

In certain countries, the produced amounts of certain types of meat are different. In 2005, there were many groups of different order of the produced amounts of beef, pork and poultry meat. Produced amounts of certain types of meat, from the most produced to the least produced, in certain countries my be listed in the following groups of order: beef, pork and poultry (Russian Federation); pork,

beef and poultry (Germany, Italy, Serbia and Montenegro and Canada); pork, poultry and beef (Spain, France, Belgium, The Netherlands, Poland, Slovenia, Croatia, Japan and China); poultry, beef and pork (USA, Brasil and UK); and beef, poultry and pork (Australia and Bosnia and Herzegovina).

Key words: beef and veal, pork, poultry, world, continents, countries, production trends

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I-9

PROIZVODNJA SVINJSKOG MESA U SVETU I NJENE TENDENCIJE

T. Stamenković, D. Milićević, Biljana Dević

U ovom radu analizirano je stanje proizvodnje svinjskog mesa u svetu, po kontinentima i pojedinim zemljama.

Utvrđeno je da proizvodnja svinjskog mesa u svetu stalno raste. Ona je 2001. godine iznosila 91.188.000 tona, 2002. godine 94.186.000 tona, 2003. godine 98.473.000 tona, 2004. godine 100.483.000 tona i 2005. godine 102.523.000 tona.

U periodu od 2001. do 2005. godine, tendencija proizvodnje svinjskog mesa u svetu je pozitivna i iznosi 2.896.700 tona godišnje.

Posmatrano po kontinentima, najveću proizvodnju svinjskog mesa u 2005. godini imali su: Azija (58.439.000 tona), zatim Evropa (25.627.000 tona), potom Severna i Srednja Amerika (12.751.000 tona), Južna Amerika (4.372.000 tona), Afrika (809.000 tona) i zemlje Okeanije (526.000 tona).

Tendencija proizvodnje svinjskog mesa od 2001. do 2005. godine bila je pozitivna na svim kontinentima. Ona je bila najveća u Aziji (Y = 46.114.000 + 2.595.000 x – izraženo u tonama), zatim u Evropi (Y = 23.254.900 + 967.300 x), potom u Južnoj Americi (Y = 2.828.200 + 354.800 x), Severnoj i Srednjoj Americi (Y = 11.761.300 + 205.900 x), Africi (Y = 605.900 + 47.900 x) i Okeaniji (Y = 499.200 + 8.800 x).

Vodeći proizvođači svinjskog mesa u 2005. godini bili su: Kina (50.095.000 tona), SAD (9.402.000 tona), Nemačka (4.505.000 tona), Španija (3.310.000 tona), Brazil (3.110.000 tona), Francuska (2.257.000 tona), Kanada (1.960.000 tona), Poljska (1.923.000 tona), Danska (1.800.000 tona), Ruska Federacija (1.610.000 tona), Italija (1.550.000 tona), Holandija (1.299.000 tona), Japan (1.250.000 tona) i Belgija – Luksemburg (1.100.000 tona).

Pozitivne tendencije u proizvodnji svinjskog mesa od 2001. do 2005. godine imale su sledeće zemlje: Austrija, Belgija – Luksemburg, Bosna i Hercegovina, Danska, Italija, Srbija i Crna Gora, Makedonija, Nemačka, Poljska, Ruska Federacija, Slovenija, Španija, Japan, Kina, Nigerija, Kanada, SAD, Brazil, Čile, Australija i Novi Zeland.

Negativne tendencije u proizvodnji svinjskog mesa, od 2001. do 2005. godine, imale su: V. Britanija, Francuska, Holandija, Češka Republika, Mađarska i Rumunija.

Ključne reči: proizvodnja svinjskog mesa, svet, kontinenti, zemlje, tendencije proizvodnje

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WORLD PORK PRODUCTION AND ITS TRENDS

T. Stamenkovic, D. Milicevic, Biljana Devic

This paper gives the survey of world pork production, by continents and some countries.

It has been found that world pork production is constantly increasing. In 2001 it amounted to 91.188.000 tons, in 2002 it was 94.186.000 tons, in 2003 it was 98.473.000 tons, in 2004 it was 100.483.000 tons and in 2005 it was 102.523.000 tons.

In the period from 2001 to 2005, the world pork production trend was positive and amounted to 2.896.700 tons a year.

Observed by continents, the largest pork production in 2005 was recorded in: Asia (58.439.000 tons), followed by Europe (25.627.000 tons), then North and Middle America (12.751.000 tons), South America (4.372.000 tons), Africa (809.000 tons) and countries of Oceania (526.000 tons).

Pork production trend in the period from 2001 to 2005 was positive in all the continents. The largest production was in Asia (Y = 46.114.000 + 2.595.000 x – expressed in tons), followed by Europe (Y = 23.254.900 + 967.300 x), then South America (Y = 2.828.200 + 354.800 x), North and Central America (Y = 11.761.300 + 205.900 x), Africa (Y = 605.900 + 47.900 x) and Oceania (Y = 499.200 + 8.800 x).

The leading pork producers in 2005 were: China (50.095.000 tons), USA (9.402.000 tons), Germany (4.505.000 tons), Spain (3.310.000 tons), Brasil (3.110.000 tons), France (2.257.000 tons), Canada (1.960.000 tons), Poland (1.923.000 tons), Danmark (1.800.000 tons), Russian Federation (1.610.000 tons), Italy (1.550.000 tons), The Netherlands (1.299.000 tons), Japan (1.250.000 tons) and Belgium – Luxemburg (1.100.000 tons).

Positive trends in pork production, in the period from 2001 to 2005, were shown in the following countries: Austria, Belgia – Luxemburg, Bosnia and Herzegovina, Danmark, Italy, Serbia and Montenegro, Macedonia, Germany, Poland, Russian Federation, Slovenia, Spain, Japan, China, Nigeria, Canada, USA, Brasil, Chile, Australia and New Zealand.

Negative trends in pork production, in the period from 2001 to 2005, were shown in the following countries: UK, France, The Netherlands, Czech Republic, Hungary and Romania.

Key words: pork production, world, continents, countries, production trends

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I-10

OBELEŽJA PROIZVODNJE GOVEĐEG MESA U REPUBLICI SRBIJI

B. Vlahović, Đ. Laćarac, G., Kunovac, M. Mažić

Govedarstvo čini značajnu granu stočarstva. Njegova razvijenost predstavlja osnovni parametar razvoja stočarske i ukupne poljoprivredne proizvodnje. U visoko razvijenim zemljama govedarstvo zauzima dominantnu poziciju u strukturi ukupne stočarske proizvodnje. Savremena govedarska proizvodnja zasniva se na grlima koja poseduju visoke potencijale za proizvodnju mesa i mleka.

Osnovni cilj rada jeste da se sagledaju promene koje su nastale u proizvodnji goveđeg mesa u Republici Srbiji. Zadatak je, takođe, da se sagledaju uslovi koji su doveli do ispoljenih trendova. Osnovni izvori podataka preuzeti su iz Zavoda za statistiku Republike Srbije. U radu su primenjene standardne statističko-matematičke metode.

U posmatranom vremenskom periodu (2000-2005) proizvodnja goveđeg mesa u Republici Srbiji ostvarila je trend opadanja po prosečnoj stopi od 2,1% godišnje. Ovo je posledica smanjenja brojnog stanja goveda u uzgoju, prisutnih tranzitornih promena u agroindustriji, nedefinisanog statusa pojedinih kapaciteta klanične industrije, narušenih pariteta cena, relativno niske tražnje na domaćem, i visoke konkurencije na inostranom tržištu. Autori daju predloge neophodnih mera, odnosno ukazuju na moguće pravce izlaska iz sveobuhvatne krize u kojoj se ova grana stočarstva već duže vremena nalazi.

Ključne reči: goveđe meso, proizvodnja, Repubika Srbija

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CHARACTERISTICS OF BEEF PRODUCTION IN THE REPUBLIC OF SERBIA

B. Vlahovic, Dj. Lacarac, G., Kunovac, M. Mazic

Cattle farming is a very significant branch of livestock farming. Its development is the basic parameter of development of animal and agricultural production. In the highly developed countries cattle farming is gaining the dominant position in the structure of overall animal production. Modern beef production is based on animals with high potentials for meat and milk production.

Main purpose of this work is to understand the changes that occurred in the production of beef meat in the Republic of Serbia. The task is, also, to summarise the conditions that led to these trends.

Main sources of data were taken from the Statistical Office of the Republic of Serbia. Standard statistical-mathematical methods have been used.

In the given period (2000-2005) beef production in the Republic of Serbia was declining by the average rate of 2.1% per year. This is the result of smaller number of animals in breeding, transitory changes in agroindustry, undefined status of some capacities of slaughtering industry, disturbances in price parity, relatively low demand on domestic and high competition on international market. The authors suggest necessary measures and show the possible ways out of crisis which this part of animal production has been faced with for a long time.

Key words: Beef meat, production, the Republic of Serbia

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I-11

SAVREMENI NAČINI SNABDEVANJA I PRIPREME GOVEĐEG MESA

Prof dr S. Čepin

Pre pedesetak godina, količina proizvedenog i konzumiranog goveđeg mesa u svetu iznosila je oko 9 kg po glavi stanovnika godišnje. U poslednjih nekoliko godina, proizvodnja se udvostručila, ali je potrošnja ostala na istom nivou, zbog povećane gustine populacije. U istom periodu, u Sloveniji, potrošnja goveđeg mesa po glavi stanovnika se povećala sa 15 na 22kg, što je nešto ispod zapadno evropskog proseka i nešto iznad evropskog. Tokom ovog perioda, način pripreme goveđeg mesa se značajno izmenio, što se posebno odnosi na pripremu junetine. Pre nekih pedeset godina, konzumiralo se ¾ kuvanog i barenog a samo ¼ pečenog goveđeg mesa. Danas se ovaj odnos promenio. Većina junetine se u celom svetu konzumira kao pečena. Nažalost, nismo pratili ovaj kulinarski trend u zemljama bivše Jugoslavije i novoformiranim zemljama. Razlog za ovo se može naći u klaničnoj industriji i njenom nastojanju da prodaje potpuno sveže i nezrelo goveđe meso. Sveža govedina je žilava i kao takva nije pogodna za brzu pripremu u vidu pečene govedine i odrezaka, osim u slučaju najnežnijih delova mesa (Tender loin). Goveđe meso može da zri u rashladnom prostoru na temperaturi od 0 do 5°C, rasečeno na polutke ili četvrti. U današnje vreme, najčešće se koristi vakuum pakovana makro konfekcija zbog ekonomičnosti. Vreme zrenja zavisi od temperature. Na 4-5°C zrenje traje 1 nedelju, 2-3 nedelje na 3-4°C, na 2-3°C zrenje traje 3-4 nedelje, a na 1-2°C 4-5 nedelja dok na 0-1°C zrenje može da traje 5-8 nedelja. Tokom zrenja odvijaju se mnogi procesi zahvaljujući enzimima, kao što su proteoliza, lipoliza i glikoliza. Ovi procesi imaju pozitivno dejstvo na kvalitet i kulinarske osobine mesa, naročito nežnost, miris i ukus. Pored zrenja, važni faktori koji utiču na kvalitet mesa su starost životinje, rasa, pol i ishrana. U mnogim zemljama širom sveta, odresci predstavljaju najčešću formu služenja junećeg mesa. Odresci mogu da se griluju na otvorenom plamenu ili na gril pločama. Obično su odresci debljine 0,5 do 6 cm što zavisi od navika potrošača u raznim zemljama. U zavisnosti od debljine, odrezak je spreman za 2 do 15 minuta. Veoma popularan je tzv engleski metod pečenja do temperature u unutrašnjosti odreska od 60-65°C, što rezultira pojavom većeg ili manjeg dela crvenog mesa na preseku odreska. Čak i veći komadi mesa mogu da se peku na ovaj način, do postizanja određene temperature u unutrašnjosti mesa. Za brzu pripremu pečenih odrezaka, može da se koristi praktično svaki deo sa trupa a najpopularniji su "T-bone steaks", kapak, rebra , ramstek.

Ključne reči: goveđe meso, snabdevanje, priprema

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CONTEMPORARY SUPPLY AND PREPARATION OF BEEF

S. Cepin

Some fifty years ago the prevailing production and consumption of beef worldwide was about 9 kg per capita/year. In the recent years, the production has doubled, but the consumption stayed at the

same level due to increased population density. In the same period, in Slovenia, beef consumption per capita has increased from 15 to 22 kg, which is considered a bit below the West European, and a bit above the European average. During this period, the preparation of beef greatly changed, especially the preparation of young beef. Some fifty years ago as much as ¾ of cooked or stewed, and only ¼ of roast beef was consumed. Today, this proportion has changed. The majority of young beef is consumed as roast beef, worldwide. Unfortunately, in ex-Yugoslavia and later, in the newly formed countries, we have not followed this culinary improvement. The reason can be found in slaughter industry and its persistence on the sale of entirely fresh, non aged beef. Fresh beef is tough and therefore not suitable for quick preparation of roast beef and steaks, except for the most tender part, the tender loin of beef. Beef can be aged in cooling rooms at the temperature from 0 to 5^0 C, cut into carcass halves or quarters. Nowadays, mostly vacuum-packed macro-confection parts are used for the economical reasons. The duration of ageing depends on temperature. At 4-5^0 C it lasts 1 week, 2 to 3 weeks at 3-4^0 C, at 2 to 3^0 C 3 to 4 weeks, at 1 to 2 ^{0} C up to 4 or 5 weeks, and at 0 to 1^0 C it lasts 5 to 8 weeks. During aging many different processes occur due to enzymes, such as proteolysis, glycolisis and lipolysis, having a positive effect on the quality and culinary meat traits, especially tenderness, odour and taste. Apart of ageing, important factors influencing meat quality are also age of the animal, breed, sex, and animal nutrition. In many countries worldwide steaks represent the most frequent form of young beef. They can be grilled on open fires or on grill plates. Usually steaks are 0.5 to 6 cm thick, depending on the habits in different countries. Depending on its thickness a steak can be ready in 2 to 15 min. Very popular is the so called English method of roasting to the inside temperature of 60 to 65^0 C still having a larger or smaller part of red coloured meat at the cut of a steak. In addition, even larger peaces of meat can be roasted the same way, to the same inside temperature. For the quick preparation of steaks or roasts almost any carcass part can be used, the most popular being T-bone steaks, rump steaks, rib steaks or loin steaks.

Key words: beef, supply, preparation

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I-12

UTICAJ KVALITETA POLUTKI NA PRINOS MESA RAZVRSTANOG PO KATEGORIJAMA ZA PRERADU I UTVRĐIVANJE KRITERIJUMA ZA STANDARDIZACIJU

Ljiljana Petrović, Tatjana Tasić, V. Tomović, Natalija Džinić, P. Ikonić, Jasmina Adamović, Nataša Petrović

Većina zemalja sa razvijenom proizvodnjom svinjskog mesa ima definisane standarde u pogledu hemijskog sastava za kategorije mesa predviđene za preradu. Radi obezbeđenja potpune standardizacije, optimizacije i ekonomske valorizacije u proizvodnji i preradi svinjskog mesa u našoj zemlji, postavljen je zadatak da se u ovom radu definišu parametri i kriterijumi za standardizaciju i vrednovanje svinjskog mesa namenjenog preradi.

Prikazani rezultati dobijeni su ispitivanjima na tovnim svinjama u dva ogleda. Na kraju linije klanja, utvrđen je prinos mesa u polutkama, odnosno klasa polutki metodom dve tačke. Nakon hlađenja, polutke primarno klasirane za preradu (uglavnom U, R i O klase) rasecane su na osnovne anatomske delove, potom otkoštene, a dobijeno meso je klasirano na osnovu vizuelne procene sadržaja masnog i vezivnog tkiva u šest kategorija.

Nakon što je utvrđen hemijski sastav klasiranog mesa dobijenog u prvom ogledu, zaključeno je da vizuelna ocena nije bila dovoljno precizna u odnosu na zadati sadržaj masti u pojedinim kategorijama mesa za preradu.

U drugom ogledu, meso je prema procenjenom sadržaju masti, uglavnom, dobro razvrstano po kategorijama. Na osnovu hemijskog sastava i analize celokupno dobijenih rezultata, predloženi su kriterijumi za standardizaciju mesa za preradu, koji pored maksimalnog sadržaja masti obuhvataju i minimalni sadržaj proteina mesa.

Ključne reči: kvalitet polutki, kategorije mesa, standardizacija

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INFLUENCE OF CARCASS QUALITY ON MEAT YIELD CLASSIFIED BY CATEGORIES FOR PROCESSING AND DEFINING OF CRITERIA FOR STANDARDIZATION

Ljiljana Petrovic, Tatjana Tasic, V. Tomovic, Natalija Dzinic, P. Ikonic, Jasmina Adamovic, Natasa Petrovic

Standards for meat categories for processing, regarding chemical composition, are defined in most countries with developed pork production. The main task of this work was to define the parameters and criteria for standardization and evaluation of pork for processing in order to provide for complete standardization, optimization and economic valorization in the production and processing of pork in our country.

The presented results were obtained by investigation of fattening pigs in two trials. At the end of the slaughterline, meat yield in carcasses, i.e. class of carcasses was determined by two-point method. After cooling, the carcasses classified for processing (mainly U, R and O classes) were cut into primal cuts, deboned, and the meat obtained was classified into six categories on the bases of visual estimation of fat and connective tissue.

After the determination of chemical composition of classified meat – first trial – it was concluded that the visual evaluation was not precise enough concerning the fat content in certain meat categories.

The classification of meat regarding the evaluated fat content was well performed in the second trial. On the basis of chemical composition and analyses of all results, criteria for standardization of meat for processing, which include the min. protein content beside the max. fat content were suggested.

Key words: carcass quality, categories of meat for processing, standardization

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I-13

UTICAJ KVALITETA SVINJSKIH POLUTKI NA EKONOMIKU POSLOVANJA U VELEPRODAJI MESA

Đ. Okanović, Ljiljana Petrović, Natalija Džinić, V. Tomović, V. Zekić, Nada Kurjakov

Proizvodnja svinjskog mesa čini preko jedne trećine ukupne proizvodnje mesa u Srbiji. Ako se posmatra Vojvodina kao region, udeo proizvodnje svinjskog mesa penje se na skoro polovinu ukupne proizvodnje. U intenzivnoj, tržišno orijentisanoj proizvodnji svinja i svinjskog mesa, veoma je bitno da se pored adekvatnog kvaliteta i proizvodnih pokazatelja obezbedi i detaljan uvid u troškove proizvodnje, što predstavlja osnov ekonomičnosti procesa prerade svinjskog mesa u kasnijim fazama proizvodnje.

Iz ranije objavljenih rezultata vidimo da je proizvodna cena uzgoja tovljenika dosta ujednačena tokom godine (oko 0,95 €/kg), jer se cena stočne hrane ne menja značajno. Tokom godine, ponuda i potražnja tovljenika na tržištu varira, pa je i njihova tržišna cena promenljiva. Zato možemo zaključiti da je položaj proizvođača stoke i mesa neizvestan, a snabdevanje klanica tovljenicima i tržišta mesom nestabilno.

U radu su prikazani rezultati ispitivanja kvantitativnih pokazatelja kvaliteta svinjskih polutki i data je ekonomska analiza isplativosti plasmana svinjskih polutki prema kvalitetu, odnosno prema prinosu (%) mesa.

Prinos i udeo osnovnih delova i tkiva u polutkama određen je metodom parcijalne disekcije, a ekonomska analiza primenom divizione kalkulacije, pri čemu se kao osnov za raspodelu troškova koriste odnosi između tržišnih cena pojedinih kategorija mesa, te normativi troškova klanja i obrade svinjskog mesa u drugoj fazi obračuna.

Masa polutki je dosta ujednačena (oko 77 kg), a udeo mesa u polutkama je varirao od 45 do preko 60%. Procenat mesa u polutkama u proseku je bio 56,20%, a kretao se od 48,09 (R klasa) do 62,61% (S klasa), odnosno prinos mesa je bio između 37,23 i 48,58 kg.

Znajući da je angažovanje sredstava za proizvodnju svinja i lošeg i dobrog kvaliteta skoro istovetno, od presudnog značaja je stimulacija proizvođača tovljenika, odnosno plaćanje svinja prema prinosu mesa, ocenom tople polutke na liniji klanja svinja. Na taj način proizvođači stoke mogu da ostvare značajno veću cenu za proizvedene tovljenike, odnosno da ostvare adekvatnu nadoknadu za uloženi kvalitetan rad prilikom selekcije, izbora hrane, optimalnog završetka tova... Istovremeno, proizvođači mesa i proizvoda od mesa, iako bi sirovinu platili više, dobijaju bolji kvalitet, više mesa, bolji ekonomski efekat, a potrošači su nagrađeni boljim kvalitetom proizvoda.

Ključne reči: proizvodnja svinjskog mesa, kvalitet polutki, troškovi

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THE INFLUENCE OF PORK CARCASS SIDE QUALITY ON MEAT MARKET ECONOMY

Dj. Okanovic, Ljiljana Petrovic, Natalija Dzinic, V. Tomovic, V. Zekic, Nada Kurjakov

Pork meat production makes over one third of total meat production in Serbia. In Voivodina region, pork meat production rises up to one half of total meat production. In an intensive market- oriented pig and meet production, it is very important to provide, besides adequate quality and production parameters, a detailed view of the production costs, which represents the basis of economical pork meet production process in the later phases of production.

Previous results show that the production price of fatteners does not vary during the year (around 0.95 €/kg) because feed price does not vary significantly. During the year, supply and demand of fatteners may change, so the market prices are changeable. We might conclude that position of livestock producers and meat producers are insecure and supply of slaughterhouses with livestock and meat market is unstable.

This paper presents the results of the investigation of quantitative parameters of carcass quality and economic analysis of marketability of carcass sides, according to quality of meat and meat yields.

Yield and share of primal cuts and tissues in carcass sides were determined by partial dissection method. Divisional calculation was used for economic analysis, while the base for cost of distribution was presented as relations between market price for different meat categories, slaughter work and pork meat processing costs in the second phase of calculation.

Carcass side weight was equalised (around 77kg), and meat share ranged form 45 to over 60%. Average meat percentage was 56.20%, and it ranged from 48.09% (class R) to 62.61% (class S), i.e. meat share was between 37.23 and 48.58 kg.

If we know that the production requirements are the same for both bad and good pigs, stimulations for fattener producers by paying them according to percentage of meat production by classifying warm carcass sides on the pig slaughter line, proved to be essential. Livestock producers can achieve greater price and adequate compensation for quality work on selection, choice of food, optimum finish of fattening etc... At the same time, producers of meat and meat products, although paying more for raw materials, get better meat quality, more meat, better economic effect and consumers are rewarded with better quality.

Key words: Pork meat production, carcass side quality, costs

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I-14

FAKTORI KOJI MODIFIKUJU SADRŽAJ MUTAGENIH SUPSTANCI U MESU

R. Borisyuk, A. Shleykin

Heterociklični aromatični amini (HCA) su supstance sa visokim mutagenim i kancerogenim potencijalom. Mogu se naći u zagrejanom mesu i ribi na visokim temperaturama kuvanja. Ovo znači da se HCA formiraju u vrlo maloj količini pri kuvanju, ali se nastanak ovih supstanci značajno uvećava kada se meso intenzivnije zagreva, pri prženju, pečenju na roštilju, pečenju na vatri i pečenju u rerni.

Četiri faktora utiču na formiranje HCA: tip hrane, način pripreme, temperatura i vreme pripreme. HCA su nađeni u kuvanom mišićnom tkivu; drugi izvori proteina (sveže ili kuvano mleko, jaja ili jetra) ili imaju vrlo mali ili uopšte nemaju HCA. Najvažniji faktor u formiranju HCA je temperatura. Prženje u ulju i pečenje na roštilju dovodi do nastanka najveće količine HCA zato što se meso priprema na veoma visokim temperaturama. Istraživanja su pokazala trostruki porast sadržaja HCA kada se temperatura pripreme povećala sa 200°C na 250°C. Pečenje u rerni se odvija na nižim temperaturama (ne više od 150°C) pa je verovatnije formiranje manjih količina HCA, međutim, otopljena mast sa pečenja ima značajne količine HCA. Dinstanje, kuvanje ili kuvanje na pari se odvijaju na ispod 100°C, te se pri ovim načinima pripreme stvaraju zanemarljive količine ovih komponenti. U hrani koja se priprema duže vreme (reš umesto srednje pečenog) drugim metodama, naćiće se nešto više ovih mutagenih supstanci.

Tabela 1. Količine heterocikličnih amina u goveđim pljeskavicama prženim na različitim temperaturama (ng)

Heterociklični amini	**Vreme pripreme min**	**Temperatura u °C**		
		150	**190**	**230**
IQ	2	Nije nađeno	Nije nađeno	Nije nađeno
	4	Nije nađeno	0,10	0,15
	6	0,10	0,45	0,60
	10	0,10	0,75	0,85
MeIQx	2	Nije nađeno	0,10	0,40
	4	Nije nađeno	0,25	0,70
	6	0,20	1,30	5,60
	10	0,60	1,50	7,30
PhIP	2	Nije nađeno	Nije nađeno	1,30
	4	Nije nađeno	0,15	1,50
	6	0,25	1,90	7,80
	10	1,80	9,80	32,0

Meso koje je pre kuvanja obrađeno u mikro rerni ima manje nivoe HCA. Studije su pokazale da obrada mesa u mikro-rerni pre kuvanja smanjuje količinu mutagena tako što uklanja njihove prekursore. Meso koje je pre kuvanja bilo u mikro-rerni 2 minuta ima 90% smanjen sadržaj HCA. Nadalje, ukoliko se nakon obrade u mikro-rerni odlije formirana tečnost iz mesa pre kuvanja, konačna količina HCA se takođe smanjuje.

Tabela 2. Sadržaj heterocikličnih amina u goveđim pljeskavicama koje su pržene po 6 minuta sa svake strane nakon obrade u mikro-rerni tokom različitog vremena

Heterociklični amini	Vreme obrade u mikro rerni (min)	Temperatura °C	
		150	250
MeIQx	0	1,30	5,6
	1	0,71	2,1
	1,5	0,32	1,60
	2	0,18	0,95
	3	0,12	0,81
PhIP	0	1,9	7,8
	1	1,1	3,1
	1,5	0,6	2,2
	2	0,32	1,3
	3	0,2	1,1

Zaključak: naši podaci ukazuju na mogućnost smanjenja sadržaja kancerogenih amina u proizvodima od mesa prethodnim tretmanom u mikro-rerni. U sledećim eksperimentima, proučavaćemo uticaj antioksidanasa i drugih antikancerogenih supstanci na sadržaj najznačajnijih HCA u mesu.

Ključne reči: meso, kancerogeni amini, kuvanje, mikro rerna

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FACTORS MODIFYING CONTENTS OF MUTAGENIC SUBSTANCES IN MEAT

R. Borisyuk, A. Shleykin

Heterocyclic aromatic amines (HCAs) are substances with high mutagenic and carcinogenic potential. They occur in heated meat and fish when temperature exceeds high cooking temperatures. This means that during boiling, HCAs are formed at a very low level but the formation of these substances is increased significantly when the meat is heated more intensively by frying, grilling, baking or roasting.

Four factors influence HCAs formation: type of food, cooking method, temperature and cooking time. HCAs are found in cooked muscle tissues; other sources of protein (fresh or cooked milk, eggs or liver) have very little or no HCAs content. Temperature is the most important factor in the formation of HCAs. Frying, broiling and barbecuing produce the largest amounts of HCAs because the meats are cooked at very high temperatures. The research showed a threefold increase in the content of HCAs when the cooking temperature was increased from 200° to 250°C. Oven roasting and baking are done at lower temperatures (no more 150 °C), so lower levels of HCAs are likely to form, however, gravy made from meat drippings has substantial amounts of HCAs. Stewing, boiling, or poaching are done at or below 100°C; cooking at this low temperature creates negligible amounts of the chemicals. Foods cooked for a long time (“well-done” instead of “medium”) by other methods will also form slightly more of the mutagenic substances.

Table 1. Amounts of heterocyclic amines in beef patties fried at different temperatures, ng.

Heterocyclic amines	Cooking time, min	Temperature, °C		
		150	190	230
IQ	2	Not detectable	Not detectable	Not detectable
	4	Not detectable	0,10	0,15
	6	0,10	0,45	0,60
	10	0,10	0,75	0,85
MeIQx	2	Not detectable	0,10	0,40
	4	Not detectable	0,25	0,70
	6	0,20	1,30	5,60
	10	0,60	1,50	7,30
PhIP	2	Not detectable	Not detectable	1,30
	4	Not detectable	0,15	1,50
	6	0,25	1,90	7,80
	10	1,80	9,80	32,0

Meats that are precooked in the microwave oven before cooking by other methods also have lower levels of HCAs. Studies have shown that microwaving of meat prior to cooking helps to decrease mutagens by removing of their precursors. Meats that were microwaved for 2 minutes prior to cooking had a 90-percent decrease in HCAs content. In addition, if the liquid that forms during microwaving is poured off before further cooking, the final quantity of HCAs is reduced.

Table 2. Heterocyclic amines content in beef patties fried for 6 min per side following various microwave pretreatment times

Heterocyclic amines	Microwave time, (min)	Temperature, °C	
		150	250
MeIQx	0	1,30	5,6
	1	0,71	2,1
	1.5	0,32	1,60
	2	0,18	0,95
	3	0,12	0,81
PhIP	0	1,9	7,8
	1	1,1	3,1
	1.5	0,6	2,2
	2	0,32	1,3
	3	0,2	1,1

Conclusion. Our data show the possibility to decrease the carcinogenic amines content in meat products by microwave precooking. In the next experiments we will study the influence of the antioxidants and other anticarcinogenic substances on the main HCAs content in meat.

Key words: meat, carcinogenic amines, cooking, microwave.

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I-15

HISTOLOŠKE I HISTOMORFOLOŠKE KARAKTERISTIKE MIŠIĆNIH VLAKANA PITOMIH SVINJA RAZNIH RASA

Vjera Pribiš, Lj. Lević, M. Popović, Dragana Plavšić

Proizvodnja mesa i proizvoda od mesa zauzima značajno mesto u ishrani i plasmanu hrane, jer se udeo mesa u ishrani povećava u većini zemalja. Ta činjenica ukazuje na to da je produkcija mesa pod pritiskom organizacionih, tehnoloških, proizvođačkih i rasno-selekcijskih faktora. Nekontrolisano povećanje proizvodnje mesa može da izazove smanjenje kvaliteta trupa i mesa. Kvalitet mesa je rezultat promena i procesa koji se dešavaju na mišićnom vlaknu, kao osnovnoj funkcionalnoj jedinici mišića/mesa.

U radu su ispitana mišićna vlakna dve rase svinja (durok i belgijski landras) u raznim starosnim grupama (3, 6 i 12 meseci), na tri mišića (*M. deltoideus, M. l. dorsi i M. semimembranosus*). Preparati za histološka ispitivanja bojeni su sa hematoksilineozinom.

Došlo se do sledećih zaključaka:
- sa povećanjem starosti jedinki prečnik mišićnih vlakana se povećava kod obe rase; kod jedinki starosti do 6 meseci mišićna vlakna su tanja kod rase durok;
- kod rase durok broj gigantskih vlakana se značajno povećava sa starošću jedinki (2 do 10 puta); kod rase belgijski landras broj gigantskih vlakana je u svim starostima na visokom nivou;
- prosečni broj jedara ravnomerno se povećava sa starošću kod obe rase, a veći je kod rase durok.

Ključne reči: durok, belgijski landras, mišićna vlakna

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HISTOLOGICAL AND HISTOMORPHOLOGICAL CHARACTERISTICS OF MUSCLE FIBRES FROM DIFFERENT DOMESTIC PIG BREEDS

Vjera Pribis, Lj. Levic, M. Popovic, Dragana Plavsic

Production of meat and meat products has an important position in nutrition and marketing of food, because the share of meat in nutrition shows an increasing trend in most of the countries. That fact indicates that meat production is under the pressure of organisational, technological, producing and breeding-selection factors. Uncontrolled increase in meat production may cause lowering of carcass and meat quality. Meat quality is a result of changes and processes which occur in the muscle fibre, as basic functional unit of muscles/meat.

Muscle fibres of two pig breeds (Duroc and Belgian Landrace) were investigated at three different age groups (3, 6 i 12 months), on three muscles (*M. deltoideus, M. l. dorsi i M. semimembranosus*)

using two measuring methods. Preparations for histological investigations were stained with chematoxilineosine.

The following conclusions were drawn:

- with the increase in age, muscle fibre diameter increases in both breeds; in animals up to 6 months of age, muscle fibres are thinner than in Durock breed;
- in Durock breed, number of giant fibres significantly increases with the age of animals (2 to 10 times); in Belgian Landrace breed, the number of giant fibres at all ages is at the high level;
- average number of nuclei increases evenly with the age in both breeds, and is greater in Durock breed.

Keywords: Durock, Belgian Landrace, muscle fibres

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I-16

EPIDEMIOLOGIJA *Escherichia coli* O157 U GOVEDA/GOVEĐEM MESU OD FARME DO VILJUŠKE: PODACI IZ LITERATURE

I. Nastasijević, Radmila Mitrović, S. Bunčić

Verocitotoksični sojevi *E. coli*, uključujući O157, serotip uzrokovali su povećan broj humanih infekcija (epidemije ili pojedinačni slučajevi) različitim putevima: hranom, vodom i direktnim kontaktom (sa inficiranim životinjama). Izvori infekcija putem hrane uključivali su uglavnom nedovoljno termički obrađeno govođe meso (usitnjeno meso ili slične oblike, e.g. burgeri), ali i mleko i mlečne proizvode. Infektivna doza može da bude veoma niska i to između nekoliko pa do 100 CFU. Glavni rezervoar *E. coli* O157 su klinički zdrava goveda koja mogu fekalno da izlučuju patogen i tako posledično kontaminiraju govođe meso u klanici.

U našoj zemlji, trenutno, nisu dostupni objavljeni podaci o pojavi *E. coli* O157 u lancu proizvodnje govođeg mesa, niti o kontrolnim strategijama.

Stoga je potrebno obaviti ocenu rizika za *E. coli* O157. Ocena rizika treba da pokrije sve faze u proizvodnji govođeg mesa i da bude zasnovana na longitudinalnom i integrisanom pristupu. Takođe, svi odnosni podaci o prevalenci ovog patogena i/ili broju treba da budu dobijeni korišćenjem međunarodno priznatih metoda koji uključuju pred-obogaćenje, koncentraciju patogena upotrebom imunomagnetske separacije i izolaciju na selektivnim podlogama, praćenu biohemijskom i imunološkom konfirmacijom.

Strategija za redukciju rizika *E. coli* O157 zahteva primenu kontrolnih mera na više tačaka duž lanca proizvodnje govođeg mesa tako da njihovi zbirni efekti svode na minimum rizik od infekcije potrošača *E. coli* O157 preko govođeg mesa.

Primena najbolje higijenske prakse, zasnovane na principima GHP i HACCP osnovni je element takve strategije. Efektivne kontrolne mere treba da budu primenjene u primarnoj proizvodnji (na farmi), transportovanju goveda (farma - stočna pijaca - klanica), depou, klanju/obradi (sa ili bez antimikrobnih tretmana), hlađenju, skladištenju, distribuciji i pripremi hrane u keteringu i/ili domaćinstvima (e.g. adekvatno kuvanje).

Važno je imati na umu da prevencija infekcije *E. coli* O157 putem hrane mora da osigura ne samo sprečavanje rasta patogena u hrani, već i prevenciju kontaminacije hrane spremne za upotrebu.

Ključne reči: *E. coli* O157, govođe meso, oboljenja preko hrane, ocena rizika, kontrolna strategija

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EPIDEMIOLOGY OF *Escherichia coli* O157 IN CATTLE/BEEF FROM FARM TO FORK: LITERATURE DATA

I. Nastasijevic, Radmila Mitrovic, S. Buncic

Verocytotoxic *E. coli* including O157 serotype have caused increasing numbers of human infections (outbreaks or sporadic cases) via various routes: foodborne, waterborne and direct contact (with infected animals). The sources of the foodborne infections have included primarily undercooked beef (minced or related preparations e.g. burgers) but also milk/dairy products. The infectious dose could be as low as between few and 100 CFU. The main reservoir of *E. coli* O157 are healthy cattle which can faecally shed the pathogen subsequently contaminating beef at abattoir.

In our country, presently, there are no available published data neither on occurrence of *E. coli* O157 in the beef chain nor on the related controls.

Therefore, risk assessment of *E. coli* O157 is necessary. It should cover all stages in the beef chain, based on longitudinal and integrated approach. Furthermore, related data on pathogen's prevalence and/or counts should be obtained by internationally recognized methods that include pre-enrichment, concentration using immunomagnetic separation, and isolation on selective media, followed by biochemical and immunological confirmation.

The risk-reduction strategy for *E. coli* O157 requires that control measures are applied at multiple points along the beef chain so that their summative effects minimize the risks of beef-borne *E. coli* O157 infections in consumers.

The application of the best hygienic practices, based on GHP- and HACCP principles, is the essential element of such strategy. The effective control measures have to be applied at primary production (on-farm), transport of cattle (farm - market - abattoir), lairaging, slaughter/dressing (with or without antimicrobial treatments), chilling, warehousing, distribution, and food preparation in catering and/or households (e.g. proper cooking).

It is important to keep in mind that prevention of foodborne *E. coli* O157 infections must ensure not only the growth suppression in foods, but prevention of contamination of ready-to-eat foods.

Key words: *E. coli* O157, beef, foodborne disease, risk assessment, control strategies

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I-17

NALAZ SALMONELA U STOČNOM DEPOU KLANICE ZA SVINJE

N. Karabasil, Nataša Kilibarda, M.Ž. Baltić, Mirjana Dimitrijević, V. Teodorović

Infekcija svinja salmonelama može nastati još na farmi, ali se ove životinje mogu inficirati ili kontaminirati i tokom trasporta, boravka u stočnom depou i prilikom klanja. Cilj ovoga rada bio je da se utvrdi nalaz salmonela na površinama u stočnom depou klanice za svinje. Nalaz salmonela je utvrđen pregledom briseva (ukupno 90) uzetih sa površina od istovarne rampe do boksa za omamljivanje u dve klanice. Ispitivanjem je ustanovljeno da je 22,22 % pregledanih uzoraka pozitivno na salmonele, što ukazuje na značaj stočnog depoa kao izvora kontaminacije mesa svinja.

Ključne reči: svinje, salmonela, stočni depo, klanica

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EXAMINATION OF *SALMONELLA SPP.* IN THE LAIRAGE OF PIG ABATTOIRS

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Infection of pigs with *Salmonella* can occur on the farm, but they also can get infected or contaminated during transport, lairage or slaughter. The aim of this paper was to examine the prevalence of *Salmonella* in the lairage environment. Prevalences of *Salmonella* spp. were examined in swabs (90 in total) taken from selected sites along the unloading-to-slaughter routes of pigs movement in lairages of two abattoirs. The results showed, positive findings of *Salmonella* spp. in 22.22 % examined samples, which indicates the importance of lairage environment as a source of contamination.

Key words: pig, salmonella, lairage, abattoir

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I-18

MESO PILIĆA - NAMIRNICA ILI PRENOSILAC *CAMPYLOBACTER JEJUNI*

Snežana Ivanović, M. Žutić, T. Kočovski

Kampilobakter enteriti kod ljudi predstavljaju bez sumnje važan svetski zdravstveni problem. Posebno je ugrožena populacija ljudi u zemljama sa intenzivnom proizvodnjom stoke. Na ljude se može preneti sa životinja, kao izvora infekcije, na više načina, najčešće preko kontaminiranog mesa, mleka i vode. Pretpostavka je da se čovek najčešće inficira preko nedovoljno termički obrađenog pilećeg mesa.

Campylobacter jejuni je značajan uzročnik gastroenteritisa ljudi. Infektivna doza prema nekim autorima, može da bude manja od 500 ćelija po ml ili gramu namirnice. Imajući ove podatke u vidu ispitivali smo prisustvo Campylobacter jejuni u mišićnom tkivu zaklanih pilića. Kao materijal za ispitivanje koristili smo 115 uzoraka mišićnog tkiva (2-3g iz dubine M. pectoralis) i 115 uzoraka jetre (2-3g) koja je pripadala istim trupovima. Uzorci su uzeti od pilića zaklanih u industrijskoj klanici. Za izolovanje Campylobacter jejuni koristili smo dve podloge: tečnu – Brucella bujon sa dodatkom antibiotika, i čvrstu - po Skirrowu. Mikroaerofilne uslove, potrebne za rast ovih bakterija, postigli smo upotrebom posude za anaerobe po McIntoshu uz primenu Genbox microaer kesica. Za identifikaciju Campylobacter jejuni koristili smo probu katalaze, test razlaganja hipurata i temperaturu rasta. Campylobacter jejuni utvrdili smo u mišićnom tkivu 35 pilećih trupova, što iznosi 40,25%. U jetri smo ovu bakteriju ustanovili u 46 uzoraka, što iznosi 52,9%. Nalaz Campylobacter jejuni u pilećem mesu i jetri, u našim ispitivanjima manji je u odnosu na nalaze pojedinih autora koji su ga utvrdili u 82,60% slučajeva u mesu pilića, odnosno u 85% živinskih jetri. Sadašnji rezultati su vrlo slični rezultatima koje smo dobili tokom naših ranijih istraživanja.

Ključne reči: *Campylobacter jejuni*, pilići, meso, jetra

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CHICKEN MEAT – FOODSTUFF OR CAMPYLOBACTER JEJUNI VECTOR

Snezana Ivanovic, M. Zutic, T. Kocovski

Human enteritis caused by *Campylobacter spp*. is, doubtless, worldwide problem. Particularly endangered is human population in countries with intensive animal husbandry. *Campylobacter spp*. can be transmitted from animals to humans in several ways, mostly by contaminated meat, milk and water. There is assumption that people can be infected by inadequately cooked chicken meat. *Campylobacter jejuni* is important cause of human gastroenteritis. Infection dose, according to some

authors, can be less than 500 cfu per mL or g of foodstuff. According to these data, we have examined the occurrence of *Campylobacter jejuni* in meat and liver of slaughtered chickens. As a material for examination, 115 meat samples (2-3 g of inner part of M. pectoralis) and 115 liver samples (2-3 g) from the same carcasses were used. Samples were collected from the chicken in slaughterhouse. For isolation of *Campylobacter jejuni* both liquid medium Brucella broth with antibiotics and solid medium by Skirrow were used. Microaerophylic conditions were achieved using McIntosh tank with Genbox microaer bags. For *Campylobacter jejuni* identification catalasa test, hypurate dissolution and growth temperature were used. *Campylobacter jejuni* was detected in meat of 35 chicken carcasses (40.25%) and in 46 liver samples (52.9%). Occurrence of *Campylobacter jejuni* in chicken meat and liver is lower compared to data of some authors that report the occurrence of this bacterium in 82.60% chicken meat and in 85% of liver samples. These results are similar to the results obtained in our earlier investigations.

Key words: Campylobacter jejuni, chicken, meat, liver

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II TEMATSKA OBLAST
2nd THEMATIC TOPIC

PRERADA I PROMET MESA
PROCESSING AND TRADE OF MEAT

II-1

UTICAJ KOMBINOVANOG NAČINA SALAMURENJA NA POJEDINE MIŠIĆE SVINJSKOG TRUPA

A. Kuzelov, O. Kirovska Cigulevska

U radu je ispitivan uticaj različitih načina salamurenja na pojedine komade mesa svinjskog trupa. Pojedini komadi mesa svinjskog trupa salamureni su sa pikl-injektorom. Početna masa pre salamurenja iznosila je 597,41 grama, pri pH 5,78, nakon salamurenja 625,33 grama, a nakon termičke obrade, prosečna masa komada mesa iznosila je 512,67 grama. Prosečna masa komada mesa koji su salamureni pikl-injektorom, a zatim stavljeni u tambler iznosila je 650,3 grama pri pH 5,85, nakon salamurenja 750,01 gram, a nakon termičke obrade 631,59 grama.

Na osnovu rezultata izvršenih ispitivanja, konstatovano je da način salamurenja sa pikl- injektorom i tamblovanjem daje bolje rezultate u randmanu gotovih proizvoda.

Ključne reči: salamurenje, pikl-injektor, tambler

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EFFECTS OF COMBINED BRINING ON PARTICULAR PORK MUSCLES

A. Kuzelov, O. Kirovska Cigulevska

The paper explores the influence of different brining methods on some meat pieces from the pork carcass. The pork meat cuts were brined with pickle injector. The starting mass before brining was 597.41 g at pH 5.78, and after brining it was 625.33 g, while after the thermal processing the average mass of meat pieces was 512.67 g. The average weight of pork meat pieces that were brined with pickle-injector and afterwards placed in a tumbler was 650.3 g before brining, at pH 5.85 and after brining 750.01, while after the thermal processing it was 631.59 g.

Based on the test results it was concluded that brining with pickle injector and tumbling gives better results in the yield of finished products.

Key words: brining, pickle injector, tumbler

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II-2

NAUČNO UTEMELJENJE USLOVA ZA TERMIČKU OBRADU NOVE GENERACIJE PAŠTETE OD PREPELIČIJEG MESA U KONZERVI

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Pri konzervisanju proizvoda od mesa, najvažniji je razvoj optimalnih uslova termičke obrade (sterilizacija). Naučno utemeljenje ovog procesa sastoji se od teoretskog određivanja letalnosti kod specifičnih vrsta proizvoda, kompleksnog ispitivanja svojstava konzervisanog mesa i određivanja pravog efekta sterilizacije.

U ovom radu predstavljeni su rezultati istraživanja razvoja uslova sterilizacije nove generacije paštete od prepeličijeg mesa u konzervi. Po prvi put su sprovedena komparativna mikrobiološka i fizičko-hemijska ispitivanja. Takođe je određena hranljiva vrednost konzervisane mesne paštete u zavisnosti od različitih efekata sterilizacije tokom 5, 7 i 10 minuta.

Utvrđena je zavisnost promena pokazatelja kao što su aktivnost vode, redoks potencijal u odnosu na pH vrednost, nivo zagrevanja i hemijski sastav konzervirane paštete.

Dobijeni rezultati kompleksnih komparativnih istraživanja omogućili su razvoj racionalnih režima sterilizacije sa optimalnim efektom tokom 7 minuta.

Ključne reči: prepeličije meso, pašteta u konzervi, sterilizacija, utemeljenje

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SCIENTIFIC SUBSTANTIATION OF RATIONAL CONDITIONS FOR THERMAL PROCESSING OF NEW GENERATION CANNED PÂTÉ FROM QUAIL'S MEAT

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In meat products canning the development of optimum conditions of thermal processing (sterilization) is the most important. Scientific substantiation of this process consists of theoretical determination of lethality in specific types of canned products, complex investigations of canned meat properties and determination of the actual sterilizing effect.

The paper presents the results of investigations into the development of rational conditions of sterilization of a new generation of pâté from quail's meat. For the first time comparative

microbiological, physico-chemical investigations were carried out, and the food value of canned meat pâté depending on different sterilizing effects during 5, 7, 10 min. was evaluated.

There was established correlation between change of such indices, as water activity and redox potential, on one side, and pH-value, level of heat loads and chemical composition of canned pâté, on the other.

The obtained results of complex comparative investigations allowed development of rational regimes of sterilization with the optimum sterilizing effect during 7 min.

Key words: quail's meat, canned pâté, sterilization, substantiation

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II-3

NOVA TEHNOLOGIJA PROIZVODNJE BILJNO-MESNIH EKSTRUDATA SA VISOKIM FUNKCIONALNIM OSOBINAMA

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Postoji trend na ruskom tržištu u smislu pronalaženja alternativa proizvodima od soje koji su uglavnom produkti prerade genetski modifikovanih biljaka, a koriste se u proizvodima od mesa. Korišćenje različitih izvora biljnih proteina je jedno od rešenja za zamenu proizvoda od soje.

Tehnologija ekstrudiranja omogućava dobijanje proizvoda različitog sirovinskog sastava, balansiranih hemijskih svojstava i izraženih funkcionalnih svojstava. U 2004. godini, Rusija je po prvi put proizvela biljno-mesne ekstrudate koji sadrže nativne mesne sirovine i komponente koje sadrže skrob. Danas je paleta sličnih ekstrudiranih proizvoda narasla i sadrži proizvode izrađene od kompleksnih sirovina sa sadržajem proteina do 22-24%.

Rezultati ispitivanja funkcionalnih i tehnoloških svojstava visokoproteinskih ekstrudata ukazuju na dobru perspektivu njihovog korišćenja kao zamenu za skupe mesne sirovine u različitim proizvodima od mesa, uključujući i proizvode u konzervi.

Ključne reči: ekstrudati, svojstva, emulzije protein-mast

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NEW TECHNOLOGY OF PRODUCTION OF PLANT-MEAT EXTRUDATES WITH HIGH FUNCTIONAL PROPERTIES

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There is a trend on the Russian meat market to find an alternative to soy products used in meat products, which are mostly the products of processing of GMO. The use of different sources of plant protein is one of the solutions on replacement of soy products.

The extrusion technology enables obtaining products of different raw material composition, balanced chemical composition and expressed functional properties. In 2004, in Russia for the first time were produced plant-meat extruded products, containing native meat raw materials and starch-containing components. Nowadays, the range of similar extruded products is increased and contains the products of complex raw material composition with the contents of proteins up to 22-24%.

The results of the investigations of functional-technological properties of high-protein extrudates indicate good prospects for their use in the technology of different meat products, including canned products, as substitutes of expensive basic meat raw materials.

Key words: extrudates, properties, protein-fat emulsions

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II-4

VAŽNIJI PARAMETRI KVALITETA FERMENTISANIH POLUSUVIH KOBASICA PROIZVEDENIH SA MASNIM TKIVOM I BILJNIM MASTIMA

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Polusuve fermentisane kobasice kod nas predstavljaju novu grupu proizvoda, čiji kvalitet je definisan Pravilnikom o kvalitetu i drugim zahtevima za proizvode od mesa (33/2004). Cilj ovog rada bio je da se ispitaju važniji parametri kvaliteta ovih kobasica, kao i proizvoda kod kojih je čvrsto masno tkivo zamenjeno biljim mastima.

Fermentisane polusuve kobasice proizvedene su od svinjskog i goveđeg mesa i čvrstog masnog tkiva, uz dodatak nitritne soli za salamurenje, šećera, začina i starter kultura. Kod modifikovanih fermentisanih polusuvih kobasica, masno tkivo je zamenjeno sa 15 i 25% biljne masti. Nadev kobasica je finije usitnjen u kuteru i napunjen u veštačke kolagene omotače prečnika 65 mm. Kobasice su sazrevale do 14 dana na temperaturi od 18-20^{o}C, pri čemu su blago odimljene. Fermentisane polusuve kobasice sadržale su 33,0-34,8% masti, dok su proizvodi dobijeni sa 25% biljne masti sadržali 38,1% masti, a proizvodi dobijeni sa 15% biljne masti sadržali su 28,5% masti. Sadržaj proteina mesa iznosio je 20,4%, kod proizvoda sa 25% biljne masti 18,1% i kod proizvoda sa 15% biljne masti 21,0%, dok je relativan sadržaj proteina vezivnog tkiva varirao od 7 do 8%. pH -vrednost fermentisanih polusuvih kobasica iznosila je 4,97 - 5,10, kod proizvoda sa 25% biljne masti 5,06, a kod proizvoda sa 15% biljne masti 5,18. Aktivnost vode svih grupa proizvoda bila je oko 0,90. Logaritam broja bakterija koje stvaraju mlečnu kiselinu kod fermentisanih polusuvih kobasica bio je 8,34, kod proizvoda sa 25% biljne masti 7,95 i kod proizvoda sa 15% biljne masti 8,04. Kobasice sa biljnim mastima imale su čvršću konzistenciju nego proizvodi sa masnim tkivom. Izgled preseka proizvoda sa 25% biljne masti nije bio dobro ocenjen, ali nisu utvrđene značajne razlike u odnosu na izgled preseka kobasica sa masnim tkivom svinja i 15% biljne masti. Takođe, nisu utvrđene značajne razlike u aromi između ovih proizvoda.

Ključne reči: polusuve fermentisane kobasice, biljna mast, kvalitet

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IMPORTANT QUALITY PARAMETERS OF FERMENTED SEMI-DRY SAUSAGES PRODUCED WITH PORK BACKFAT AND VEGETAL FAT

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Fermented semi-dry sausages are new meat product in our country and their quality parameters are defined by the regulations No. 33/2004. The aim of this work was to investigate some important quality parameters of these sausages, as well as of the sausages in which the pork backfat was substituted with vegetal fat.

Fermented semi-dry sausages were produced from beef and pork, pork backfat, with addition of nitrite curing salt, sugar, spices and starter culture. In modified fermented semi-dry sausages the pork backfat was substituted with 15% and 25% vegetal fat. The meat batter was comminuted in the cutter and stuffed in artificial collagen casings (65 mm). The sausages ripened during 14 days at 18-20^{o}C and were slightly smoked. Fermented semi-dry sausages contained 33-34.8% fat, while the sausages produced with 25% vegetal fat contained 38,1% fat and the sausages produced with 15% vegetal fat contained 28.5% fat. The meat protein content was 20,4%, in the products with 25% vegetal fat 18.1% and in the products with 15% vegetal fat 21,0 %, while the relative content of the connective tissue proteins varied from 7 to 8%. The pH-value of fermented semi-dry sausages was 4.97 - 5.10, of the sausages with 25% vegetal fat 5.06 and of the sausages with 15% vegetal fat 5.18. The a_w-value of all groups of products was about 0.90. The lactic acid bacteria count in the fermented semi-dry sausages was 8.34 $\log_{10}$cfu/g, in the products with 25% vegetal fat 7.95 $\log_{10}$cfu/g and in the products with 15% vegetal fat was 8.04 $\log_{10}$cfu/g. The sausages with vegetal fat had a bit harder consistence than the products with pork backfat. The cross-section appearance of the product with 25% vegetal fat was lower ranked, while there were not significant differences in the cross- section appearance of the sausages with pork backfat and with 15% vegetal fat. The differences in flavour between these products were not significant, too.

Key words: fermented semi-dry sausages, vegetal fat, quality

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II-5

VAŽNIJI PARAMETRI KVALITETA I ODRŽIVOST FERMENTISANIH KOBASICA ZA MAZANJE

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Fermentisane kobasice za mazanje kod nas predstavljaju novu grupu proizvoda od mesa, čiji kvalitet je definisan Pravilnikom o kvalitetu i drugim zahtevima za proizvode od mesa (33/2004). Cilj ovog rada bio je da se ispitaju važniji parametri kvaliteta i održivost finousitnjenih i grubousitnjenih fermentisanih kobasica za mazanje.

Fermentisane kobasice za mazanje proizvedene su od svinjskog i goveđeg mesa, potrbušine svinja bez kože, nitritne soli za salamurenje i začina; nadev finousitnjenih kobasica dobijen je usitnjavanjem u kuteru, a grubousitnjenih mlevenjem na vuku. Nadev kobasica napunjen je u veštačko kolageno crevo promera 38 mm, a proizvodi su sazrevali na 18-20^{o}C do 5 dana, pri čemu su blago dimljeni. Održivost proizvoda je ispitivana tokom skladištenja proizvoda od 30 dana na temperaturi od 4^{o}C na vazduhu i u vakuum-pakovanju i na 15^{o}C u vakuum-pakovanju. Finousitnjene fermentisane kobasice za mazanje sadržale su 41,8% vode, 43,5% masti, 2,76% kuhinjske soli, 12,0% proteina mesa i 8,57% proteina vezivnog tkiva u proteinima mesa. Grubousitnjene fermentisane kobasice za mazanje sadržale su 41,5% vode, 41,3% masti, 13,8% proteina mesa, 2,90% kuhinjske soli, i 6,74% proteina vezivnog tkiva u proteinima mesa. pH-vrednost grubousitnjenih kobasica bila je 5,84, finousitnjenih 5,88, a a_w-vrednost obe grupe 0,94. Logaritam broja bakterija koje stvaraju mlečnu kiselinu iznosio je kod finousitnjenih kobasica 5,28, odnosno 5,94 kod gubousitnjenih. U toku skladištenja opadala je vrednost pH do 5,51 kod grubousitnjenih, odnosno do 5,75 kod finousitnjenih kobasica i povećavao se broj bakterija koje stvaraju mlečnu kiselinu, ali kobasice nisu izgubile mazivost i nije utvrđen kvar proizvoda.

Ključne reči: fermentisane kobasice za mazanje, kvalitet, održivost

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IMPORTANT QUALITY PARAMETERS AND SHELF-LIFE OF FERMENTED SPREADABLE SAUSAGES

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Fermented spreadable sausages are relatively new meat product in our country and their quality parameters are defined by the regulations No. 33/2004. The aim of this work was to investigate

some important quality parameters and the shelf-life of fine and coarse comminuted fermented spreadable sausages.

Fermented spreadable sausages are produced from beef and pork, pork side fat without skin, nitrite curing salt and spices; the meat batter for the fine comminuted product was prepared in the cutter and for the coarse comminuted product in the meat grinder. The products were stuffed in the artificial collagen casings (38 mm), and the products ripened at 18-20^{o}C for 5 days and were slightly smoked. The shelf-life was investigated during 30-day storage at 4^{o}C in the air and in the vacuum-packaging and at 4^{o}C in the vacuum packaging. Fine comminuted fermented spreadable sausages contained 41.8 % water, 43.5 % fat, 2.76 % sodium chloride, 12.0 % meat proteins and 8.57 % relative content of connective tissue proteins in the meat proeins. Coarse comminuted fermented spreadable sausages contained 41.5% water, 41.3% fat, 2.90% sodium chloride, 13.8% meat proteins and 6.74% relative content of connective tissue proteins in the meat proteins. The pH value of coarse comminuted products was 5.84 and of the fine comminuted products 5.88. The water activity of the both kinds of products was about 0.94. Lactic acid bacteria count was 5.29 $\log_{10}$cfu/g in fine comminuted products and 5.94 $\log_{10}$cfu/g in coarse comminuted products. During the storage the pH value of the coarse comminuted fermented spreadable sausages decreased to 5.51 and of the fine comminuted sausages to 5.75, while lactic acid bacteria count increased, but the sausages did not lose their spreadyness and the spoilage was not detected.

Key words: fermented spreadable sausages, quality, shelf-life

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II-6

ZNAČAJ AKTIVNOSTI VODE I PH VREDNOSTI U ODREĐIVANJU ODRŽIVOSTI KOBASICA

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U radu su predstavljeni rezultati istraživanja hemijskog sastava i nekih hemijskih i fizičkih svojstava najvažnijih tipova kobasica proizvedenih u Rusiji.

Prema vrednostima za aktivnost vode i pH, proizvodi od mesa su podeljeni u grupe održivosti u zavisnosti od vrste proizvoda i izvedeni su odgovarajući zaključci.

Ključne reči: aktivnost vode, pH, kobasice, održivost

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THE IMPORTANCE OF WATER ACTIVITY AND PH VALUES IN DETERMINATION OF STORAGE LIFE OF SAUSAGES

M.H. Iskakov, PhD, E.V. Fatyanov, Ch.K. Avylov

The results of the investigation of chemical composition and some physical and chemical indices of the main types of sausages produced in Russia are presented.

With the consideration of the values of water activity and pH, meat products are divided into storage groups depending on the kind of the product; the corresponding conclusions are drawn.

Key words: water activity, pH, sausages, shelf life

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II-7

UPOTREBA *LACTOBACILLUS SAKEI* I 151 U PROIZVODNJI SREMSKE KOBASICE

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Proizvodnja fermentisanih proizvoda od mesa rezultat je metaboličke aktivnosti prisutnih i u mesu adaptiranih bakterija mlečne kiseline (BMK). Na korisnim efektima koje ispoljavaju epifitni mikroorganizmi zasniva se i upotreba selekcionisanih i posebno dodatih mikroorganizama, označenih kao starter kulture.

Rezultati mnogih studija vezanih za ispitivanje mikroflore tradicionalnih sirovih kobasica, pokazuju da je od ukupnog broja BMK najdominantnija vrsta *Lactobacillus sakei*.

Danas, *Lb. sakei* često nazivaju "dobrom" tehnološkom bakterijom zbog poželjnog svojstva da, u toku svoje metaboličke aktivnosti, produkuje sekundarna jedinjienja, označena kao bakteriocini.

Bakteriocini predstavljaju peptidne ili proteinske molekule koji ispoljavaju inhibitorni efekat u odnosu na određene patogene mikroorganizme, pri čemu se baktericidno dejstvo u odnosu na *Listeria monocytogenes* i bakterije kvara, smatra naročito značajnim.

Rastuće potrebe za prirodno sigurnom i zdravstveno bezbednom hranom, dovelo je do pojačanog interesa za upotrebom bakteriocin-produkujućih BMK, koje se danas, kao protektivne kulture, koriste za proizvodnju fermentisanih proizvoda u industriji mesa.

Tradicionalni fermentisani proizvodi od mesa predstavljaju deo prirodnih resursa i nacionalne kulture svake zemlje koji je čine prepoznatljivom u svetu. Početak proizvodnje tradicionalne Sremske kobasice vezuje se za period od pre 150 godina i ravničarske krajeve jugoistočnog dela Panonske nizije. Danas, proizvodnja Sremske kobasice na tradicionalan način, vrši se u domaćinstvima ili manjim zanatskim objektima. Osnovni sastojci predstavljaju, uglavnom, svinjsko meso, slanina (čvrsto masno tkivo) a od začina se, najčešće, koristi aleva paprika, biber i beli luk. Sam proces mlečne fermentacije je spontan i nekontrolisan. Kvalitet nastalog proizvoda rezultat je sastava samog nadeva, metaboličke aktivnosti prisutne epifitne mikroflore, tankog svinjskog creva kao omotača i fizičko-hemijskih promena nastalih usled procesa dehidratacije i efekata dimljenja.

Stoga, ova ispitivanja su imala za cilj da utvrde mogućnost primene protektivnog soja *Lactobacillus sakei* I151 u proizvodnji tradicionalne Sremske kobasice, kao dopuna „barijernom" pristupu zaštite hrane u cilju dobijanja zdravstveno bezbedne kobasice.

Istovremeno, upotrebom *Lactobacillus sakei* I151 u proizvodnji domaće fermentisane kobasice, nastojalo se utvrditi i mogućnost njegove primene u cilju dobijanja proizvoda sa poželjnim i visoko ocenjenim organoleptičkim karakteristikama.

Ključne reči: Sremska kobasica, *Lactobacillus sakei*, bakteriocini, zdravstvena ispravnost, kvalitet

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USAGE OF *LACTOBACILLUS SAKEI* I 151 IN THE PRODUCTION OF SREMSKA SAUSAGE

Slavica Veskovic-Moracanin, D. Obradovic, Dragica Karan

Production of fermented meat products is the result of metabolic activity of meat and of adapted Lactic Acid Bacteria (LAB). The application of selected and specially added microorganisms, named as starter cultures, has been based on the knowledge of beneficial effects exhibited by epiphyte microorganisms.

Results of many studies on traditional raw sausages have showed that the most dominant species of all LAB is *Lactobacillus sakei*.

Today, *Lb. sakei* is often referred as "good" industrial bacteria due to its metabolic activity reflected trough the production of secondary components named as bacteriocines. Bacteriocines are peptides or protein molecules exhibiting the inhibitory effect towards certain pathogenic microorganisms. This bactericide effect towards *Listeria monocytogenes* and spoilage bacteria is considered to be especially important.

Growing need for naturally safe and healthy food has lead to the increased interest for the application of bacteriocine-producing LAB, used today as protective cultures in the meat industry for production of fermented meat products.

Traditional fermented meat products represent the natural resources and part of the national culture of every country that make it recognizable all over the world. The initiation of Sremska sausage production has connected to the period 150 years ago and lowland area of Panonska valley. Today, traditional Sremska sausage production has been done in the households and smaller manufactures. Basic ingredients are, mostly, pork meat, bacon (solid fat tissue) and spices such are powder paprika, pepper and onion. The fermentation process itself is spontaneous and uncontrolled. Quality of the products is the result of the filling content, metabolic activity of the present epiphyte micro flora, pork ileum as coating and physicochemical changes occurred due to the dehydrating process and effects of fumigation.

Based on these facts, this research aimed towards determination of the possibility of application of protective strain of *Lactobacillus sakei* I151 in the production of traditional Sremska sausage, as an addition of „barrier" approach of food protection in the aim of providing the safe sausage. At the same time the aim was to, by application of *Lactobacillus sakei* I151 in the production of domestic fermented sausage, determine the possibility of its application in the production of products of desirable and highly evaluated sensory properties.

Key words: Sremska sausage, *Lactobacillus sakei*, bacteriocins, safety, quality

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II-8

PRIKAZ NEKIH OD PARAMETARA KVALITETA SREMSKE KOBASICE PROIZVEDENE SA *LACTOBACILLUS SAKEI* I 151

Dragica Karan, Slavica Vesković-Moračanin, Snežana Saičić

Savremeni koncept proizvodnje i prerade hrane bazira se na primeni različitih vidova zaštitnih tehnologija koje imaju za cilj da, istovremeno, osiguraju i očuvaju zdravstvenu bezbednost proizvoda, kao i prihvatljiv i pri tom nepromenjen kvalitet, od momenta proizvodnje do momenta konzumiranja. Jedna od takvih, ujedno i najstarijih, tehnologija je fermentacija.

Rastuća potreba za prirodno sigurnom i zdravstveno bezbednom hranom, dovela je do pojačanog interesa za upotrebom bakteriocin-produkujućih bakterija mlečne kiseline (BMK), koje se, kao protektivne kulture, koriste za proizvodnju fermentisanih proizvoda u industriji mesa. Princip na kome počiva biološka zaštita zasniva se na smanjenju rizika po zdravlje potrošača delovanjem, prvenstveno, na nepoželjne bakterije kvara ili trovače hranom, ali bez promene kvaliteta.

Lactobacillus sakei je često prisutan u komercijalnim starterima evropskih zemalja. Zbog osobina da razlaže glukozu bez stvaranja gasa, produkcije bakteriocina sa inhibitornim efektom u odnosu na određene patogene mikroorganizme, prvenstveno *Listeria. monocytogenes* i bakterije kvara i izražene tolerantnosti na visoke koncentracije soli, predstavlja značajan potencijal primene u industriji mesa.

Sremska kobasica je tipičan predstavnik fermentisanih, sirovih kobasica. To je naš, domaći proizvod u kome se zrenje (fermentacija) odvija pod posebnim uslovima, pa se zbog toga umnogome razlikuje od drugih trajnih kobasica.

Karakteristična organoleptička svojstva rezultat su aktivnosti prisutne domaće, epifitne mikroflore kao i fizičko-hemijskih promena nastalih u toku procesa zrenja.

Kako je imperativ savremene proizvodnje osigurati i očuvati bezbednost proizvoda, kao i prihvatljiv i pri tom nepromenjen kvalitet, od momenta proizvodnje do momenta konzumiranja, proizvedena je sremska kobasica sa dodatom protektivnom kulturom *Lb.sakei* u količini koja obezbeđuje koncentraciju od 10^5-10^6 cfu/g.

U toku procesa fermentacije, koji je trajao 28 dana, praćeni su određeni parametri kvaliteta kao i organoleptička svojstva. Ogled u industriji mesa ponovljen je tri puta.

Dobijeni rezultati ispitivanih parametara kvaliteta kao i rezultati senzorske ocene kobasica proizvedenih sa *Lb. sakei,* daju mogućnost unapređenja proizvodnje sremske kobasice. Naime, navedena ogledna grupa sremske kobasice imala je bolja organoleptička svojstva u odnosu na kontrolnu grupu uzoraka, pa je i utvrđena razlika u ocenama bila statistički značajna.

Ispitivani parametri kvaliteta (pH, a_w, % NaCl, % H_2O, sadržaj nitrita, indeks proteolize - Pi, SMK izražene kao sadržaj oleinske kiseline) bili su u granicama karakterističnim za ovu grupu proizvoda.

Ključne reči: Sremska kobasica, *Lactobacillus sakei,* organoleptička svojstva, parametri kvaliteta

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OVERVIEW OF SOME QUALITY PARAMETERS OF SREMSKA SAUSAGE PRODUCED WITH *LACTOBACILLUS SAKEI* I 151

Dragica Karan, Slavica Veskovic-Moracanin, Snezana Saicic

Contemporary concept of food production and processing has been based on the application of different types of protection technologies that aim towards providing and preserving the safety of the products that, in the same time, have acceptable and unchanged quality from the moment of production to the moment of consumption. One of these technologies, belonging to the oldest ones, is fermentation.

Growing need for environmentally safe food and food safe for consumer's health has led towards the increased interest in application of bacteriocine-producing Lactic Acid Bacteria (LAB). These bacteria are used in the meat industry as protective cultures. The principle on which the biological protection is based can be summarized in decreasing the risk for consumer health primarily by activity of these compounds towards unwanted spoilage or poisoning bacteria, having at the same time, unchanged product quality.

Lactobacillus sakei is often used as a starter culture in the European countries. This bacteria has significant potential for application in the meat industry due to the fact that metabolizes glucose without gas creation, produces bacteriocines that have inhibitory effect to certain pathogenic microorganisms, primarily to *Listeria monocytogenes* and spoilage bacteria, and is tolerant to high salt concentrations.

Sremska sausage is the typical representative of fermented, raw sausages. This is our national product where maturing (fermentation) occurrs under special conditions which makes it different compared to the other fermented sausages.

Its characteristical sensory properties are the result of the metabolic activity of present domestic, epiphyte microflora and physico-chemical changes which occur during the process of maturing.

Following the imperative of every modern production, summarized in the efforts to ensure and maintain safety of the product of acceptable and unchanged quality from the moment of production to the moment of consumption, Sremska sausage was produced with *Lb.sakei* added in the amount to provide its concentration of 10^5-10^6 cfu/g .

During the fermentation process, lasting for 28 days, certain quality parameters have been determined as well as sensory properties. The experiment was conducted in the meat industry with three replicates.

Obtained results of the examined quality parameters, as well as the results of the sensory analyses of the sausages produced with *Lb. sakei,* give the opportunity for the improvement of the Sremska

sausage production. Actually, the experimental group of Sremska sausage have had better sensory properties compared to the control group of samples which was confirmed by the determined statistically significant grade differences.

The examined quality parameters (pH, a_w, % NaCl, % H_2O, nitrite content, proteolysis index - Pi, FFA presented as content of oleic acid) were within the limits characteristical for this group of products.

Key words: Sremska sausage, *Lactobacillus sakei,* sensory properties, quality parameters

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II-9

HEMIJSKE KARAKTERISTIKE HEMOGLOBINSKE FRAKCIJE DOBIJENE IZ KRVI SVINJA

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Hemoglobinska frakcija koja se dobija separacijom krvi životinja za klanje ima visok sadržaj nutritivno iskoristljivog gvožđa, što je, između ostalog, svrstava u potencijalno veoma vredne sirovine za izradu različitih funkcionalnih prehrambenih proizvoda. Pored nutritivno iskoristljivog sadržaja gvožđa koji je helatnog oblika, pulverizovana hemoglobinska frakcija, hemoglobin u prahu, posmatrano s aspekta tehnologije hrane, značajan je i zbog visokog sadržaja belančevina koje se, pored nutritivne vrednosti, odlikuju i dobrim funkcionalnim karakteristikama.

S obzirom na to da hemijske karakteristike krvi, pa samim tim i hemoglobinske frakcije, variraju u zavisnosti od pola, rase, starosti, uslova uzgoja i dr., u našem radu smo ispitali neke najvažnije, za praksu prehrambene tehnologije, hemijske parametre hemoglobinske frakcije dobijene iz krvi deset svinja klanične težine između 100 i 110 kg.

Hemoglobinska frakcija dobijena separacijom svinjske krvi na 7000 ob/min pri temperaturi od 10^{o}C, koja je bila stabilizovana sa 1% trinatrijumcitratom dodatim u obliku desetopostotnog vodenog rastvora, ispitana je na sadržaj belančevina, vode, pepela, ukupnog sadržaja gvožđa i sadržaj neheliranog gvožđa.

Prosečan sadržaj belančevina u deset ispitivanih uzoraka hemoglobina iznosio je 32,5 g u 100 g, pri čemu je maksimalna vrednost iznosila 34,10 g/100g, a minimalna vrednost 31,30 g/100g. Sadržaj ukupnog gvožđa u ispitivanim uzorcima hemoglobinske frakcije varirao je od 110,82 mg/100g do 125,09 mg/100g, sa prosečnom vrednošću od 118,87mg/100 g. Preračunato na suvu materiju, maksimalan sadržaj gvožđa iznosio je 342,6 mg/100g, a minimalan 339,2 mg/100g, što za praksu nema bitnog značaja. Ispitivanja su pokazala da se sadržaj neheliranog gvožđa u odnosu na ukupno gvožđe u uzorcima hemoglobinske frakcije kretao u granicama od 0,26% do 0,33%, što su za praksu zanemarljive količine. Posle petnaest dana skladištenja hemoglobinske frakcije na temperaturi od –18^{o}C, sadržaj neheliranog gvožđa uvećao se u proseku 3,5 puta. S obzirom na to da je i posle petnaest dana zamrzavanja procenat neheliranog gvožđa u odnosu na ukupno gvožđe i dalje manji od 1%, smatramo da ova promena u sastavu hemoglobinske frakcije nije značajna za praksu. Međutim, rezultati koje smo dobili u pogledu promene sadržaja neheliranog gvožđa u toku skladištenja hemoglobinske frakcije na –18^{o}C, obavezuju autore na dalja ispitivanja u ovoj oblasti.

Ključne reči: hemoglobin, krv svinja, nutritivno iskoristljivo gvožđe,

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CHEMICAL PROPERTIES OF HEMOGLOBIN FRACTION OBTAINED FROM PORCINE BLOOD

Vesna Matekalo-Sverak, L. Turubatovic, Dejana Trbovic, Jelena Babic, D. Milicevic

Hemoglobin fraction obtained by separation of slaughter animal blood has high contents of nutritively efficient iron, which place it, apart from the other things, among the potentially very valuable raw materials for formulation different functional food products. Besides its nutritively efficient iron content which is of helate form, pulverised hemoglobin fraction, hemoglobin in powder, considering the aspect of food technology, it is also important for its high content of proteins which, apart from their nutritive value are characterised by good functional characteristics.

Considering that chemical characteristics of blood, and so the hemoglobin fraction, vary depending on the sex, breed, age, welfare etc., this paper addressed some of the most important chemical parameters for the practice of food technology, chemical parameters of hemoglobin fraction obtained from blood of ten pigs of slaughter weight between 100 and 110 kg.

Hemoglobin fraction obtained by separation of porcine blood at 7000 r/min at 10^{o}C, stabilised with 1% trisodium citrate added in form of 10% water solution, was assayed for the contents of proteins, water, ash, total iron and non-chelated iron.

Average protein content in ten examined samples of hemoglobin was 32.5 g in 100 g, maximum value being 34.10 g/100g, and minimum value 31.30 g/100g. Total iron content in the examined samples of hemoglobin fraction varied from 110.82 mg/100g to 125.09 mg/100g, with average value of 118.87mg/100 g. Counted as dry matter, maximum iron content was 342.6 mg/100g, and minimum 339.2 mg/100g, what is not significant for practice. The examinations showed that non-chelated iron content compared to total iron in the samples of hemoglobin fractions ranged from 0.26% to 0.33%, what are neglectable quantities for practice. After fifteen days of storage hemoglobin fraction at – 18^{o}C, contents of non-chelated iron increased on the average 3.5 times. Considering that after fifteen days of freezing, percentage of non-chelated iron compared to total iron was still below 1%, we deem this change in composition of hemoglobin fraction insignificant for practice. However, the results obtained regarding the change of non-chelated iron content during storing of hemoglobin fraction at –18^{o}C, direct authors towards further investigations in this area.

Key words: hemoglobin, porcine blood, nutritively efficient iron

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II-10

MOGUĆNOSTI PRIMENE PROIZVODA ALGEL 55 ZA REKONSTRUKCIJU KOMADNOG I MLEVENOG MESA I DRUGIH SIROVINA U PRERADI MESA

P. Modić, U. Spinetta, G. D'Avenia

Alginati su soli alginske kiseline dobijeni ekstrakcijom mrkih morskih algi. U prisustvu jona kalcijuma, u hladnim uslovima, sa vodom grade jak, kohezivni i termostabilni gel što se može iskoristiti za restrukturiranje manjih komada mesa, masnog tkiva i drugih animalnih i biljnih sirovina koje se mogu upotrebiti za izradu proizvoda od tzv. reformiranog mesa (šunke, stejkovi, hamburgeri, pljeskavice, kebab, šašlik i dr.), proizvoda od ribe, vegetalno-mesnih proizvoda itd.

Snaga, kohezivnost i termorezistentnost gela alginata Algel 55 su takvi da se novodobijeni restrukturirani proizvodi po svojim senzornim svojstvima (povezanosti, konzistenciji, izgledu, ukusu i dr.) gotovo ne razlikuju od uobičajenih proizvoda od mesa u komadima. Ovo daje mogućnost široke primene Algela 55 u izradi navedenih proizvoda kako u industriji mesa tako i u kateringu.

U radu se navode primeri načina pripreme i upotrebe Cargill proizvoda Algel 55 u izradi nekoliko vrsta proizvoda od komadnog i mlevenog mesa, kao i u pripremi „čvrstog" masnog tkiva, meso-vegetalnog hamburgera i sojinog hamburgera.

Ključne reči: alginati, resrukturiranje, reformirano meso, Algel 55

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POSSIBILITIES OF USE OF PRODUCT ALGEL 55 FOR RECONSTITUTION OF MEAT PIECES, GROUND MEAT AND OTHER RAW MATERIALS IN MEAT PROCESSING

P. Modic, U. Spinetta, G. D'Avenia

Alginates are saltes of alginic acid produced by extraction from brown seaweed. In presence of calcium ions, in cold conditions, alginates make with water strong, cohesive and thermoresistent gel, so they can be used for restructuring of small meat pieces and chunks, fat, and other animal or vegetal raw materials, which may be used in production of so called re-formed meat products (ham, steak, hamburger, pleskavica, kebab, saslik etc.), various fish products, vegetable-meat products etc.

Strength, cohesivity and thermoresistence of gel made of Algel 55, allow practicaly the same sensory properties of restructured meat products as at similar meat product produced from chunks. In meat industry and catering, there are various possibilities of application of Algel 55 in production of mentioned products.

In this paper authors give examples of some application possibilities of using Cargill's product Algel 55 in preparing various meat products, „hard" pork fat, meat/vegetable hamburgers, as well as pure soy hamburgers.

Key words: alginates, reconstitution, reformed meat, Algel 55

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II-11

PROUČAVANJE MOGUĆNOSTI UPOTREBE DIHIDROKVERCETINA ZA UJEDNAČAVANJE KVALITETA KOBASICA PROIZVEDENIH UZ KORIŠĆENJE MDPM

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Rad ukazuje na mogućnost upotrebe bioflavonoida dihidrokvercetina (DHQ) kao antioksidansa kada se u proizvodnji kobasica koristi otkošteno živinsko meso. Prikazani su rezultati eksperimentalnog određivanja peroksidnog broja u cilju evaluacije uticaja DHQ na nivo lipidne oksidacije MDPM uzoraka, kao i rezultati proučavanja mikrostrukture poludimjenih kobasica proizvedenih sa uzorcima MDPM koje su čuvane jedan mesec. Dobijeni rezultati ukazuju na to da se sa povećanjem količine dodatog DHQ nadevu za kobasice povećava i stabilnost u smislu izostanka lipidne oksidacije. Gustina rasporeda strukturnih elemenata se povećava i praktično se ne razlikuju od strukturnih elemenata standardnih uzoraka poludimljenih kobasica.

Ključne reči: dihidrokvercetin, kvalitet, stabilizacija, kobasičarski proizvodi, MDPM

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STUDY ON POSSIBILITY OF DIHYDROQUERCETIN APPLICATION FOR STABILIZATION OF SAUSAGE QUALITY MANUFACTURED WITH THE USE OF MDPM

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The article shows a possibility of use of a bioflavonoid dihydroquercetin (DHQ) as an antioxidant, if mechanically deboned poultry meat is used in sausage products. The results of the experimental determination of peroxide number to evaluate the influence of DHQ on the lipid oxidation rate of MDPM samples were presented, as well as the results of study of microstructure of semi-smoked sausages, manufactured with the use of samples of MDPM, which have been stored for one month. The obtained results suggest that with the increase of DHQ added to the sausage meat, the stability to oxidation spoilage is increased. The density of arrangement of structural elements increases, and practically is not different from that of structural elements of standard samples of semi-smoked sausage.

Key words: dihydroquercetin, quality, stabilization, sausage products, MDPM

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II-12

NUTRIVNI I SENZORNI KVALITET BARENIH KOBASICA IZRAĐENIH SA DODATKOM PREHRAMBENIH VLAKANA

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U ovom radu analiziran je uticaj dodatka prehrambenih vlakana na kvalitet fino usitnjenih barenih kobasica. Ispitana je kobasica ''Fitnes'' izrađena sa dodatkom prehrambenih vlakana (inulina) i ''Posebna'' kobasica kao srodan proizvod istog proizvođača.

Tržišno-potrošački kvalitet ispitan je po parametrima i kriterijumima Pravilnika o kvalitetu i drugim zahtevima za proizvode od mesa (2004) i Pravilnika o deklarisanju i označavanju upakovanih namirnica (2004). Takođe, ispitan je i uticaj prehrambenih vlakana na senzorni i nutritivni kvalitet fino usitnjenih barenih kobasica i teksturu određenu instrumentalno (nežnost i čvrstoća, uređajem INSTRON), radi definisanja ukupnog kvaliteta ove grupe kobasica.

Analizom dobijenih rezultata pokazatelja hemijsko-tehnološkog i senzornog kvaliteta, kao i teksture, određene instrumentalno, zaključeno je da ispitani proizvodi zadovoljavaju osnovne parametre kvaliteta po važećim Pravilnicima i da dodatak prehrambenih vlakana u nadev fino usitnjenih barenih kobaca utiče pozitivno na nutritivni i senzorni (teksturu) kvalitet proizvoda, te da se ovaj proizvod može okarakterisati kao proizvod koji je "izvor vlakana", odnosno kao "funkcionalna hrana".

Ključne reči: barene kobasice, nutritivni i senzorni kvalitet, prehrambena vlakna

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NUTRITIONAL AND SENSORIAL QUALITY OF COOKED SAUSAGES MADE WITH ADDITION OF DIETARY FIBERS

Ljiljana Petrovic, V. Tomovic, Natalija Dzinic, Biljana Pesovic, P. Salitrezic, B. Sojic, Marija Jokanovic

The influence of dietary fibre addition on quality of fine comminuted coocked sausages was analyzed in this work. The investigated sausages were: "Fitnes", made with the addition of dietary fibers (inulin) and "Posebna" sausage, similar product made by the same producer.

The market-consumer quality was analyzed according to criteria of Regulations on quality and other demands for meat products (2004) and Regulations on declaration and labelling of packed food products (2004). Effect of dietary fiber on nutritional and sensory quality of fine comminuted

cooked sausages and texture instrumentally (tenderness and firmness using the INSTRON device) was also analysed aiming to define the total quality of this group of sausages.

Analysing the chemical–technological and sensory quality indicators, as well as texture, determined instrumentally, of the investigated products, it was concluded that the analysed products satisfy the basic parameters of quality according to the current regulations (2004), and that the addition of dietary fibre in stuffing of fine comminuted coocked sausages has positive influence on nutritive and sensory quality of the product. Therefore this product may be caracterised as a product which is a source of fibres, or as "functional food".

Key words: cooked sausages, nutritional and sensory quality, dietary fiber

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II-13

PROBLEM GENETSKI MODIFIKOVANIH BILJNIH VLAKANA, POTRAGA ZA ALTERNATIVNIM REŠENJIMA

Dr Tatyana M. Geero, Olga I. Chirkova

Rad se bavi problemom genetski modifikovanih biljnih vlakana i proizvodnjom prehrambenih proizvoda.

Takođe se razmatra i razvoj tehnologije proizvodnje mešane paštete na bazi sporednih proizvoda klanja jaganjaca i živine sa korišćenjem leblebije.

Ključne reči: biljna vlakna, mešana pašteta, leblebija, H'm – kulture, leguminoze

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PROBLEM OF GENETICALLY MODIFIED PLANT FIBERS, SEARCH FOR ALTERNATIVE SOLUTIONS

Tatyana M. Geero, PhD., Olga I. Chirkova

The urgency of problem of genetically modified plant fibers and creation of food products nutrition is discussed.

The development of the technology of combined paste on the basis of lamb and chicken by-products with the use of chick pea is considered.

Key words: plant fibers, combined paste, chick pea, H'm-cultures, legumes

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II-14

SUPERKRITIČNI CO_2 EKSTRAKTI IZ BILJAKA KAO ADITIVI U PROIZVODNJI I PRERADI MESA

Irena Žižović, Nada Aničić, Jasna Ivanović, S.D. Petrović

Jedan od najznačajnijih trendova u prehrambenoj industriji danas je primena prirodnih aditiva (aroma, začina, antioksidanasa, pigmenata). Proces natkritične ekstrakcije (NKE) ugljen dioksidom ima brojne prednosti u osnosu na druge vrste ekstrakcija (organski rastvarači) i destilaciju. Dobijeni ekstrakti ne sadrže tragove organskih rastvarača, nisu pretrpeli termičku degradaciju i bakteriološki su čisti, a uslovi ekstrakcije omogućavaju koncentrisanje željene frakcije u ekstraktu. Iz navedenih razloga, natkritični ekstrakti su superiorniji u odnosu na ekstrakte dobijene drugim metodama i postoje brojne mogućnosti njihove primene u prehrambenoj industriji.

Procesom natkritične ekstrakcije ugljen dioksidom iz nekih vrsta biljne familije Lamiaceae moguće je dobiti ekstrakte sa antioksidativnim svojstvima. Danas se u prehrambenoj industriji koriste sintetisani antioksidansi kao BHT (butilovani hidroksi-toluen), BHA (butilovani hidroksi-anisol), propil-galat ili TBHQ (tercijalni butil-hidrokinon). Kako se ovi antioksidansi proizvode hemijskim procesima sinteze, njihova primena kao sintetičkih hemijskih supstanci je rigorozno ograničena. Stoga je, poslednjih godina, najviše istraživanja usmereno na izdvajanje antioksidanasa iz biljnog materijala i to karanfilića, đumbira, muskatnog oraščića i pripadnika familije Lamiaceae: ruzmarina, žalfije, timijana i oregana. Fenolski di- i tri-terpeni izolovani iz ruzmarina (rosmanol, carnosol, rosmaridiphenol, rosmaridiquinone) i žalfije, pokazali su ekvivalentnu antioksidativnu moć sa BHA i BHT. Procesom NKE čistim ugljen dioksidom moguće je dobiti ekstrakte ruzmarina, žalfije, oregana i timijana ekvivalentne antioksidativne moći sa sintenskim antioksidansima, koji pri tome, ne utiču na ukus hrane. Izdvojeni antioksidativni ekstrakti, koji imaju smolasti karakter na sobnoj temperaturi, mogu se mleti u fini prah na -18^{o}C i rastvarati ili dispergovati u biljnim ili životinjskim uljima i mastima za primenu u prehrambenim proizvodima.

U ovom radu biće prezentovane mogućnosti primene natkritičnih ekstrakata biljaka familije Lamiaceae u proizvodnji i preradi mesa. Takođe, biće predstavljeni sopstveni eksperimentalni rezultati dobijanja ekstrakata sa antioksidativnim svojstvima iz ruzmarina, žalfije i izopa.

Ključne reči: prirodni aditivi, antioksidansi, natkritična ekstrakcija, ruzmarin, žalfija

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SUPERCRITICAL CO_2 PLANT EXTRACTS AS ADDITIVES FOR MEAT INDUSTRY

Irena Zizovic, Nada Anicic, Jasna Ivanovic, S.D. Petrovic

One of the most important trends in food industry today is application of natural additives (aromatics, spices, antioxidants, pigments). Supercritical fluid extraction (SFE) with carbon dioxide has numerous advantages over the other techniques of extraction (organic solvents) and distillation. Supercritical extracts are free of traces of organic solvents, they were not subjected to thermal degradation and are free of bacteria. Extraction conditions allow concentration of desirable fraction in the extract. For the abovementioned reasons, the supercritical extracts are superior to the extracts obtained by other methods and there is a number of possibilities for their application in the food industry.

Using the process of supercritical fluid extraction with carbon dioxide from some species of plant family Lamiaceae it is possible to obtain extracts with antioxidative properties. Nowadays, in the food industry, synthetic antioxidants such as BHT (butylated hydrohytoluene), BHA (butylated hydrohyanisole), propyl-galate and TBHQ (tert-butylhydroquinone) are used as antioxidants in food industry. Since these antioxidants are produced by synthetic chemical processes, their application as synthetic chemical substances is severely limited. Therefore, most of the work has been focused on isolation of compounds with antioxidant properties from plant material such as clove, ginger, nutmeg and members of Lamiaceae family species: rosemary, sage, thyme and oregano. Phenolic di- and triterpenes isolated from rosemary (rosmanol, carnosol, rosmaridiphenol, rosmaridiquinone) and sage, showed antioxidative power equivalent with that of BHA and BHT. Using the SFE process with pure carbon dioxide it is possible to obtain extracts of rosemary, sage, oregano and thyme with antioxidative power equivalent with that of synthetic antioxidants which do not affect the taste of food. The antioxidative extracts which have resiny character at room temperature, may be powdered at -18^{o}C and dissolved or dispersed in vegetable or animal oils and fats suitable for application in food products.

Possibilities for the application of supercritical extracts of Lamiaceae family species as additives in meat industry will be presented in this study. Experimental results (supercritical extractions of rosemary, sage and hyssop) will be presented as well.

Key words: Natural additives, antioxidants, supercritical fluid extraction, rosemary, sage

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II-15

SADRŽAJ ADITIVA U NEKIM VRSTAMA PROIZVODA OD MESA

D. Jančić, Milena Đurišić

Aditivi su najviše osporavani sastojci u prehrambenoj industriji. Međutim, industrijska proizvodnja prehrambenih proizvoda, pa i proizvoda od mesa, ne može se zamisliti bez korišćenja određenih dodataka. Salamurenje mesa je od velikog značaja za mesno-prerađivačku industriju. Ključni sastojak salamure za meso su soli za salamurenje, nitriti i nitrati (0,5-0,6%), koji se sa kuhinjskom soli, začinima i drugim dodacima (redukujuće supstance, fosfati i sl.) redovno koriste u industrijskoj preradi mesa.

Cilj rada je da prikaže vrste i sadržaj upotrebljenih aditiva u nekim proizvodima od mesa proizvođača „Pantomarket“ iz Herceg Novog. Analziran je 21 uzorak različitih proizvoda od mesa iz grupe barenih i polutrajnih kobasica i konzervi od mesa u komadima.

U svim ispitivanim uzorcima utvrđeno je prisustvo nitrita, nitrata, fosfata i hlorida, čiji je sadržaj određivan kvantitativno. Kod 15 uzoraka utvrđeno je prisustvo boje košenila - E 120, dok je kod 12 uzoraka utvrđeno prisustvo skroba.

Za određivanje navedenih parametara korišćene su sledeće tehnike: spektrofotometrija (nitriti, nitrati, fosfati), ICP (fosfati), volumetrija (hloridi), papirna hromatografija (boje) i Lugolova reakcija (skrob).

Nađene vrednosti za $NaNO_2$ kretale su se od 37,2 mg/kg («Mini alpska kobasica») do 78,5 mg/kg («Mini šunka u crevu - konzerva od mesa u komadima»). Sadržaj $NaNO_3$ je bio najmanji u uzorku «Mini pileća ekstra – fino usitnjena barena kobasica» i iznosio je 167,7 mg/kg, a najveći u uzorku «Pileća prsa u crevu – konzerva od mesa u komadima» i iznosio je 249,1 mg/kg. Najmanje fosfata izraženih kao P_2O_5 sadržao je uzorak «Posebna kobasica – fino usitnjena barena kobasica» i to 3,9 g/kg, a najviše uzorak «Kranjska kobasica – vakuum» i to 5,0 g/kg. Sadržaj NaCl se kretao od 1,5% u uzroku «Mini pileća ekstra – fino usitnjena barena kobasica» do 2,8% u uzorku «Šunka u crevu – konzerva od mesa u komadima». U svim uzorcima je upotrebljena boja Košenila - E 120, izuzev 6 proizvoda od mesa peradi (četiri pileća i dva ćureća), gde je sadržaj određen samo kvalitativno. Prisustvo skroba je, takođe, određivano samo kvalitativno i dokazano je kod 12 ispitivanih uzoraka.

Procena ispravnosti proizvoda vršena je u skladu sa odredbama Pravilnika o kvalitetu i uslovima upotrebe aditiva u namirnicama i o drugim zahtevima za aditive i njihove mešavine (»Sl. list SCG«, br. 56/03, 5/04 i 16/05). Nađene vrednosti za $NaNO_2$, $NaNO_3$ i fosfate izražene kao P_2O_5 bile su u granicama propisanim navedenim Pravilnikom. Prosečno, nitrita je bilo manje za 40% od limitirane količine, nitrata za 18%, a fosfata za 11%. Takođe, upotrebljena boja Košenila – E 120, kao i dodatak skroba bili su u skladu sa propisima navedenog Pravilnika. Svi navedeni aditivi bili su pravilno deklarisani.

Ovim ispitivanjima utvrđeno je da analizirani uzorci mesnih proizvoda Industrije mesa »Pantomarket« iz Herceg Novog prema vrstama i količinama upotrebljenih aditiva odgovaraju uslovima Pravilnika o kvalitetu i uslovima upotrebe aditiva u namirnicama i o drugim zahtevima za aditive i njihove mešavine (»Sl. list SCG«, br. 56/03, 5/04 i 16/05).

Ključne reči: aditivi, mesni proizvodi, pravilnik

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THE CONTENT OF ADDITIVES IN SOME KINDS OF MEAT PRODUCTS

D. Jancic, Milena Djurisic

Additives are the most disputable components in the food industry. However, industrial production of food products, including meat products, cannot be imagined without the use of additives. Curing of meat is very important for the meat industry. The main components of the brine are curing salts, nitrites and nitrates (0.5-0.6%), which are normally used in meat industry with salt, spices and other additives (reducing substances, phosphates etc).

The main objective of this work is to present kinds and amounts of used additives in several meat products made by Meat industry „Pantomarket“, Herceg Novi, Montenegro. The analyses were made on 21 samples of different meat products from group of boiled and semi-durable sausages and canned meat chunks.

In all the analysed samples presence of nitrites, nitrates, phosphates and chlorides was detected, and their contents was determined quantitatively. In 15 samples presence of colour Cochinilla (E 120) and in 12 samples starch content were detected.

For determination of these parameters the following techniques were used: spectrophotometry (nitrates, nitrites and phosphates), ICP (phosphates), volumetry (chlorides), paper chromatography (colours) and Lugol reaction (starch).

The values determined for $NaNO_2$ ranged from 37.2 mg/kg (Mini Alpine sausage) to 78.5 mg/kg (Mini Ham in Casing – canned meat chunks). The contents of $NaNO_3$ was the lowest in the sample Mini Chicken Extra – finely minced boiled sausage and it was 167.7 mg/kg. The highest contents of $NaNO_3$ was determined in sample Chicken Breast in Casing – canned meat chunks 249.1 mg/kg. The minimum level of phosphates as P_2O_5 was found in sample Extra Sausage - finely minced boiled sausage 3.9 g/kg, and maximum level was found in sample Kranjska sausage – vacuum-packed 5.0 g/kg. The content of NaCl varied from 1.5% in the sample Mini Chicken Extra – finely minced boiled sausage to 2.8% in sample Ham in Casing – canned meat chunks. The colour Cochinilla (E 120) was used for all the samples, except for 6 products of poultry meat where the contents was determined only quantitatively. Also starch presence was determined only quantitatively and was confirmed in all 12 samples.

Evaluation of safety of products was done in accordance with the provision of the Regulations on the quality and conditions of the use of additives in foodstuffs and about other requirements for additives and their mixtures (“Official Journal of Serbia and Montenegro”, No. 56/03, 5/04 and 16/05). Values determined for the contents of $NaNO_2$, $NaNO_3$ and phosphates as P_2O_5 were within the limits prescribed by the mentioned Regulations. On the average, nitrite content was lower by

40% from the limits, nitrates by 18% and phosphates 11%. Also, the used Cochinilla dye (E 120) and addition of starch have been in accordance with articles of this Regulation. All of these additives have been properly indicated on the labels.

These investigations showed that the analysed samples of meat products from Meat industry "Pantomarket", Herceg Novi, Montenegro, are in accordance with the provisions of the Regulation on the quality and conditions of the use of additives in foodstuffs and other requirements for additives and their mixtures ("Official Journal of SCG", No. 56/03, 5/04 and 16/05).

Key words: additives, meat products, Regulation

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II-16

ADITIVI I ZDRAVSTVENA ISPRAVNOST HRANE

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Aditivi su supstance koje se iz tehnoloških razloga namerno dodaju prehrambenim proizvodima u toku proizvodnje, prerade, pripreme, obrade, pakovanja, transporta i čuvanja, pri čemu postaju njihovi sastojci. Proizvođači koriste aditive da bi napravili organoleptički prihvatljiviji i konkurentniji proizvod.

Aditivi se moraju prikazati u deklaraciji proizvoda. Svi aditivi prikazani sa **E** numeracijom su odobreni, pod kontrolom i prati se njihov efekat na zdravlje. WHO/FAO-Codex Alimentarius komitet prati svaki aditiv koji je u upotrebi. Kod mesa i mesnih proizvoda nitriti, nitrati, NaCl, nitrozamini, polifosfati su neizbežni jer su manje zlo od onoga zbog čega se oni koriste (*Cl. botulinum*). Neosporna činjenica je da su mnogi aditivi razlog pojavi nutritivne intolerancije ili alergijske reakcije kod osetljivijih osoba.

Svetski trend u proizvodnji hrane postaje zdravstveno bezbedna i kvalitetna hrana, neutralna i profitabilna ambalaža i zdravstveno bezbedna budućnost.

Svi korisnici hrane sa aditivima nisu podjednako tolerantni ili osetljivi. Detaljno studiranje i razumevanje poruka iz deklaracije proizvoda ide u prilog kontroli unosa aditiva u organizam.

Ključne reči: aditivi, hrana, proizvodi od mesa

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ADDITIVES AND FOOD SAFETY

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Additives are substances that are intentionally added to food products during their manufacturing, processing, preparation, handling, packaging, distribution, storage, which results in them becoming components of such foods. Producers use additives to make more organoleptically acceptable and competitive product.

Food additives must be declared in the label of the product. All additives marked with E numeration are aproved for use, under control and their effect on health is monitored. WHO/FAO Codex Alimentarius Committee monitors every additive in use. Additives added to meat and meat products like nitrites, nitrates, NaCl, nitrosomines, polyphosphates are unavoidable part of these products as they are less harmful than the reason which they are used for (*Cl. botulinum*). It is undisputable that many additives are the cause of food intolerance or food allergy cases.

The world trend in food production is reflected in safe and quality food, as well as neutral and cost-effective packaging and health safe future.

All consumers of food with additives are not equally tolerant or susceptible. Detailed studying and understanding of the declaration from the label of a product are important for the control of additive intake.

Key words: additives, food, meat products.

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II-17

BIOLOŠKI OGLED NA INFUZORIJAMA U CILJU ODREĐIVANJA TOKSIČNOSTI FERMENTISANOG PIRINČA

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Sredstvo za bojenje hrane – fermentisani pirinač (crveni pirinač), koji poseduje i konzervišuća i lekovita svojstva, našao je široku primenu u mesnoj industriji. Međutim, prema međunarodnim propisima, fermentisani pirinač je jedno od "najkontroverznijih" sredstava za bojenje (sa aspekta bezbednosti) koje se koristi u proizvodnji različitih vrsta proizvoda od mlevenog mesa.

Ovo sredstvo za bojenje nije odobreno od strane FAO/WHO kao prehrambeni aditiv i nije mu dodeljen E broj uglavnom zbog toga što može da sadrži toksičnu supstancu citrinin koji nastaje tokom procesa fermentacije pirinča sa kulturama mikroskopskih kvasaca *Monascus purpureus* i *Monascus ruber*. Iz tog razloga, potvrda bezbednosti crvenog pirinča sa toksikološkog aspekta mogla bi da predstavlja odlučujući faktor za njegovo zvanično odobrenje kao prehrambenog aditiva.

Toksikološka svojstva fermentisanog pirinča utvrđuju se metodom automatskog biološkog ogleda zasnovanog na kvalitativnom i kvantitativnom određivanju odgovora testiranih organizama (infuzorije) na toksične komponente. Od tri uzorka fermentisanog pirinča odabranih u uslovima proizvodnje, jedan uzorak je pokazao toksična svojstva na mikroorganizam *Tetrahymena pyriformis*.

Ključne reči: sredstvo za bojenje, fermentisani pirinač, toksična svojstva, određivanje

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BIOTESTING OF FERMENTED RICE ON INFUSORIA FOR THE DETERMINATION OF ITS TOXIC PROPERTIES

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A food colorant – fermented rice (red rice), possessing also preserving and curative properties, is widely used in meat industry. However in the international food law the fermented rice is one of the most “controversial” colorants (from the safety aspect) used in production of different kinds of minced meat products.

This colorant is not adopted by FAO/WHO as a food additive and doesn’t have E index, mainly because it can contain a toxic substance – citrinin, produced during fermentation of rice with cultures of microscopic fungi *Monascus purpureus* and *Monascus rubber*. Thus, confirmation of toxicological safety of red rice could become a decisive factor for its official approval as a food additive.

Toxicological properties of fermented rice were determined by the method of automatic biotesting, based on qualitative and quantitative determination of the response of the test-objects (infusoria) on toxic components. Out of three samples of fermented rice selected under production conditions, one sample showed toxic properties in relation to the microorganisms *Tetrahymena pyriformis*.

Key words: colorant, fermented rice, biotesting, toxic properties, determination

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II-18

INHIBITORNI EFEKAT EKSTRAKATA ZAČINA NA RAST *Penicillium aurantiogriseum* I *Penicillium corylophilum*

Gordana Dimić, Sunčica Kocić-Tanackov, Dragana Karalić

Ispitan je efekat ekstrakata kima, belog luka i origana na inhibiciju rasta prema *Penicillium aurantiogriseum* i *P. corylophilum*. *P. aurantiogriseum* je rastao samo u prisustvu 0,1% ekstrakta kima. Ekstrakt belog luka je kompletno redukovao rast ove plesni iznad 0,5%. Origano je takođe imao antifungalni aktivitet, ali tek pri 0,5% i nekompletno je inhibirao *P. aurantiogriseum* pri koncentracijama od 1 i 2%. *P. corylophilum* je kompletno inhibiran kimom pri 1%. Međutim, beli luk i origano su sa koncentracijama od 1 i 2% imali parcijalni efekat u odnosu na *P. corylophilum*. Ispitivani ekstrakti su, pored ograničavanja rasta kolonija, uzrokovali i promene u morfologiji. Rezultati podržavaju mišljenje da ekstrakti dobijeni iz začina mogu imati ulogu prirodnih antimikrobnih agenasa u zaštiti hrane.

Ključne reči: začini, antifungalni aktivitet, *Penicillium*

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INHIBITORY EFFECT OF SPICE EXTRACTS ON GROWTH OF *Penicillium aurantiogriseum* AND *Penicillium corylophilum*

Gordana Dimic, Suncica Kocic-Tanackov, Dragana Karalic

The effect of caraway, garlic and oregano extracts on inhibition of growth against *Penicillium aurantiogriseum* and *P. corylophilum* were investigated. *P. aurantiogriseum* only grew at 0.1% of caraway extract. Garlic extract retarded completely growth of this mould above 0.5%. Also, oregano has antifungal activity, but just at 0.5%, and incompletely inhibited *P. aurantiogriseum* at 1 and 2% concentrations. *P. corylophilum* was completely inhibited by caraway at 1%. However, garlic and oregano at 1 and 2% concentrations were partially effective against *P. corylophilum*. The investigated extracts caused morphological changes, besides growth inhibition of colonies. The results support the opinion that extracts obtained by spices might have a role as natural antimicrobial agents for food protection.

Keywords: spices, antifungal activity, *Penicillium*

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II-19

AMBALAŽA I ZDRAVSTVENA ISPRAVNOST NAMIRNICA

G. Golubović, D. Krstić, Z. Basić, D. Ilić, A. Ćulafić

Ambalaža je prateći deo svake životne namirnice koja se stavlja u promet. Ona štiti proizvod, nosi imformativne podatke o proizvodu, nosilac je deklaracije. Ambalaža postaje indirektan aditiv proizvoda zbog mogućnosti migracije hemijskih supstancija od kojih je sastavljena u proizvod.

Svakodnevnom proverom zdravstvene ispravnosti ambalažiranih namirnica i predmeta opšte upotrebe, u prilici smo da uočimo manje ili veće ambalažne nedostatke.

Najčešći nedostaci koje smo uočili su iz domena informativne uloge ambalaže, mogućnost reciklaže i trajanja (izdržívosti) ambalaže kod proizvoda sa dužim rokom trajanja, kao što su limenke za pakovanje proizvoda od mesa ili nedostatak dopunske organske zaštite.

Da bi se nedostaci sveli na minimum i otklonila opasnost po zdravlje, potrebna je stalna edukacija svih onih koji su u lancu proizvodnje hrane i njenog pakovanja.

Ključne reči: ambalaža, hrana, proizvodi od mesa

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PACKAGING MATERIALS AND FOOD SAFETY

G. Golubovic, D. Krstic, Z. Basic, D. Ilic, A. Culafic

Packing material is a part of every product which comes to market. Its role is to protect food, carries basic information about the product, and holds the label. Packaging becomes an indirect additive because of the possibility of migration of chemicals from packing material into the food.

Permanent safety control of packed food and general-purpose goods allows detection of major or minor package shortcomings.

The most common failures detected in the area of its informational role, possibility of recycling and durability of packing material in products with longer expiry date, like cans for packing meat products or lack of additional organic protection.

Continuous education of all those involved in food production chain and food packing is necessary to minimise the shortcomings and remove health hazards.

Key words: packing material, food, meat products.

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II-20

UTICAJ PAKOVANJA SA PRIMENOM VAKUUMA NA SENZORNE I BAKTERIOLOŠKE PROMENE PROIZVODA OD MESA U PROMETU

T. Stamenković

Pakovanje proizvoda od mesa u plastične folije sa primenom vakuuma isključuje nastanak gubitka mase, onemogućava rast plesni, sprečava oksidativne promene, omogućava veći stepen higijenske zaštite, produžava održivost proizvodima, daje proizvodima atraktivan izgled, mogućnost štampanja i mnoge druge prednosti.

U ovom radu prikazana je održivost proizvoda od mesa upakovanih u vakuum: hrenovki, srpske kobasice, kranjske kobasice, čajne kobasice, salamina, dimljenih i sušenih proizvoda, slanine, proizvoda od usitnjenog i oblikovanog mesa i pečenja. Pored toga, prikazana je održivost narezaka upakovanih u vakuum: pariske kobasice, mortadele, tirolske kobasice, šunkarice, kuvane šunke, čajne kobasice, bekona, pečene slanine i drugih vrsta proizvoda od mesa.

Ipak, i pri pakovanju proizvoda od mesa sa primenom vakuuma, pored povećane održivosti i mnogih drugih prednosti, dolazi do promene senzornih svojstva i kvara proizvoda, uglavnom usled razmnožavanja prisutne mikroflore. Pri tome, utvrđen je razvoj dominantne mikroflore. U više slučajeva određeno je da nju čine laktobacili. Njihovo prisustvo praćeno je izraženim kiselim mirisom pri otvaranju upakovanog proizvoda. Osim ove pojave, ukazuje se na mogućnost razmnožavanja patogenih anaerobnih i fakultativno anaerobnih bakterija, kao što su: *Cl. botulinum* i *Listeria monocytogenes*. Otkriveno je prisustvo i rast drugih patogenih vrsta bakterija: salmonela, stafilokoka, enterokoka i dr.

S obzirom na to da su proizvodi od mesa upakovani sa primenom vakuuma različite održivosti i da u njima postoji opasnost od razmnožavanja određenih patogenih vrsta bakterija, preporučuje se kontrola ispravnosti pakovanja i skladištenja pri 4°C do 7°C.

Ključne reči: proizvodi od mesa, pakovanje, vakuum, održivost

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EFFECT OF VACUUM PACKAGING ON SENSORY AND BACTERIOLOGICAL CHANGES OF MEAT PRODUCTS IN TRADE

T. Stamenkovic

Packaging of meat products in plastic foils with the use of vacuum helps avoiding drip loss, impedes growth of moulds, prevents oxydation changes, enables higher degree of hygienic protection, extends the shelf-life of products, gives attractive appearance to products, possibility of printing on it, and many other advantages.

This paper presents the study on shelf-life of vacuum packed frankfurters, Serbian Sausage, Kranj Sausage, Tea Sausage, salamini, smoked and dry products, bacon, products of comminuted and shaped meat and roast meat. It also presents the study on shelf-life of vacuum packed slices of: Bologna Salami, Mortadella, Tirolska Salami, cooked sausage, cooked ham, tea sausage, bacon, roast bacon and other types of meat products.

Nevertheless, at vacuum packaging of meat products, besides the increased shelf-life and all other advantages, changed sensory properties and spoilage of products still occur. They mainly occur due to propagation of the microflora present. Also, there has been noticed development of dominant microflora. In most of the cases it was found that it consists of lactobaccili. Their presence is followed by expressed sour smell at opening of the packed product. Apart from this phenomenon, this study indicates the possibility of propagation of pathogenic anaerobic and facultatively anaerobic bacteria like: *Cl. botulinum* and *Listeria monocytogenes*. The presence and growth of other pathogenic bacteria species was also found: salmonella, staphilococci, enterococci, etc.

Having in mind that the vacuum packed meat products are of different shelf-life and that there is a risk of propagation of certain species of pathogenic bacteria, control of package soundness and storage at 4°C to 7°C, are recommended.

Key words: meat products, packaging, vacuum, shelf-life

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II-21

UTICAJ RAZLIČITIH SMEŠA GASOVA NA BOJU I MIKROBIOLOŠKU ISPRAVNOST JUNEĆEG MESA PAKOVANOG U ZAŠTITNOJ ATMOSFERI

M. Milijašević, B. Velebit, Jelena Jovanović

U ovom radu prikazani su rezultati ispitivanja uticaja različitih smeša gasova na boju i mikrobiološku ispravnost mesa pakovanog u zaštitnoj atmosferi. Materijal za rad bilo je makrokonfekcionisano sveže juneće meso, čija je prosečna temperatura iznosila +3,13°C, a pH-vrednost mesa je iznosila 5,75. Nakon 24 časa, meso je mikrokonfekcionisano, a izmerena temperatura mesa nakon obrade iznosila je prosečno +4,20°C, pri čemu je pH mesa iznosio 5,54. Za dalji rad korišćeni su ramstek i frikando. Po jedan odrezak, debljine 1-2 cm, stavljen je u polistirenski „foodtainer“ visine 50 mm, a zatim se pristupilo pakovanju mesa u modifikovanoj zaštitnoj atmosferi. Korišćeno je ukupno 5 smeša gasova čiji sastav je naveden u Tabeli 1. Uzorci su potom čuvani pri temperaturi od +4°C tokom 28 dana. 2, 6, 13, 17 i 28. dana uzorci su ispitivani na promenu boje mesa, mikrobiološku ispravnost i pH mesa. Utvrđeno je da sve ispitivane smeše gasova deluju inhibitorno na rast patogenih mikroorganizama (*Salmonella, Escherichia, Proteus*) i truležnih bakterija (*Pseudomonas*), ali smeše koje su u sebi sadržavale kiseonik omogućavale su povećanje ukupnog broja bakterija. Smeše koje su sadržavale visoku koncentraciju CO_2 dovodile su do izraženog povećanja pH mesa. Najprihvatljivija boja mesa i prihvatljiv mikrobiološki status, čak i nakon 28 dana čuvanja, održali su se u pakovanjima koja su punjena smešom od 70%O_2 i 30%N_2.

Tabela 1. Sastav smeša gasova korišćenih u eksperimentu
Table 1. Composition of gas mixtures used in experiment

	1	2	3	4	5
CO_2	30%	100%	50%	-	20%
O_2	-	-	-	70%	20%
N_2	70%	-	50%	30%	60%

Ključne reči: juneće meso, pakovanje u modifikovanoj atmosferi, boja, mikrobiološka ispravnost

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EFFECT OF DIFFERENT GAS MIXTURES ON COLOUR AND MICROBIOLOGICAL SAFETY OF BEEF PACKAGED IN MODIFIED ATMOSPHERE

M. Milijasevic, B. Velebit, Jelena Jovanovic

This paper describes results obtained during investigation of effects of different gas mixtures on colour and microbiological safety of MAP packaged meat. We used beef primal cuts as a material for the experiment. Average temperature of meat was +3.13°C, while pH was 5.75. Twenty-four hours later, primal cuts were sliced, while the average temperature and pH value of meat were +4.20°C and 5.54, respectively. Each slice of meat, 1-2 cm thick, was placed in polystyrene containers 50 mm high. Slices were immediately packaged in modified protective atmosphere and were kept for 28 days at the temperature of +4°C. Composition of gas mixtures used are given in Table 1. Colour of meat, microbiological safety and pH value of samples were investigated on days 2, 6, 13, 17 and 28. We found that each of gas mixtures used inhibits growth of pathogenic bacteria (*Salmonella, Escherichia, Proteus*) and spoilage bacteria (*Pseudomonas*). However, increased TVC was observed in samples where gas mixtures having high oxygen content were used. pH values were significantly increased at samples packaged in high CO_2 atmosphere. The most acceptable colour and microbiological status were established at samples packaged in atmosphere having 70%O_2 and 30%N_2.

Keywords: beef, modified atmosphere packaging, colour, microbiological safety

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II-22

MONITORING TRŽIŠTA MESNIH PROIZVODA U CENTRALNOM FEDERALNOM REGIONU U RUSIJI

Dr A.N. Zakharov, Dr M.H. Iskakov, Galina A. Berlova, Dr M.N. Smirnov

U radu su razmatrani ključni rezultati istraživanja tržišta mesnih proizvoda u Centralnom Federalnom regionu u Rusiji. Predstavljeni su statistički podaci o proizvodnji mesa i sporednih proizvoda u 2006 godini.

Postavljeni su određeni ciljevi koji su omogućili objektivno ocenjivanje procesa proizvodnje u pogonima za preradu mesa koje imaju vodeću poziciju na tržištu.

Rezultati istraživanja omogućili su identifikovanje najvažnijih kriterijuma kojima se potrošači rukovode u svom izboru kobasica i proizvoda od mesa.

Ključne reči: tržište mesnih proizvoda, monitoring, Centralni Federalni region, Rusija

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MONITORING OF MEAT PRODUCTS MARKET IN THE CENTRAL FEDERAL REGION OF RUSSIA

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Main results of the investigation of the market for meat products of the Central Federal region were considered, and statistical data on production of meat and by-products in 2006 presented.

Particular tasks were set, which allowed the objective evaluation of the production activities of the main meat-processing plants having leading position on the market.

The results of the investigations enabled to find out the main criteria for consumers in their selection of sausage and meat products.

Key words: meat products market, monitoring, Central Federal region, Russia

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II-23

NACIONALNI STANDARDI ZA EKOLOŠKI (ORGANSKI) PROIZVEDENE MESNE SIROVINE NAMENJENE PROIZVODNJI DEČIJE HRANE

Prof. dr Aleksandra V. Ustinova, dr A.S. Dydykin, Prof. dr N.V. Timoshenko

Razvoj nacionalnih standarda, uzimajući u obzir specifičnosti razvoja modernog ruskog tržišta, industrije, poljoprivrede i međunarodnih propisa u vezi standardizacije, od ključnog je značaja u obezbeđivanju kvaliteta, bezbednosti hrane i povećanja konkurentnosti ruskih proizvoda, određivanju razvoja budućih inovacija, smanjenju tehničkih barijera prilikom trgovine, obezbeđenju zaštite potrošača i zaštite životne sredine. Uočeni svetski trendovi razvoja tržišta "ekološki" proizvedenih sirovina od mesa zahtevju formiranje domaće sirovinske baze za ove proizvode.

"Organske" - ekološki bezbedne mesne sirovine namenjene proizvodnji dečije hrane moraju poticati od životinja odgajanih u posebnim uslovima, bez korišćenja hormonskih preparata, antibiotika koji se dodatju hrani za životinje, stimulatora rasta, sintetskih supstanci koje sadrže azot, produkata sinteze mikroorganizama i drugih vrsta netradicionalnih supstanci.

Ključne reči: ekološki bezbedne mesne sirovine, proizvodi namenjeni ishrani dece, zahtevi

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NATIONAL STANDARDS FOR ECOLOGICAL (ORGANIC) MEAT RAW MATERIALS FOR PRODUCTION OF CHILD NUTRITION PRODUCTS

Aleksandra V. Ustinova, Prof. dr., A.S. Dydykin, Ph.D., N.V. Timoshenko, Prof. dr.

The development of national standards, taking into account the peculiarities of development of modern Russian market, industry, agriculture, and the international regulations concerning standardization, are of crucial importance in ensuring quality, safety and increasing competitiveness of Russian products, determining the development of innovations, decrease of technical barriers in trade, protection of consumers' interests and environment. The observed world trend of development of the market for ecological meat raw materials requires creation of the domestic raw materials base.

The organic, ecologically safe meat raw materials for production of child nutrition products should be obtained from animals, raised in special farms without use of hormone preparations, feed antibiotics, growth promoters, synthetic nitrogen-containing substances, products of microbial synthesis and other kinds of non-traditional feed substances.

Key words: ecologically safe meat raw materials, child nutrition products, requirements

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III TEMATSKA OBLAST
3rd THEMATIC TOPIC

ISPRAVNOST I KVALITET MESA I PROIZVODA OD MESA
MEAT AND MEAT PRODUCTS SAFETY AND QUALITY

III-1

ZDRAVSTVENA ISPRAVNOST MLEVENOG MESA NA EPIZOOTIOLOŠKOM PODRUČJU VSI "KRALJEVO"

P. Popović, D. Nenadić, Vesna Kaljević, Marija Vukašinović, A. Žarković

Na području 22 opštine epizootiološkog područja VSI "Kraljevo" iz Kraljeva ispitivano je mleveno meso na prisustvo bakterija po zahtevima Pravilnika, a izvršeno je i ispitivanje na prisustvo rezidua antibiotika i sulfonamida mikrobiološkim metodama. Ispitivanja su sprovedena sa ciljem da se utvrdi da li se mlevenom mesu dodaju neke supstanse koje zaustavljaju rast bakterija da bi se upotrebljivost mlevenog mesa (pogotovu u letnjem periodu) produžila. Kao sredstva za zaustavljanje rasta bakterija, pretpostavljeno je da se dodaju kalijum meta bisulfit i natrijum benzoat. Mlevenom mesu u prometu se ne dodaju fosfati, pa je kotrolom bilo obuhvaćeno utvrđivanje ukupnih fosfata. Pošto postoje literaturni podaci za sadržaj kalijuma, natrijuma i prirodnog fosfora u mesu, ova ispitivanja su bazirana na utvrđivanju sadržaja ovih elementa i upoređivanju sa literaturnim podacima. Ukupno je pregledano 200 uzoraka mlevenog mesa.

Antibiotici i sulfonamidi nisu bili prisutni ni u jednom od pregledanih uzoraka, dok je u 16 uzoraka mlevenog mesa utvrđen značajno viši sadržaj natrijuma. Ukupan broj bakterija (UBB) kretao se od 3.000.000 do 570.000.000.

Značajno viši sadržaj mikroorganizama bio je prisutan u uzorcima mlevenog mesa koje je zatečeno u rashladnim vitrinama u odnosu na ono koje je mleveno u prisustvu kupca.

Mikrobiološkim analizama, izvršenim uz primenu standardnih metoda prema Pravilniku o metodama vršenja mikrobioloških analiza i superanaliza životnih namirnica Sl.list SFRJ br. 25/80, ukupni fosfor je određivan spektrofotometrijski, a kalijum i natrijum emisionom AS.

Ključne reči: mleveno meso, UBB, antibiotici, sulfonamidi, P, K, Na, zdravstvena ispravnost

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SAFETY OF MINCED MEAT IN EPIZOOTIOLOGICAL REGION VSI "KRALJEVO"

P. Popovic, D. Nenadic, Vesna Kaljevic, Marija Vukasinovic, A. Zarkovic

Within the area of 22 municipalities of the epizootiological region VSI "Kraljevo", from Kraljevo, the presence of bacteria in minced meat was tested in accordance with the Regulations. The presence of residues of antibiotics and sulphonamides was also examined by means of microbiological methods. The tests were performed with the purpose of determining whether any substances inhibiting bacterial growth were added in order to extend the usability of minced meat

(specially during the summer season). It was supposed that the agents inhibiting bacterial growth were potassium meta bisulfite and sodium benzoate. Phosphates are not supposed to be added to minced meat in trade, so therefore the control included determination of total phosphates. Since there are the data for the contents of potassium, sodium and natural phosphorus in meat, these tests were based on determining the contents of these elements and on the comparison with the literature data. Total of 200 samples of minced meat were examined.

Antibiotics and sulphonamides were not present in any of the tested samples, while in 16 samples of minced meat, a considerably higher contents of sodium was found. Total bacterial count (TBC) ranged from 3.000.000 to 570.000.000.

Considerably higher contents of micro-organisms was present in samples of minced meat that was found in the cooling units in relation to minced meat that was minced in the presence of customer.

Microbiological analyses were performed by applying the standard methods in accordance with Regulations on methods of performing microbiological analyses and super-analyses of the foodstuff (Official Journal of SFRY No: 25/80), where the total contents of phosphorus was determined spectrographically, while potassium and sodium by means of emission AS.

Key words: minced meat, UBB, antibiotics, sulphonamides, P, K, Na, safety

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III-2

ANALIZA LIPIDNOG SASTAVA LESKOVAČKOG ROŠTILJ MESA

Nada Nikolić, Z. Todorović, N. Radulović, M. Stanković, M. Lazić

Proizvodi od roštilj mesa dodro su poznati, ne samo u leskovačkom kraju i Srbiji, već i van njenih granica. Proizvodnja leskovačkog roštilj mesa ima dugu tradiciju. Dnevna proizvodnja ovog proizvoda samo na području Leskovca iznosi oko 20 tona. Uobičajeno je da se kvalitet roštilj mesa, kako nalaže propis o kvalitetu proizvoda od mesa, definiše na osnovu sadržaja ukupnih proteina i preko sadržaja proteina vezivnog tkiva. U ovom radu ispitana je brzina ekstrakcije lipida i sastav lipida devet uzoraka roštilj mesa koji se proizvode na teritoriji Leskovca. Cilj rada je da se odredi sadržaj i sastav lipida roštilj mesa. Ekstrakcija lipida vršena je uz refluks sa ugljentetrahloridom kao rastvaračem (1:20 m/v). Sadržaj lipida u ispitivanim uzorcima kreće se u granicama od 13,7% do 21,9%, a vreme potrebno za ekstrakciju lipida je 30 minuta. Primenom HPLC metode (Agilent 1100 High Performance Liquid Chromatograph, kolona: Zorbax Eclipse XDB-C18; mobilna faza: metanol - rastvarač A i 2-propanol/*n*-heksan - rastvarač B u zapreminskom odnosu 5:4; temperature kolone: 40 ^{o}C; detekcija: na 205 nm) određen je sadržaj slobodnih masnih kiselina, metilestara, mono-, di- i triglicerida. Identifikacija komponenata lipida izvršena je upoređivanjem retencionih vremena komponenata sa retencionim vremenima standarda. Sadržaj slobodnih masnih kiselina kreće se u granicama od 6% do 33%, sadržaj metilestara je do 1,5%, monoglicerida do 1,7%, diglicerida do 1,4%, a sadržaj triglicerida u granicama od 46% do 89%. Za analizu sastava metil-estara lipida korišćen je GC 6890N chromatograf, Agilent Technologies; sa kapilarnom kolonom (0.25 mm x 30 m, Agilent 19091s-433: HP-5MS 5%, Phenyl Methyl Siloxane, 0,25 mm x 30 m; zapremina injektiranja: 1,0 μl hloroformskog ekstrakta lipida; temperatura kolone: 100^{0}C - 300^{0}C, gradijent 7^{0}C /min; temperatura injektora 250^{0}C i detektora 280 ^{0}C.

Ključne reči: lipidni sastav, roštilj meso

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LIPID COMPOSITION ANALYSIS OF LESKOVAC GRILLED MEAT

Nada Nikolic, Z. Todorovic, N. Radulovic, M. Stankovic, M. Lazic

Grilled meat specialties from Leskovac are well known, not only in the territory of Leskovac community, but in all of Serbia and beyond. The daily production of grilled meat in the territory Leskovac is up to 20 tons. The quality of grilled meat, according to regulation on the quality of meat products, is defined by total protein content and protein connective tissue content. In this paper, the duration of lipid extraction and lipid composition of nine grilled meat samples from the territory of Leskovac were investigated. The aim of this paper was to determine and compare the lipid content and lipid composition in investigated samples. The lipids from grilled meat were extracted by carbon tetrachloride (1:10 w/v), using reflux. The lipid content was in the range from 13.7% to 21.9%, and extraction time was 30 min. HPLC analysis was carried out by Agilent 1100 High

Performance Liquid Chromatograph. The flow rate of binary pump was 1 ml/min with a linear gradient, from 100% of - A to 40% A (methanol) + 60% B (2-propanol/ *n*-hexane), 15 min. The column temperature was held constant at 40^{o}C. The components were detected at 205 nm. The mono-, di- and tri- acylglicerols were identified by comparison of retention times (R_t) of lipid components with R_t of standards. The lipid samples were dissolved into a mixture of 2-propanol/*n*-hexane, 5:4 v/v and filtered through 0.45 μm Millipore filters. The contents of free fatty acids ranged from 6% to 33%, the contents of methyl esters, monoglycerides and diglycerides were up to 1.5%, 1.7% and 1.4%, respectively, while the contents of triglycerides were in the range from 46% to 89%. The methyl ester content of chloroform extracts was quantified using a GC 6890N chromatograph, Agilent Technologies, with a capillary column, Agilent 19091s-433 (HP-5MS 5 % Phenyl Methyl Siloxane). Quantity of 1.0 μl of the chloroform extract was injected into a capillary column (0.25 mm x 30 m) to determine the methyl ester content. The column temperature was raised from 100^{0}C to 300^{0}C with a gradient of 7^{0}C /min and held at this temperature for 2 min. The temperatures of injector and detector were set at 250 and 280 ^{0}C, respectively.

Keywords: lipid composition, grilled meat

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III-3

HEMIJSKI I SENZORNI POKAZATELJI KVALITETA PROIZVODA U TIPU "PASTERIZOVANE KONZERVE OD MESA U KOMADIMA"

D. Živković, Marija Perunović, Marijana Jovanović, Vesna Mladenović, Maja Lakić

Ispitivano je 39 proizvoda u tipu "pasterizovane konzerve od mesa u komadima", od svinjskog, kao i mesa pernate živine, prisutnih na beogradskom tržištu. Analizirani su osnovni hemijski parametri kvaliteta (sadržaj ukupnih proteina, vezivnotkivnih proteina, vode, lipida i NaCl), kao i senzorna ocena kvaliteta proizvoda. Sadržaj proteina u proizvodima od svinjskog mesa varirao je od 9,89% do 16,82%, a masti u intervalu od 1,19% do 4,17%. U proizvodima od mesa pernate živine, sadržaj proteina bio je nešto veći (11,38% do 21,10%), a masti manji (0,19% do 2,16%). Najveća variranja utvrđena su u pogledu sadržaja vezivnotkivnih proteina. Rezultati senzornog ocenjivanja pokazali su da su proizvodi u ovom tipu zadovoljavajućeg kvaliteta, iako je pet proizvoda ocenjeno kao neprihvatljivo.

Ključne reči: pasterizovane konzerve od mesa u komadima, hemijski sastav, senzorna svojstva

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CHEMICAL AND SENSORY PARAMETERS OF QUALITY OF "COOKED HAM TYPE PRODUCTS"

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Total of 39 "cooked ham type products", products of pork and poultry meat, from Belgrade market, were examined. Basic chemical quality parameters were analyzed (total proteins, connective tissue proteins, water, lipids and NaCl content) and sensory evaluation of the product quality was performed. Total protein content in pork meat products varied from 9.82% to 16.82%, and lipid content ranged from 1.19% to 4.17%. In poultry meat products, total protein content was somewhat higher (11.38% to 21.10%), and lipid content somewhat lower (0.19% to 0.16%). The greatest variations were detected regarding the connective tissue protein content. Sensory evaluation results showed that this type products have satisfactory quality, athough five products were evaluated as unacceptable.

Key words: "cooked ham type products" , chemical composition, sensory properties

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III-4

SADRŽAJ UKUPNOG FOSFORA U PROIZVODIMA OD MESA

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Pored toga što je neophodan za normalno funkcionisanje organizma, unos prevelike količine fosfora može da dovede do ozbiljnih zdravstvenih problema, kao što su oštećenja i degeneracije bubrežnih ćelija, prvenstveno kao posledica taloženja kalcijum fosfata, zatim poremećaji u resorpciji kalcijuma, i sa tim u vezi, otpuštanje kalcijuma iz kostiju.

Pored prirodnog fosfora koji potiče iz mesa, u proizvodima od mesa se nalazi i fosfor koji potiče od raznih aditiva, kao što su polifosfati, zatim neki preparati na bazi soje i drugo. Polifosfati u industriji mesa imaju veliki praktičan značaj (povećavaju sposobnost zadržavanja vode, vezivost i nežnost, sprečavaju promenu boje, poboljšavaju ukus i emulgovanje masti, sprečavaju oksidaciju nezasićenih masnih kiselina, povećavaju pH, sprečavaju razvoj mikroorganizama i dr.).

S obzirom na raširenu upotrebu polifosfata u izradi proizvoda od mesa i njihov značaj po zdravlje potrošača, postavili smo zadatak da u dužem vremenskom periodu (januar - decembar 2006. godine), steknemo uvid u sadržaj ukupnog fosfora koji potiče iz proizvoda od mesa. Ukupno je ispitano 1734 uzorka proizvoda od mesa stoke za klanje i mesa živine, poreklom od domaćih proizvođača i iz uvoza. Sadržaj ukupnog fosfora je određen spektrofotometrijski, standardnom metodom JUS ISO (13730/1999).

U radu je prikazan sadržaj ukupnog fosfora u analiziranim uzorcima proizvoda od mesa, izražen kao P_2O_5. Najniži prosečan sadržaj ukupnog fosfora utvrđen je u kobasicama u konzervi, domaće proizvodnje, proizvedenih od mesa živine i mesa stoke za klanje (1,96 g/kg, odnosno 2,13 g/kg). Najviši prosečan sadržaj je utvrđen u suvomesnatim proizvodima domaće proizvodnje i iz uvoza (6,08 g/kg, odnosno 6,42 g/kg). Od ukupnog broja ispitanih uzoraka, kod 35 uzoraka (2,02%) utvrđen je sadržaj ukupnog fosfora koji ne ispunjava uslove predviđene Pravilnikom o kvalitetu i drugim zahtevima za proizvode od mesa (Sl. list SCG 33/2004), od čega 14 uzoraka od mesa živine (0,81%) i 21 uzorak od mesa stoke za klanje (1,21%).

Ključne reči: ukupan fosfor, proizvodi od mesa

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TOTAL PHOSPHORUS CONTENT IN MEAT PRODUCTS

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Although phosphorus is necessary for the normal functioning of the body, increased phosphorus intake may cause serious health problems, such as damages and degeneration of kidney cells, mainly

as a result of sedimentation of calcium phosphate, than disturbance in calcium resorption and, consenquently, release of calcium from bone.

Apart from the natural phosphorus content in meat, meat products also contain phosphorus from different kinds of additives, such as polyphosphates, as well as soya based preprations, etc. Polyphosphates in the meat processing industry have great practical importance (cause an increase in water-holding capacity, connective ability and tenderness, prevent discoloration, improve taste and lipids emulsifying, prevent oxidation of nonsaturated fatty acids, increase the pH, prevent development of microorganisms, etc.).

Considering the widespread use of polyphosphates in the meat processing industry and its importance for consumer's health, our aim was to determine total phosphorus content in the analysed samples of meat products for the period January - December 2006. Total phosphorus content was determined in 1734 samples of meat and poultry products from national producers and import. The content of total phosphorus was determined by spectrophotometric method according to JUS ISO method (13730/1999).

Total phosphorus content in the analysed samples of meat products was presented and expressed as P_2O_5 (g/kg). The lowest average phosphorus content was found in the canned sausages from poultry and the slaughter animal meat, from national producers (1.96 g/kg and 2.13 g/kg, respectively). The highest average phosphorus content was determined in dry meat products from domestic producers and from import (6.08 g/kg and 6.42 g/kg, respectively). Out of total number of analyzed samples, 35 (2.02 %) samples (14 samples of poultry meat products and 21 samples of slaughter animal meat products) were not in compliance with the Regulations on quality and other requirements for meat products (Official Journal SCG No 33/2004).

Key words: total phosphorus, meat products

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III-5

SADRŽAJ NITRITA I UKUPNIH FOSFATA U PROIZVODIMA OD MESA RAZLIČITIH PROIZVOĐAČA SA TERITORIJE JUŽNO-BAČKOG I SREMSKOG OKRUGA TOKOM 2006. GODINE

Nadežda Prica, Jelena Petrović, Olga Rackov

Najvažniji konzervansi koji se dodaju u proizvode od mesa su nitriti i nitrati, a najvažniji antioksidansi su fosfati. Našim pravilnicima su propisane dozvoljene vrednosti ovih aditiva u različitim proizvodima od mesa. Cilj rada bio je da se u proizvodima od mesa istih proizvođača tokom godinu dana prati sadržaj nitrita i ukupnih fosfata. Na osnovu dobijenih rezultata može se uporediti sadržaj aditiva između malih proizvođača koji nemaju laboratorije i većih proizvođača koji imaju sopstvene laboratorije i mogu sami da kontrolišu kvalitet svojih proizvoda.

Tokom 2006. godine, praćen je sadržaj aditiva u proizvodima dva velika proizvođača i dva mala, zanatska proizvođača sa teritorije južno-bačkog i sremskog okruga. Ukupno je ispitano 256 uzoraka. Sadržaj ukupnih fosfata kod većih proizvođača varira u zavisnosti od grupe proizvoda, dok je kod manjih proizvođača ujednačen. Sadržaj nitrita je varijabilan u istim grupama proizvoda, i kod velikih i kod malih proizvođača. Sadržaj ukupnih fosfata je samo u dva uzorka (0,78%) bio veći od propisane vrednosti, dok je sadržaj nitrita bio u okviru dozvoljenih vrednosti.

Na osnovu izvršenih ispitivanja može se zaključiti da proizvođači uprkos razlici u obimu i načinu rada kao i posedovanju sopstvene laboratorije, na pravilan način dodaju aditive u svoje proizvode.

Ključne reči: sadržaj nitrita, sadržaj ukupnih fosfata, proizvodi od mesa

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CONTENTS OF NITRITE AND TOTAL PHOSPHATES IN MEAT PRODUCTS OF THE PRODUCERS IN SOUTHERN BACKA AND SREM REGION IN 2006

Nadezda Prica, Jelena Petrovic, Olga Rackov

The most important additives for meat products are nitrites and nitrates, but the most important antioxidants are phosphates. Permitted values for additives are established in Serbian legislation. The aim of this research was to monitor the content of nitrite and total phosphate in meat products of the same producers during one year. On the basis of the obtained results it was possible to compare the contents of nitrite and total phosphate between small producers without own laboratory and larger producers who own laboratories for quality control.

In 2006, the content of additives was monitored in the products of two big producers and two small ones in Southern Backa and Srem area. A total of 256 samples were examined. Contents of total phosphate in most products of large producers varied depending on type, while at smaller producers it was about the same. Content of nitrites varied in the same product groups, both in large and small producers. Only in two samples (0.78%) the content of total phosphates exceeded the permitted values, while nitrite content was within the permitted limits.

On the basis of our examination it can be concluded that the producers, despite the difference in volume and the way of production, as well as possesion of internal laboratories, use additives according to the regulations.

Key words: nitrite content, contents of total phosphate, meat products

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III-6

ISPITIVANJE SVOJSTAVA GOTOVIH PROIZVODA OD MESA PROIZVEDENIH U OMOTAČIMA OD SELEKTIVNO PROPUSTLJIVOG MATERIJALA

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Dobijanje proizvoda sa dugim rokom održivosti, a bez promena u parametrima kvaliteta, predstavlja značajno pitanje industrije i prerade mesa.

Tokom mnogo godina, omotači od prirodnog i veštačkog kolagena kao i od celuloze koristili su se za proizvodnju kobasica. Ovi proizvodi su propustljivi za vlagu i sastojke dima, te se koriste za proizvodnju kuvanih, kuvanih i dimljenih, poludimljenih i sirovih kobasica.

Značajna mana ovakvih omotača je njihova nestabilnost u odnosu na mikrofloru, značajnu sa zdravstvenog aspekta, pa usled toga održivost ovakvih proizvoda nije veća od 5 dana, dok je kod kuvanih, poludimljenih i dimljenih proizvoda održivost maksimalno 15 dana.

Korišćenje barijernih poliamidnih omotača omogućava produžavanje održivosti kuvanih kobasica do 60 dana. Međutim, njihova glavna prednost – nepropustljivost za isparenja i gasove je u isto vreme i njihova mana zbog toga što ograničava polje primene - ovi omotači su nepropustljivi za dim.

Rešenje ovog problema je razvoj omotača sa selektivnom propustljivošću. Selektivno permeabilni polimerni omotači ne predstavljaju prepreku za prolazak dima i isparenja, ali u isto vreme oni ispoljavaju visoko barijerne osobine i sprečavaju prolazak kiseonika; takođe ne podležu uticaju mikroorganizama i ne propuštaju ih.

Cilj ovog rada je proučavanje svojstava materijala za pakovanje nove generacije koji obezbeđuje adekvatni stepen održivosti i bezbednosti proizvoda od mesa.

Uporedna ispitivanja strukture kolagena i permeabilnog polimernog omotača su izvedena uz pomoć metode skenirajuće elektronske mikroskopije. Dokazano je da obe vrste omotača poseduju slabu, poroznu strukturu.

Ispitivanja su pokazala da selektivno propustljivi omotači maksimalno utiču na očuvanje kvaliteta kobasičarskih proizvoda i da produžavaju njihovu održivost.

Ključne reči: selektivno propustljivi omotač, kuvane, kuvane i dimljene i polu dimljene kobasice

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INVESTIGATIONS OF THE PROPERTIES OF READY MEAT PRODUCTS, MANUFACTURED IN SELECTIVELY-PERMEABLE CASING MATERIAL

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Manufacturing products with long shelf-life without change in quality attributes is the urgent problem of meat-processing industry.

For many years natural and artificial collagen and cellulose casings have been used in production of sausage products. These products are permeable for moisture and smoking gases and are used for production of cooked, cooked-smoked, semi-smoked and raw sausages.

A significant disadvantage of such casings is their instability against the sanitary-indicative microflora, therefore, shelf life of cooked sausages is not longer than 5 days, and of cooked and smoked and semi-smoked – not longer than 15 days.

The use of barrier polyamide casings makes it possible to increase shelf life of cooked sausages up to 60 days. However, their major advantage – vapor-gas impermeability at the same time is their disadvantage, because it limits the area of application – they don't admit smoking fume.

The solution to this problem is development of the materials possessing selective permeability. Selective-permeable polymer casings do not present obstacles for smoke and vapor, but at the same time they have high barrier properties against oxygen; they are not subject to the effect of microorganisms and are impermeable to them.

The purpose of this work is to study properties of packaging materials of new generation, ensuring adequate shelf-life and safety of meat products.

Comparative investigations of the structure of collagen and permeable polymer casing have been carried out by the method of scanning electronic microscopy. It is shown that both casings have loose, porous structure.

The investigations have shown that selective-permeable casing to a maximum degree preserves quality indices of sausage products and increases their shelf life.

Key words: selectively-permeable casing, cooked, cooked-smoked and semi-smoked sausages

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III-7

UPOTREBA HISTOLOŠKE METODE U PROCENI FUNKCIONALNIH SVOJSTAVA PREPARATA ZA SALAMURENJE

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U poslednje vreme, ispitivanje mikrostrukture proizvoda od mesa sve više dobija na značaju. Mikrostrukturalne metode značajno povećavaju broj podataka kada se koriste sa drugim metodama ispitivanja, dok su ponekad i superiornije, s obzirom na to da se primenom ovih metoda mogu otkriti čak i najmanje promene u strukturi tkiva koje mogu imati uticaja na kvalitet gotovog proizvoda. Ovaj rad ukazuje na glavne aspekte mikrostrukturalne analize za evaluaciju kvaliteta delikatesnih proizvoda proizvedenih uz korišćenje višekomponentnih salamura. Takođe, ukazuje na značaj upotrebe histološke metode za poboljšanje procesa salamurenja delikatesnih proizvoda i za razvoj novih višekomponentnih salamura, namenjenih za dobijanje proizvoda sa željenim svojstvima.

Ključne reči: histološki metod, evaluacija, funkcionalna svojstva, salamura

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USE OF HISTOLOGICAL METHOD FOR THE EVALUATION OF FUNCTIONAL PROPERTIES OF BRINE PREPARATIONS

Anastasiya A. Semenova, Ph.D., Tatyana G. Kuznetsova, Ph.D., Elena K. Tuniyeva

In recent time investigations of microstructure of meat products increasingly gains interest. Microstructural methods significantly expand the information when used with other methods of investigations, and sometimes are superior, since they allow detection of minor changes in tissue structures, that are reflected in the quality of the obtained products. This paper describes the main aspects of the use of microstructural analysis for the evaluation of the quality of delicatessen products manufactured with the use of multi-component brines. It shows also the importance of the use of the histological method for the improvement of delicatessen products curing process and for the development of new multi-component brines, designed for creation of the products with required properties.

Key words: histological method, evaluation, functional properties, brine

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III-8

IDENTIFIKACIJA SIROVINSKOG SASTAVA MESNIH I BILJNIH PROIZVODA METODOM PCR U CILJU OTKRIVANJA FALSIFIKATA

Tatyana A. Fomina, mlađi istraživač

U svrhu otkrivanja falsifikovanja proizvoda, razvijena je metoda PCR u stvarnom vremenu za identifikaciju vrsta animalnog tkiva. Ovom metodom ispitano je ukupno 60 uzoraka mesa i mesnih proizvoda podvrgnutih termičkoj obradi (uključujući meso u konzervi). Rezultati ovih studija pokazali su da sirovinski sastav u 18% slučajeva nije odgovarao podacima navedenim na deklaraciji proizvoda.

Ključne reči: PCR u stvarnom vremenu, identifikacija sirovinskog sastava, falsifikovanje proizvoda

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IDENTIFICATION OF RAW MATERIALS COMPOSITION OF MEAT AND PLANT PRODUCTS BY POLYMERASE-CHAIN REACTION TO REVEAL ADULTERATION

Tatyana A. Fomina, post graduate, junior research worker

To detect the adulteration of quality attributes of products, the method of identification of species of animal tissues, based on the use of real time polymerase-chain reaction has been developed. The laboratory investigations of 60 samples of meat and meat products, subjected to thermal processing (including canned meat) were carried out using this method. The results of these studies have shown that the raw materials composition of 18% of food products did not correspond to the information indicated on the label.

Key words: real time polymerase-chain reaction, identification of raw materials, adulteration of quality indices

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III-9

UTVRĐIVANJE ZASTUPLJENOSTI *LACTOBACILLUS SAKEI* U SREMSKOJ KOBASICI KONVENCIONALNIM METODAMA I PCR TEHNIKOM

Branka Borović, Slavica Vesković-Moračanin, Aleksandra Stjepanović

Proizvodnja fermentisanih proizvoda od mesa rezultat je metaboličke aktivnosti prisutnih i u mesu adaptiranih bakterija mlečne kiseline (BMK). Rezultati mnogih studija vezanih za ispitivanje mikroflore tradicionalnih sirovih kobasica pokazuju da je od ukupnog broja BMK najdominantnija vrsta *Lactobacillus sakei.* Od ukupnog broja izolata *Lactobacillus sakei* pripada 55%.

Danas, *Lactobacillus sakei* često nazivaju "dobrom" tehnološkom bakterijom. Ovakav odnos bazira se na postojanju izraženog svojstva ovoga soja da stvara bakteriocine, sekundarne metabolite koji imaju inhibitorni efekat u odnosu na neke patogene mikroorganizme, prvenstveno *Listeria monocytogenes* i bakterije kvara.

Često je prisutna u komercijalnim starter kulturama evropskih zemalja. Ono što je za industriju mesa Amerike *Pediococus pentosaceus,* to je *Lactobacillus sakei* za evropsko tržište.

Polazeći od tog saznanja, utvrđeno je prisustvo, tj. procenat zastupljenosti određenih sojeva BMK u tradicionalnoj fermentisanoj sremskoj kobasici, sa naročitim osvrtom na prisustvo *Lactobacillus sakei*.

U radu je korisćen konvencionalni način ispitivanja prisustva i identifikacije BMK sa biohemijskom potvrdom – API testom, kao konačnim nivoom identifikacije.

Dobijeni izolati su podvrgnuti potvrdi PCR - tehnike.

PCR (Polymerase Chain Reaction) predstavlja savremenu biološku tehniku koja se bazira na enzimskom umnožavanju specifičnog segmenta DNK, karakterističnim za odredjeni bakterijski soj, pri čemu se za nekoliko sati sintetiše i preko milion kopija toga segmenta.

Rezultati istraživanja su pokazali da *Lactobacillus sakei* nije, kao takav, izolovan konvencionalnim metodama, ali je PCR tehnika pokazala njegovu zastupljenost u 52,7%.

Naime, konvencionalne metode, uključujući i API identifikaciju, nisu dale profil karakterističan za *Lactobacillus sakei.*

Poredeći dobijene rezultate, ustanovljeno je da vrste *Lactobacillus fermentum*, *Lactobacillus curvatus* i *Lactobacillus delbruetski ssp.delbruetski*, podvrgnuti konačnoj PCR identifikaciji tj. potvrdi, daju *Lactobacillus sakei*.

Na taj način, utvrđena zastupljenost ove kulture, u odnosu na ostale BMK izolovane iz tradicionalne sremske kobasice, bila je 52,7%.

Ključne reči: Sremska kobasica, *Lactobacillus sakei*, API identifikacija, PCR- tehnika

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DETERMINATION OF PRESENCE OF *LACTOBACILLUS SAKEI* IN SREMSKA SAUSAGE BY CONVENTIONAL METHODS AND PCR TECHNIQUE

Branka Borovic, Slavica Veskovic-Moracanin, Aleksandra Stjepanovic

Production of fermented meat products is the result of metabolic activities naturally occurring in meat and Lactic Acid Bacteria (LAB) adapted in meat. Many studies on microflora of traditional raw sausages have showed that the most dominant species among all LAB is *Lactobacillus sakei.* Out of total number of isolates, it is determined that 55% belongs to *Lactobacillus sakei*.

Today, *Lactobacillus sakei* is often referred to as beneficial (good) industrial bacteria. This relation is based on the existence of its pronounced property to create bacteriocines - the secondary metabolites having inhibitory effect towards some pathogenic microorganisms, primarily towards *Listeria monocytogenes* and spoilage bacteria.

This species is very often present in commercial starter cultures of European countries. *Lactobacillus sakei is* for the European meat industry the same as *Pediococcus pentosaceus* in the meat industry of United States.

Based on this knowledge, the determination of presence and percentage of abundance of certain LAB strains in traditional fermented Sremska sausage has been done, with the special attention paid to the presence of *Lactobacillus sakei*.

In this paper, the conventional methodology for examination of presence and identification of LAB has been used, along with the biochemical confirmation - API test, as the final level of identification.

Obtained isolates have been subjected to the confirmation by PCR technique.

PCR (Polymerase Chain Reaction) is a contemporary biological technique based on enzymatic multiplication of specific DNA sequence, typical for certain bacterial strain, having over one million copies of the fragment synthesized in several hours.

Results of the research have shown that *Lactobacillus sakei* has not, as it is, been isolated by conventional methods, but, PCR technique has shown its presence in the amount of 52.7%.

Actually, conventional methods, including API identification, have not given the characteristic profile of *Lactobacillus sakei.*

Comparison of the obtained results has shown that *Lactobacillus fermentum*, *Lactobacillus curvatus* and *Lactobacillus delbruetski ssp.delbruetski* species, subjected to the final PCR identification, confirmation, resulted in *Lactobacillus sakei*.

The determined abundance of this bacterial culture, compared to other LAB isolated from traditional fermented Sremska sausage, was 52.7%.

Key words: Sremska sausage, *Lactobacillus sakei*, API identification, PCR- technique

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III-10

RAZVOJ BRZE METODE ZA ODREĐIVANJE *LISTERIA MONOCYTOGENES* U HRANI POMOĆU REAL TIME PCR

Anna A. Braguta, mlađi istraživač

Razvijena je brza metoda za određivanje L*isteria monocytogenes* u hrani metodom reakcije lančanog umnožavanja u stvarnom vremenu. Za ovu svrhu je kreirana serija oligonukleotidnih sekvenci čija je specifičnost potvrđena serijom eksperimenata na laboratorijskim i muzejskim sojevima. Sprovedena su komparativna ispitivanja metoda izolacije DNK. Nova metoda je ispitana na 50 uzoraka mesnih proizvoda i polufabrikata. Iz 17 uzoraka je izolovana *Listeria monocytogenes.* Rezultati ispitivanja tradicionalnom metodom i novom metodom bili su 100% podudarni.

Ključne reči: real time PCR, *Listeria monocytogenes*, oligonukleotidi, prajmeri, brze metode

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DEVELOPMENT OF RAPID METHOD FOR REVEALING LISTERIA MONOCYTOGENES IN FOODS BY REAL TIME PCR

Anna A. Braguta, post-graduate, junior research worker

Fast method for detecting *Listeria monocytogenes* in food by the method of real time polymerase-chain reaction has been developed. A set of oligonucleotide sequences, the specificity of which was confirmed by a series of experiments on laboratory and museum strains, has been created for this purpose. Comparative investigations of the methods of isolation of DNA have been carried out. The new method was tested on 50 samples of meat and semi-prepared meat products. 17 samples containing *Listeria monocytogenes* were isolated. A 100% agreement of the results of investigations by classical and a new method was achieved.

Key words: Real time PCR, Listeria monocytogenes, oligonucleotides, primers, express-method

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III-11

ANTIMIKROBNA REZISTENCIJA ZOONOTSKIH PATOGENA POREKLOM IZ MESA ŽIVINE

Jelena Petrović, M.Ž. Baltić, R. Kljajić

Antimikrobna rezistencija patogena koji se prenose hranom danas je predmet javne rasprave u naučnim krugovima. Upotreba antimikrobnih lekova u terapiji, profilaksi i kao promotera rasta kod životinja za proizvodnju namirnica otvorila je pitanje razvijanja rezistencije kod bakterija još u organizmu životinje, mogućeg prenosa kroz lanac ishrane na čoveka i nastanka oboljenja koja se zbog rezistencije teško leče.

Alimentarne infekcije nastale posle konzumiranja živinskog mesa su najčešće izazvane sa *Salmonella spp*. i termofilnim *Campylobacter spp.*, te rezistencija ovih patogena prema antimikrobnim lekovima ima poseban značaj. Ispitivanje rezistencije je izvršeno tokom šestomesečnog perioda, u kom je uzorkovano 480 uzoraka jetre i briseva visceralne duplje živine u sedam objekata za klanje živine. Prisustvo *Salmonella spp*. ustanovljeno je u 69 uzoraka (14.37%), a *Campylobacter spp.* u 158 uzoraka (32.92%). Delimična i/ili potpuna rezistencija prema jednom ili više antimikrobnih lekova ustanovljena je kod 28 (40,58%) sojeva *Salmonella spp*., odnosno 119 (75,32%) sojeva *Campylobacter spp.*

Našim ispitivanjima raširenosti rezistencije zoonotskih patogena koji se najčešće prenose živinskim mesom ustanovljeni su alarmantni podaci. Zato je neophodna primena profilaktičkih i higijensko-sanitarnih mera u objektima za držanje, klanje i preradu mesa koje će značajno redukovati rizik od pojave rezistentnih zoonotskih bakterija. Pored primene preventivnih i higijensko-sanitarnih mera problem rezistencije patogena zahteva uvođenje organizovanog sistema nadzora kao i primenu integrisanog sistema kontrole u lancu primarne proizvodnje, koji bi obezbedili kontrolu distribucije i primene antimikrobnih lekova i sprovođenje odgovarajućih monitoring programa za praćenje rezistencije.

Ključne reči: antimikrobna rezistencija, zoonotski patogeni, živinsko meso

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ANTIMICROBIAL RESISTANCE OF ZOONOTIC PATHOGENS ORIGINATED FROM POULTRY MEAT

Jelena Petrovic, M.Z. Baltic, R. Kljajic

Nowadays antimicrobial resistance in food-borne pathogens is a subject of public discussion in scholarly circles. Application of antimicrobial drugs in therapy, prophylaxis and as growth promoters in food producing animals, raised the question of developing resistance in bacteria while

they are still in body of animals, their possible transfer on humans via food chain and treatment failures because of resistance.

Campylobacter and *Salmonella* species are the most common cause of alimentary infections developed after consumption of chicken meat. Therefore, resistance of these pathogens to antimicrobial drugs has a special importance. Resistance was examined in the period of six months; 480 samples of chicken liver and visceral swabs were taken from seven abattoirs. Presence of *Salmonella spp*. was found in 69 samples (14.37%) and *Campylobacter spp.* was found in 158 samples (32.92%). Reduced susceptibility or resistance to one or more antimicrobial drugs were found in 28 (40.58%) isolates of *Salmonella spp*. and in 119 (75.32%) isolates of *Campylobacter spp.*

According to our research, prevalence of resistence in the most common zoonotic pathogens transferred by chicken meat, alarming data were found. Application of prophylactic and sanitary measures in facilities, abattoirs and during processing of meat, may considerably reduce the risk from the incidence of resistant zoonotic bacteria. Besides preventive and hygiene-sanitary measures, the problem of pathogen resistance demands introducing system of surveillance and applying integral control system in the chain of primary production. This can provide control of distribution, application of antimicrobial drugs and carrying out adequate resistance monitoring programmes.

Key words: antimicrobial resistance, zoonotic pathogens, poultry meat

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III-12

POREĐENJE METODA UZORKOVANJA I ISPITIVANJA MIKROBIOLOŠKOG STATUSA SVINJSKIH POLUTKI

Tamara Šakota, Marija Škrinjar, Ljiljana Petrović, Jasmina Adamović

Praćenje dobre higijenske prakse (DHP) je preduslov za proizvodnju zdravstveno bezbedne hrane. Analiza dobre higijenske prakse u proizvodnji svinjskih polutki izvršena je prema utvrđenoj šemi, shodno Odluci komisije 2001/471/EC i Regulativi EU No 2073/2005, uzimanjem uzoraka za mikrobiološka ispitivanja nakon obrade polutki, a pre rashlađivanja i to komparativno, metodom brisa i destruktivnom metodom. Praćen je ukupan broj aerobnih mezofilnih bakterija, ukupan broj bakterija porodice *Enterobacteriaceae* i vrste roda *Salmonella*. Izvršeno je poređenje metoda ispitivanja prema Pravilniku o metodama vršenja mikrobioloških analiza i superanaliza životnih namirnica (Sl. list SFRJ 25/80) i Odluci komisije 2001/471/EC, sa modernim metodama (3M Petrifilm™ i Tecra Unique ™ *Salmonella*). Nije bilo značajnih razlika u ukupnom broju aerobnih mezofilnih bakterija, ukupnom broju bakterija porodice *Enterobacteriaceae* i vrstama roda *Salmonella* pri primeni metoda prema Pravilniku (Odluci komisije) i modernih metoda. Postoji značajna razlika u ukupnom broju aerobnih mezofilnih bakterija i ukupnom broju bakterija porodice *Enterobacteriaceae* u zavisnosti od metode uzorkovanja.

Ključne reči: svinjske polutke, destruktivna metoda, metoda brisa, mikroorganizmi

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COMPARISON OF METHODS FOR SAMPLING AND TESTING OF MICROBIOLOGICAL STATUS OF PORK HALF CARCASSES

Tamara Sakota, Marija Skrinjar, Ljiljana Petrovic, Jasmina Adamovic

Monitoring of Good Hygiene Practice (GHP) is a prerequisite for safe food production. The analysis of Good Hygiene Practice in production of pork half carcasses has been followed according to Commission Decision 2001/471/EC and Regulation EU No 2073/2005, by taking samples for microbiological analyses after carcasses treatment before cooling, comparatively by swab and destructive method. The aerobic mesophilic bacteria colony count, total number of *Enterobacteriaceae* and *Salmonella* spp. were monitored. Comparison of the methods was performed according to Regulation on conduction of microbiological analyses and superanalyses of foodstuffs (Official Gazette SFRJ 25/80) and Commission Decision 2001/471/EC, with modern methods (3M Petrifilm TM, and Tecra Unique TM *Salmonella*). There were no important differences in aerobic mesophilic bacteria colony count, total number of *Enterobacteriaceae* and *Salmonella* spp. obtained by method according to Regulations (Commission Decision) and modern methods. There was significant difference in aerobic mesophilic bacterial colony count and number of *Enterobacteriaceae*, depending on the sampling method.

Keywords: pork half carcasses, destructive method, swab method, microorganisms

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III-13

IZVORI MIKOLOŠKE I MIKOTOKSIKOLOŠKE KONTAMINACIJE NA SUVOMESNATIM PROIZVODIMA

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U ovom radu je dat prikaz mogućih izvora kontaminacije nekih trajnih suvomesnatih proizvoda plesnima i njihovim toksičnim metabolitima, mikotosinima.

Praćena je pojava plesni na površini čajne kobasice i suvog svinjskog vrata tokom zrenja u fermentacionoj komori, pri temperaturi od 13,1^{0}C do 14,8 ^{0}C i vlažnosti vazduha od 62 do 78%. Ukupan broj plesni po cm^2 omotača kretao se od 10,5 do 69,0. Dominantna plesan pripada rodu *Penicillium.*

Mikološkom i mikotoksikološkom analizom začina (piment) utvrđeno je prisustvo plesni (*Penicillium, Aspegillus*) i mikotoksina aflatoksina B_1 (1,33 μg/kg), aflatoksina G_1 (0,42 μg/kg) i ohratoksin A (3,8 μg/kg).

Ključne reči: plesni, aflatoksin, ohratoksin, suvomesnati proizvod

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SOURCES OF MYCOLOGICAL AND MYCOTOXICOLOGICAL CONTAMINATION OF SMOKED MEAT PRODUCTS

Snjezana Mandic, R. Grujic, Ljiljana Topalic-Trifunovic, R. Djurica, Sandra Stojkovic

This paper gives review of possible sources of contamination of dry meat products by moulds and their toxic metabolites, mycotoxins.

Mould appearance on the surface of tea sausage and dried pork neck was monitored during the process of ripening in fermentation chamber, at 13.1 C^0 to 14.8 C^0 and air moisture from 62 to 78%. Total count of moulds per cm^2 of casing ranged from 10.5 to 69.0. Dominating mould belongs to *Penicillum.*

Mycological and mycotoxicological analysis of spices (pimento) indicated the presence of mould (*Penicillum, Aspegillus*) and mycotoxins aflatoxin B_1 (1.33 μg/kg), aflatoxin G_1 (0.42μg/kg) and ochratoxin A (3.8 33 μg/kg).

Key words: mould, aflatoxin, ohratoxin, smoked meat product

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III-14

ZNAČAJ MIKOLOŠKE KONTROLE U POGONIMA ZA PROIZVODNJU MESA I PROIZVODA OD MESA

Snježana Mandić, R. Grujić, Ljiljana Topalić-Trifunović, R. Đurica, Sandra Stojković

U mesnoj industriji, kao i u malim pogonima za proizvodnju mesa i proizvoda od mesa, tokom proizvodnje i skladištenja, nije retka naknadna ili sekundarna kontaminacija toksogenim plesnima.

U ovom radu dat je prikaz mogućih izvora kontaminacije sa različitih površina u proizvodnom pogonu (radne površine, oprema, zid i pod prostorija, bris ruku radnika), koje dovode, direktno ili indirektno, u opasnost bezbednost proizvoda od mesa.

Ukupan broj plesni po cm^2 na 25 ispitanih površina varirao je u rasponu od 0 (creva za punjenje) do 50,7 (površina suvog vrata). Najveći udeo izolovanih plesni pripadao je rodu *Penicillium*, koja je poznati proizvođač brojnih toksičnih metabolita.

Zbog odsustva postupaka kojima se utvrđuju način i koraci sanitacije (Sanitarni Standardni Operativni Postupci, SSOP), mikološkom analizom utvrđeno je da kontaminirane površine u fermentacionim komorama (48,8/cm^2) predstavljaju veliku opasnost za indirektnu kontaminaciju fermentisanih proizvoda od mesa. Utvrđeno je prisustvo istih plesni na površini sledećih proizvoda: omotač čajne kobasice od 22,5/cm^2 do 27,6/cm^2 i na površini suvog vrata od 45,2/cm^2 do 50,7/cm^2.

Ključne reči: plesni, proizvodi od mesa, sanitacija, mikološka kontrola

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IMPORTANCE OF MYCOLOGICAL CONTROL IN PLANTS FOR PRODUCTION OF MEAT AND MEAT PRODUCTS

Snjezana Mandic, R. Grujic, Ljiljana Topalic-Trifunovic, R. Djurica, Sandra Stojkovic

In meat industry, as well as in small plants for production of meat and meat products, during production process and storing, not rarely, additional or secondary contamination by toxic moulds might occur.

This paper gives a review of possible sources of contamination from various surfaces in the production plant (working surface, equipment, walls and floors of the premises, smear from worker's hands) that directly or indirectly affect safety of meat products.

Total number of mould per cm^2 on 25 examined surfaces varied from 0 (casing for processed meat) to 50.7 (surface of dried neck). Most of the the isolated moulds belong to genera *Pencillium,* known also as producers of many toxic metabolites.

Due to lack of procedures that would establish the way and steps for sanitation (Sanitary Standards and Operative Procedures, SSOP) it has been confirmed by mycological analysis that contaminated surfaces in fermentation chambers ($48.8/cm^2$) posed high danger for indirect contamination of fermented meat products. Presence of the same mould on the following product surfaces: casings for tea sausages from $22.5/cm^2$ to $27.6/cm^2$, dried neck from $45.2/cm^2$ to $50.7/cm^2$, was detected.

Key words: mould, meat products, sanitation, mycological control

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III-15

IZOLOVANjE I IDENTIFIKACIJA KSEROFILNIH PLESNI IZ ZAČINA KOJI SE KORISTE U INDUSTRIJI MESA

Vesna Janković, Marija Škrinjar, Jelena Vukojević, Branka Borović, M. Radmili

Kao jedan od mogućih izvora kontaminacije mesnih prerađevina toksigenim plesnima često se navode začini. Vrste koje se pojavljuju kao kontaminenti začina su kserofilne, skladišne plesni, najčešće iz rodova ***Aspergillus*** i ***Penicillium***. Kserofilne plesni su sposobne da se normalno razvijaju i proizvode toksične metabolite pri a_w vrednostima znatno nižim od 0,85.

Uzimajući u obzir činjenicu da začini predstavljaju moguć izvor kontaminacije finalnog proizvoda, neophodno je uočiti zakonitosti rasprostranjenja plesni u začinima korišćenjem selektivnih podloga, što je ujedno i cilj rada.

Mikološkim analizama obuhvaćeno je po pet uzoraka origana i karanfilića. Kontaminacija plesnima ispitana je paralelno korišćenjem Sabouraud maltoznog agara (SMA) i podloge koja favorizuje rast kserofilnih vrsta – sladni kvaščev ekstrakt agar sa 50% glukoze (MY50G). Određivanje ukupnog broja plesni izvedeno je standardnim laboratorijskim postupkom u dva ponavljanja, a izolovane vrste određivane su na osnovu ispitivanja makromorfoloških osobina kolonija i mikromorfoloških osobina konidijalnih i drugih struktura prema odgovarajućim ključevima.

Rezultati ispitivanja ukupnog broja plesni u origanu i karanfiliću pokazala su kontaminiranost svih uzoraka. Upoređivanjem rezultata uočena je drastična razlika u pogledu broja plesni izraslih na obe podloge. Naime, kod origana daleko veća učestalost plesni uočena je na MY50G, dok je kod karanfilića situacija upravo suprotna – najviše plesni izolovano je pomoću SMA podloge.
Izolovane plesni svrstane su u 5 rodova (***Aspergillus***, ***Alternaria***, ***Cladosporium***, ***Rhizopus*** i ***Penicillium***) i 9 vrsta.

Podloga MY50G pokazala se efikasnijom za detekciju ***Aspergillus*** vrsta, dok je najveća učestalost roda ***Penicillium*** utvrđena korišćenjem SMA podloge. Kao poseban indikator može nam poslužiti ***A. rubrum,*** čija zastupljenost na SMA iznosi 0 a na MY50G 50%.

Na osnovu dobijenih rezultata može se zaključiti da je za određivanje realnog stepena kontaminacije začina plesnima, neophodno uključiti podloge prilagođene specifičnim zahtevima kserofila.

Ključne reči: plesni, a_w vrednost, selektivne podloge

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ISOLATION AND IDENTIFICATION OF XEROPHILIC FUNGI FROM SPICES USED IN THE MEAT INDUSTRY

Vesna Jankovic, Marija Skrinjar, Jelena Vukojevic, Branka Borovic, M. Radmili

Contamination aspects of meat products by toxigenic moulds are numerous. It is necessary to mention the spices as the possible source of contamination. The main contaminating agents are xerophilic moulds from genera *Aspergillus* and *Penicillium*. The xerophilic moulds have normal growth and produce toxic metabolites - mycotoxins even with a_w value at 0,85.

Considering the fact that spices represent a source of contamination, it is necessary to observe a principle of moulds prevalence in spices using different selective culture media. This was, also, the aim of our work.

The mycological research encompassed determination of the total number of moulds in 1 g of the tested spices – oregano and clove (five different samples of each) and their identification according to the standard laboratory procedure, with two replicates. Two types of selective culture media were used: Sabouraud-maltose agar (SMA) and maltose yeast extract agar with 50% glucose (MY50G). The species isolated were identified on the basis of investigation of the macromorphological properties of colonies and micromorphological properties of conidial and other structures.

According to the results of the investigation of total count, we found that all of tested samples were contaminated. Comparison of the results indicates o drastic differences between the number of moulds grown on the two culture media. In oregano, the highest number of moulds were generated on the MY50G, while in clove we have the opposite situation – on SMA we had the highest contamination level. Isolated moulds were classified into 5 genera (***Aspergillus***, ***Alternaria***, ***Cladosporium***, ***Rhizopus*** и ***Penicillium***) and 9 species.

MY50G was more efficient for ***Aspergillus*** species detection, while ***Penicillium***, was mostly detected on SMA. The very specific was ***A. rubrum*** with frequency 0 (SMA) and 50% (MY50G).

We can conclude that it is necessary, in order to get real contamination level, to use different selective culture media, especially those which favour the growth of xerophilic moulds.

Key words: moulds, a_w, selective culture media

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III-16

PROIZVODNJA AFLATOKSINA B_1 OD STRANE PLESNI IZOLOVANIH IZ ZAČINA KOJI SE KORISTE U INDUSTRIJI MESA

Lj. Ć. Šarić, Marija Škrinjar

Ovaj rad se bavi istraživanjem mogućnosti proizvodnje aflatoksina B1 (AB1) od strane plesni iz grupe *A. flavus-oryzae* (10 izolata) i *A. niger* (5 izolata), izolovanih iz začina koji se često koriste u industriji mesa (mleveni biber, biber u zrnu, aleva paprika, kim i lovorov list). 5mL suspenzije čiste kulture ispitivanog mikroorganizma (10^7/g) naneto je na podlogu sa ekstraktom kvasca i sukroze (YES-50mL). Inkubacija se odvijala 13 dana na 25°C sa periodičnim protresanjem da bi se postigli aerobni uslovi. Nakon toga, proizvedena biomasa je eliminisana filtracijom i 25 mL filtrata je ispitano na prisustvo AB1 metodom hromatografije na tankom sloju (TLC). Utvrđeno je da je 50% ispitanog *A. flavus-oryzae* izolata pozitivno na AB1 u rasponu koncentracija od 2,4 do 48 μg/kg. Izolati *A. niger* nisu pokazali sposobnost da proizvode AB1.

Ključne reči: aflatoksin B1, proizvodnja, aflatoksikogene plesni, začini

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PRODUCTION OF AFLATOXIN B1 BY MOULDS ISOLATED FROM SPICES USED IN MEAT PROCESSING INDUSTRY

Lj.C. Saric, Marija Skrinjar

This paper investigated the ability of production of aflatoxin B1 (AB1) by moulds from group *A. flavus-oryzae* (10 isolates) and *A. niger* (5 isolates), which were isolated from spices that are often used in the meat processing industry (ground pepper, grain pepper, powder paprika, caraway and laurel). 5 ml of suspension of pure culture of tested microorganism (10^7/ g) was added in the medium with yeast extract and sucrose (YES - 50 ml). Incubation was carried out for 13 days at 25 ºC with periodical shake in order to achieve aerobic conditions. After that, the produced biomass was eliminated by filtration and 25 ml of filtrate residue was examined on AB1 by thin layer chromatography (TLC). It was detected that 50% of examined *A. flavus-oryzae* isolates were positive on AB1, with concentration range from 2,4 to 48 $\mu g.kg^{-1}$. The *A. niger* isolates did not show the ability of production of AB1.

Key words: aflatoxin B1, production, aflatoxigenic moulds, spices

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III-17

MONITORING NAKUPLJANJA TOKSIČNIH ELEMENATA (KADMIJUM, OLOVO) U ORGANIMA I TKIVIMA SVINJA IZ REGIONA ROSTOV I LIPETSK RUSKE FEDERACIJE

Dr Yulia E. Kalinova, dr Irina M. Tchernoukha, Nataliya L. Vostrikova,
Tatyana V. Ilyina, Olga N. Orlova

Izvedena su ispitivanja akumulacije toksičnih elemenata u organima i tkivima svinja uzgajanih u različitim geografskim uslovima oblasti Rostov i Lipetsk uz različiti integralni pristup evaluaciji životne sredine sa posebnim osvrtom na ekološki stres. Određene su kritične kontrolne tačke akumulacije toksičnih elemenata u organizmu svinja (jetra za kadmijum i srce za olovo). Komparativnom analizom dobijenih rezultata o sadržaju kadmijuma i olova u organima i tkivima svinja utvrđeno je da je sadržaj kadmijuma i olova u uzorcima iz oblasti Rostov u proseku dva do četiri puta veći od sadržaja ovih elemenata u uzorcima iz oblasti Lipetsk. Nalazi pokazuju da je podela regiona na povoljne i nepovoljne sa ekološkog stanovišta uslovna i da u svim regionima oblasti Rostov i Lipetsk treba sprovesti kontrolu sirovina sa velikih svinjarskih farmi i malih privatnih farmi u cilju utvrđivanja indikatora bezbednosti.

Ključne reči: monitoring, sledljivost, residue štetnih supstanci, toksični elementi, svinjetina

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MONITORING OF ACCUMULATION OF TOXIC ELEMENTS (CADMIUM, LEAD) IN ORGANS AND TISSUES OF PIGS IN ROSTOV AND LIPETSK REGIONS OF THE RUSSIAN FEDERATION

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Tatyana V. Ilyina, Olga N. Orlova

The investigations of accumulation of toxic elements in organs and tissues of pigs raised in different geographical conditions of Rostov and Lipetsk regions, with different integral evaluation of the environment with regards to ecological stress were carried out. The critical control points of the accumulation of toxic compounds in pig's organs (for cadmium – liver, for lead – heart) were determined. The comparative analysis of the obtained results on the content of cadmium and lead in organs and tissues of pigs shows that on the average, the content of cadmium and lead in the samples from Rostov region is 2-4 times higher, than in those from Lipetsk region. It was found that the division of regions into favorable and unfavorable ones, from the ecological point of view, is rather conditional and in all the regions, Rostov and Lipetsk, the control of raw materials of pig farms and private small farms for the studied safety indices should be carried out.

Key words: monitoring, traceability, residues of harmful substances, toxic elements, pork

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III-18

ODREĐIVANJE METABOLITA NITROFURANA U TKIVIMA ŽIVOTINJA I PRIMARNIM PROIZVODIMA ANIMALNOG POREKLA PRIMENOM TEČNE HROMATOGRAFIJE SA MASENOM DETEKCIJOM (LC-MS/MS)

Valentina Batas, Aurelija Spirić, S. Janković, R. Petronijević, D. Milićevic

Nitrofurani (furazolidon, furaltadon, nitrofurazon i nitrofurantoin) spadaju u grupu antibiotika koji su efikasno korišćeni u lečenju infekcija izazvanih bakterijama *Salmonella* i *Escherichia coli* kod krava, svinja, živine i riba. Često su korišćeni i u formi dodataka stočnoj hrani i kao promoteri rasta.

Na osnovu podataka o toksičnosti kao i potencijalnoj mutagenosti i kancerogenosti, od 1993. godine zabranjena je upotreba furaltadona, nitrofurazona i nitrofurantoina za potrebe uzgoja životinja (Commision Regulation 2901/93). Godine 1995., zabranjenoj grupi nitrofurana priključen je i furazolidon (Commision Regulation 1442/95). Međutim, i pored zabrane korišćenja nitrofurana, zbog njihove velike toksičnosti i mogućnosti ilegalne upotrebe, direktivom Saveta EU 1996/23EC zahteva se njihova kontrola u okviru monitoring programa.

Imajući u vidu činjenicu da se nitrofurani karakterišu veoma kratkim vremenom poluživota *in vivo* (ne dužim od nekoliko sati), kao marker rezidue za kontrolu ilegalne upotrebe nitrofurana, u ciljnim tkivima životinja određuju se njihovi znatno stabilniji metaboliti (vreme poluživota od 4 do 9 dana). U skladu sa navedenim, 2003 godine (Commission Decision 2003/181/EC) EU je definisala najmanji zahtevani limit određivanja (MRPL- Minimum Required Performance Limit) od 1µg/kg kao najmanju količinu nitrofurana i njihovih metabolita koju je potrebno odrediti i potvrditi.

Svrstavanje nitrofurana u grupu lekova zabranjenih za upotrebu u veterinarskoj praksi uslovilo je izbor analitičke tehnike za njihovo određivanje i konfirmaciju. Odlukom EU iz 2002. godine (Commission Decision 2002/657/EC) definisana je LC-MS/MS tehnika kao jedina konfirmativna tehnika u cilju nedvosmislenog određivanja nitrofurana i njihovih metabolita. Masenom detekcijom sa dva heksapola ispunjavaju se najstrožiji zahtevi povrđivanja metabolita nitrofurana detektovanjem najmanje dve tranzicije svakog roditeteljskog jona.

Zbog navedenog, za monitoring rezidua nitrofurana prihvaćena je metoda: "Određivanje metabolita nitrofurana u tkivima životinja primenom tečne hromatografije sa masenom detekcijom", Journal of Chromatogrphy A, 2001. Nakon validacije bazirane na kriterijumima Odluke Saveta EU iz 2002 godine (Commision Decission 2002/657/EC), pomenuta metoda primenjena je na tkiva (mišićno i bubreg), urin i proizvode animalnog porekla (jaja i mleko). Posle brze i jednostavne pripreme, analiza se izvodi na Waters 2695 HPLC sistemu sa Micromass Quattro Micro masenim detektorom u pozitivnom ESI (electrospray ionization mode) režimu rada. Za hromatografsko razdvajanje korišćena je kolona C_{18} X- Terra MS (2.1x100mm, 3.5µm).

Ključne reči: rezidue, nitrofuran, metaboliti, LC-MS/MS

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DETERMINATION OF THE METABOLITES OF NITROFURAN ANTIBIOTICS IN ANIMAL TISSUE AND PRIMARY ANIMAL PRODUCTS BY LIQUID CHROMATOGRAPHY-TANDEM MASS SPECTROMETRY (LC-MS/MS)

Valentina Batas, Aurelija Spiric, S. Jankovic, R. Petronijevic, D. Milicevic

The nitrofurans (furazolidone, furaltadone, nitrofurazone and nitrofurantoin) have been widely used antibiotics for the tretment of infections caused by *Salmonella* and *Escherichia coli* in cattle, swine, poultry and fish. Very often they have been used as feed aditives as well as growth promoters.

Following data which classified furaltadone, nitrofurazone and nitrofurantoin as mutagenic and cancerogenic drugs, since 1993 (Commision Regulation 2901/93) their use has been forbiden in animal breeding. Since 1995 furazolidone has been banned, too (Commision Regulation 1442/95). However, regardless of the ban on nitrofurans use, because of their high toxicity and possibility of illegal animal treatment, EU requires strict control of nitrofurans and their matabolites (Council Directive 96/23/EC).

Due to very fast metabolism, the *in vivo* half-life of the nitrofuran type antibiotics is only few hours. For this reason, the metabolites of nitrofuran antibiotics, with more longer half-life (between 4 and 9 days), are determined as markers for the illegal use of nitrofurans. In accordance with, Commission Decision 2003/181/EC, Minimum Required Performance Limit (MRPL) of 1μg/kg was set for nitrofurans and their matabolites.

Classification of the nitrofuran antibiotics in the group of banned veterinary drugs, requires sophisticated analytical technique for their determination and confirmation. According to Commission Decision 2002/657/EC, LC-MS/MS was determinated as the confirmative technique for unambiguos determination of the nitrofurans and their matabolites. Mass detector with two hexapoles fulfilles the most severe demands, by detection at least two douther ions per one parent ion.

In accordance with the mentioned, we accepted the method: "Determination of the metabolites of nitrofuran antibiotics in animal tissue by high-performance liquid chromatograpy–tandem mass spectrometry" Journal of Chromatography A, 2001. After validation based on requirements of Commision Decision 2002/657/EC we extended application of the mentioned method to tissues (muscle and kidney), urine, as well as to primary animal products (eggs and milk). After fast and simple sample preparation procedure the analysis has been performed on Waters 2695 Separation Module with Micromass Quattro Micro mass detector operating in positive electrospray ionization mode (ESI+). Chromatography was performed on C18 X- Terra MS (2.1x100mm, 3.5μm) column.

Key words: residues, nitrofurans, metabolites, LC-MS/MS

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III-19

IMPLEMENTACIJA HACCP SISTEMA U MESNOJ INDUSTRIJI I KLANICI "SVETI NIKOLE", REPUBLIKA MAKEDONIJA

O. Kirovska Cigulevska, A. Kuzelov

Republika Makedonija, kao budući član EU, polako, ali sigurno usaglašava svoje zakone prema zakononskim regulativama i direktivama koje važe u EU. Evropski prehrambeni lanac je jedan od najsigurnijih u svetu. Izraz "od farme do trpeze" je postao popularan, kako u svetu, tako i kod nas. Taj izraz sintetizuje sve mere koje se preduzimaju da bi proizvod bio bezbedan, odnosno da nije fizički, hemijski ili mikrobiološki zagađen.

U 2002. godini, u R. Makedoniji je donesen zakon o bezbednosti hrane. Tim zakonom, sve firme koje proizvode prehrambene proizvode obavezane su da implementiraju HACCP sistem. Mesna industrija i klanica "Sveti Nikole" je implementirala i sertifikovala HACCP sistem na liniji za proizvodnju konzervi (mesni narezak i pašteta), a sada je u toku implementacija HACCP sistema u celokupnoj proizvodnji. Cilj HACCP tima, koji već ima iskustvo u implementaciji HACCP-a, je da identifikuje, prevenira i eliminiše sve moguće rizike (fizičke, hemijske i mikrobiološke) koji mogu da učine proizvod nebezbednim za ljudsku ishranu. Dokaz o bezbednosti proizvoda je pre-monitoring i vođenje dokumentacije zapisa (procedure, radna uputstva, zapisi o svakodnevnom monitoringu), a zahtevi povezani sa ispunjavanjem zadataka vezanih za higijenu i bezbednost proizvoda se svakodnevno ispunjavaju.

Iz gore navedenog može se zaključiti da Mesna industrija i klanica, koja već ima implementiran i sertifikovan ISO 9001-2000 i HACCP sistem na liniji za proizvodnju (narezak i pašteta), a u toku je implementacija HACCP-a za celu proizvodnju (svih proizvoda), strogo vodi računa o bezbednosti svojih proizvoda.

Ključne reči: HACCP sistem, bezbednost hrane

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IMPLEMENTING OF HACCP SYSTEM IN MEAT INDUSTRY AND ABATTOIR "SVETI NIKOLE", R. MACEDONIA

O. Kirovska-Cigulevska, A. Kuzelov

As a future member of EU, FYR of Macedonia gradually, but certainly, harmonises its legislation with the EU legal regulations and directives. The European food chain is one of the safest in the world. The idiom "from farm to fork" became popular, not only in the world, but in our country too. The idiom sublimates all the measures that are to be used, so that the goods are safe, i.e. not physically, chemically and microbiologically polluted.

During 2002, R. Macedonia adopted the Food Safety Act. According to that Act all companies that produce food products should implement the HACCP system. Meet Industry and Slaughterhouse "Sveti Nikole" implemented and certified the HACCP system for the production line of canned food (Meat Luncheon and Pate). The implementation of HACCP system for all production lines is underway. The goal of the HACCP team that already has experience in HACCP implementation is to identify, prevent and eradicate all possible risks (physical, chemical and microbiological) that might cause the product unsafe for human consumption. The proof of product's safety is obtained by pre-monitoring and keeping records (procedures, operation manuals, monitoring records), and all the requirements are connected with accomplishing the tasks that pertain the hygiene and safety of the products on a daily basis.

It can be concluded that Meet Industry and Slaughterhouse "Sveti Nikole" has already implemented and certified ISO 9000-2000 and HACCP system for canned food production (Luncheon and Pate) and is already implementing HACCP for all production lines, rigorously controls its products.

Key words: HACCP system, food safety

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III-20

ODGOVORNOST PROIZVOĐAČA U INTEGRISANOM SISTEMU BEZBEDNOSTI HRANE

Ružica Milovanović

Slobodno kretanje zdravstveno bezbedne hrane određenog nivoa kvaliteta na svetskom tržištu uključuje elemente koji mogu imati uticaja na bezbednost hrane u svakom nivou lanca proizvodnje, prerade i distribucije.

Osnovnim principima Zakona o hrani definisane su sve te aktivnosti:

- α kretanje proizvoda (prehrambenih proizvoda, stočne hrane, životinja za proizvodnju hrane) kroz prehrambeni lanac mora biti registrovan i poznat u svakoj tački procesa proizvodnje, prerade i distribucije i
- β u svim fazama procesa proizvodnje, prerade i distribucije proizvođači moraju da obezbede poštovanje Zakona o hrani, a države članice su dužne da sprovode restriktivne mere.

Zahtevi u pogledu svetske konkurentnosti proizvoda stalno se menjaju i usavršavaju. Preko kvaliteta proizvoda, dostignute pozicije na tržištu, roka isporuke proizvoda, cene proizvoda, kvaliteta servisa, promotivne aktivnosti i usklađenosti proizvoda sa međunarodnim standardima, sve više dolazi do izražaja briga o zaštiti životne sredine. Značajno povećanje zagađenja životne sredine i veliki pritisak na proizvođače i distributere, uslovili su pojavu novih aktivnosti. Između ostalih aktivnosti, pojavila se i aktivnost upravljanja zaštitom životne sredine.

Prema međunarodnim standardima, radi se o procesima kojima se organizovano upravlja ljudskim aktivnostima u cilju smanjenja negativnih uticaja na životnu sredinu. Suština tih aktivnosti je analiza životnog ciklusa proizvoda i usluga. Analiza životnog ciklusa pokazuje kakve ekonomske i ekološke posledice stvara proizvod tokom proizvodnje, upotrebe i odlaganja.

Posebno je važno sagledati aktivnost u domenu materijalnog poslovanja i pakovanja, što je predmet analize u ovom radu.

Ključne reči: međunarodni standardi, upravljanje kvalitetom, integrisani sistem, bezbedna hrana, ekološki status

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RESPONSIBILITY OF MANUFACTURERS IN THE INTEGRATED FOOD SAFETY SYSTEM

Ruzica Milovanovic

Unlimited movement of safe food of certain level of quality across the world market includes some elements which might affect safety of food product on every level of production, processing and distribution chain.

All these activities are defined by basic principles of the Food Act:

- α the market flow of food products (food products, feedstuffs, animals for food production) across the food chain has to be registered and known at every point of the production, processing and distribution processes and
- β in all phases of production, processing and distribution processes, the manufacturer has to ensure the enforcement of the Food Act, and member countries are obliged to implement restrictive measures.

Requirements regarding competitiveness in the world market are permanently changing and improving. Through quality of product, current market position, deadline for product shipment, market value of the product, quality of service, promotion activities and compliance of products with international standards, environmental concerns are becoming increasingly prominent. Among the other activities, there appeared environmental protection management.

According to international standards, these are the processes for organized management of human activities toward decreasing negative impacts on the environment. Analysis of the life-cycle of products and services is the essence of these activities. The life-cycle analysis shows what kind of economical and ecological consequences causes product during its production, utilization and disposal.

It is especially important to understand the activities in the domain of material business transactions and packaging, which is the subject of this paper.

Key words: international standards, quality management, integrated system, safe food products, ecological status

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III-21

MIKROBIOLOŠKA SLIKA PRIRODNIH ZAČINA KOJI SE KORISTE U MESNOJ INDUSTRIJI

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Začini se koriste u mesnoj industriji u toku tehnološkog procesa, svakodnevno, radi postizanja određenih senzornih svojstava namirnica. Dodaju se u malim količinama, isključivo radi poboljšanja ukusa i mirisa. Začini sadrže eterična ulja i druga aromatična jedinjenja, tako da imaju nadražujuće dejstvo na probavni trakt: podstiču lučenje pljuvačke, odnosno sekreta žlezda, a time utiču na veće lučenje probavnih fermenata, odnosno poboljšavaju probavu.

Cilj ovog rada je da ukaže na mikrobiološku ispravnost prirodnih začina koji se svakodnevno koriste u mesnoj industriji.

Rezultati naših ispitivanja su pokazali da je od ukupno 80 pregledanih uzoraka prirodnih začina koji se koriste u mesnoj industriji 21.25% sadržalo kvasce i plijesni.

Ključne riječi: začini, mesna industrija, mikrobiološka ispravnost

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MICROBIOLOGICAL FEATURES OF NATURAL SPICES USED IN MEAT INDUSTRY

Vesna Kalaba, S. Dojcinovic, Lj. Kalaba

Spices are continuously used in meat industry for achieving appropriate quality of foodstuffs during technological process. They are applied in small quantities in order to improve aroma and flavor. The spices comprise etheric oils and other aromatic ingredients, so they act as stimulants to the digestive system: stimulation of salivation and other gland's secretions.

The purpose of this paper is to show microbiological suitability of the natural spices used in meat industry.

The results of our examination reveal 21.25% of presence of yeasts and molds among total of 80 samples submitted for testing.

Key words: spices, meat industry, microbiological suitability

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