



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

ZBORNİK KRATKIH SADRŽAJA ***BOOK OF ABSTRACTS***

MEĐUNARODNO
55. SAVETOVANJE INDUSTRIJE MESA
INTERNATIONAL
55th MEAT INDUSTRY CONFERENCE

MESO I PROIZVODI OD MESA – BEZBEDNOST
KVALITET I NOVE TEHNOLOGIJE
MEAT AND MEAT PRODUCTS – SAFETY,
QUALITY AND NEW TECHNOLOGIES

Tara – Hotel “Omorika”
15-17. juni 2009. godine
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CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

637.5(048)

614.31:637.5(048)

664.9(048)

МЕЂУНАРОДНО саветовање индустрије меса Месо
и производи од меса - безбедност, квалитет и нове
технологије (55 ; 2009 ; Тара)

Zbornik kratkih sadržaja = Book of Abstracts / Међународно
55. savetovanje industrije mesa Meso i proizvodi od mesa
- bezbednost, kvalitet i nove tehnologije, Tara, 15-17. juni 2009.
godine = International 55th Meat Industry Conference Meat and
Meat Products - Safety, Quality and New Technologies,
15th-17th June. 2009 ; [glavni i odgovorni urednici,
editors in chief Vesna Matekalo-Sverak, Aurelija Spirić,
Slavica Vesković-Moračanin]. - Beograd ; Institut za higijenu
i tehnologiju mesa - Belgrade : Institute of Meat Hygiene and
Technology, 2009 (Beograd : Beoknjiga). 159 str. ; 25 cm

Uporedo srp. tekst i engl. prevod. - Tiraž 350.

ISBN 978-86-82547-05-1

a) Месо - апстрактни b) Месне прерађевине - Апстрактни

COBISS.SR-ID 167652364



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ISBN 978-86-82547-05-1

**Tiraž/Number of copies printed
350 primeraka**

**Štamparija/Printing House:
“Beoknjiga” - Beograd**

Štampanje Zbornika kratkih sadržaja finansijski je pomoglo Ministarstvo za nauku i tehnološki razvoj Republike Srbije

Publication of Book of Abstracts is financially supported by Ministry of Science and Technological Development the Republic of Serbia

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TEHNOLOGIJA I KONKURENTNOST

Fertin C.

Danski Institut za istraživanje mesa je deo Danske Asociacije za meso, zajedničkog tehničkog i administrativnog tela Danskog sktora za jaja i meso. Danski Institut za istraživanje mesa kao i ostali delovi R&D, u okviru Danske Asociacije za meso bio je vrlo angažovan na razvoju tehnologije i znanja Danskog sektora za svinjsko meso već nekoliko dekada.

Više od jednog veka je ovaj sektor bio izvozno orijentisan i Danska je danas vodeći izvoznik svinjskog mesa sa ukupnom količinom izvoza od 1.8 miliona tona godišnje, u 130 zemalja sveta. Ovakva pozicija iziskuje globalnu snagu za konkurentnost. Deo ove snage je u ekstenzivnom korišćenju tehnologije u toku celog lanca snabdevanja.

Danska kooperativna industrija svinjskog mesa deluje kao koordinator u lancu snabdevanja od uzgajivača, klanice do dalje prerade i distribucije. Postoje brojnu aktivni mehanizmi koji osiguravaju koordinaciju kako na duži vremenski period - strateški ili na kraći vremenski period - operativni.

Na strateškom nivou deluju institucije koje se bave ukrštanjem i stvaraju genetsku bazu za proizvodnju svinja određenog kvaliteta i boljeg iskorišćenja. Ostale jedinice R&D u okviru Danske Asociacije za meso obezbeđuju uzgajivačima tehnologiju i znanje u vezi ishrane, čuvanja životinja, zaštite okoline, dobrobiti životinja i njihovog zdravlja kao i ostale tehnologije koje se koriste pri uzgoju životinja. Doprinos navedenih delatnosti je tada danska primarna proizvodnja svinja zauzme vodeću poziciju kao jedna od najracionalnijih usvetu.

Što se tiče klanične industrije, najvažnija tehnološka poboljšanja u poslednjih dvadeset godina su u tehnologiji merenja za procenu i sortiranje polutki, ICT sistemi za logistiku i sledljivost, mehanizacija procesa i internog transporta. Danski Institut za istraživanje mesa dao je doprinos u sve tri oblasti.

Od 1990 godine uveden je u svim kooperativnim danskim klanicama sistem za automatsku procenu polutki. Sistem se se zasnivao na optičkoj sondi uz podršku kompjuterskog softvera. Na ovaj način su se dobijali funkcionalni podaci za sistem procene na osnovu krkog mesa, a operativno za dobijanje određene sirovine. Sledeća generacija je ultrazvučni sistem koji zamenjuje sistem optičkih sondi.

Ekstenzivna mehanizacija danskih klanica je jedan od načina da se omogućí siplativost uprkos visokoj ceni radne snage u Danskoj. Tehnologija takođe doprinosi poboljšanju radne okoline, visokoj produktivnosti i pvećanju bezbednosti hrane, a u nekim slučajevima poboljšanju dobrobiti životinja.

U budućnosti se predviđa da će robotizovana tehnologija zameniti sadašnje specijalizovane automatske mašine. CT sistemi za skeniranje u svrhu merenja imaju perspektivu jer omogućuju 3D prikaze. Uzevši sve ovo u obzir platforma bazirana ICT sistemu će imati sve veću ulogu.

Ključne reči: tehnologija, konkurentnost, Danski institut za meso tehnologija, konkurentnost, Danski institut za meso

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TECHNOLOGY AND COMPETITIVENES

Fertin C.

The Danish Meat Research Institute is part of the Danish Meat Association, a joint technical and administrative body for the Danish meat and egg sector. For decades the Danish Meat Research Institute and other R&D units within the Danish Meat Association have been deeply involved in the development of technology and knowledge for the Danish pig meat sector.

For more than a century this sector has been thoroughly export oriented and Denmark is today the leading pig meat exporter with an export of 1.8 million tonnes per year to more than 130 countries. This position requires a global competitive strength. A part of this strength is obtained by an extensive use of technology throughout the supply chain.

The Danish cooperative pig meat industry acts as a coordinated supply chain from farmers through slaughterhouses to further processing and distribution. A number of mechanisms are active to ensure this coordination both long term strategically and short term operationally.

On the strategic level a common breeding organisation creates the genetic basis for production of pigs with the right quality and productivity traits. Other R&D units within the Danish Meat Association provide technologies and knowledge for farmers on feeding, housing systems, environmental protection, animal welfare and healthiness and other supporting farming technologies. The contributions from these functions are a key to the position of the Danish primary pig production as one of the most cost competitive internationally.

For the slaughterhouses some of the most important technology improvements in the past 20 years are measurement technology for carcass grading and sorting, ICT systems for logistics and traceability and mechanisation of processes and internal transportation. The Danish Meat Research Institute has contributed to all three areas.

In 1990 an automatic carcass grading system was introduced at all Danish cooperative slaughterhouses. Technically the system was based on optical insertion probes combined with advanced neural network interpretation software. Functionally, the system provided data for a lean meat based payment system and for operational routines for raw materials allocation. A next generation ultra sonic system is now replacing the optical probe system.

The extensive mechanisation of Danish slaughterhouses is one of the means to maintain cost-competitiveness despite of the high labour costs in Denmark. The technology also contributes to improved work environment, high product yield and enhanced food safety and in some cases even better animal welfare.

For the future it is anticipated that robotics technology will supplement the current specialised automatic machines. For measurement purposes CT scanning seems very perspective because it enables 3D representations. For tying it all together work floor ICT systems will continuously play an increasing role.

Key words: technology, competitiveness, Danish Meat Institute

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ITEMATSKA OBLAST
1st THEMATIC TOPIC

NOVE TEHNOLOGIJE
NEW TECHNOLOGIES

UTICAJ SELENA I VITAMINA E NA KVALITET I PRINOS MESA BROJLERA

Marković Radmila, Baltić M. Ž., Petrujkić B., Šefer D.

U radu su ispitivani efekti suplementacije obroka brojlera organskim i neorganskim oblicima selena i različitim količinama vitamina E na kvalitet mesa i prinos mesa brojlera. Ogled je izveden na ukupno 240 jedinki podeljenih u 4 grupe. Ogled je trajao 42 dana, a podeljen je u tri faze. Prva faza trajala je 21, druga 14, a treća 7 dana.

Brojleri su hranjeni sa tri vrste potpunih smeša za ishranu pilića u tovu standardnog sirovinskog i hemijskog sastava koje su u potpunosti zadovoljavale potrebe brojlera u različitim fazama tova. Potpuna smeša za početni tov pilića korišćena je od 1–21. dana, a potpune smeša za završni tov od 21–35, odnosno 35–42. dana ogleđa. Tokom ogleđa kontrolna grupa brojlera hranjena je smešama sa dodatim neorganskim selenom (natrijum-selenitom) u količini od 0,3 mg/kg + 20 IJ vitamina E, a ogleđne grupe, po redosledu (O-I, O-II, O-III), dobijale hranu sa dodatkom organskog selena (Sel-Plex-a) + 20 IJ vitamina E, neorganskog selena (natrijum selenita) + 100 IJ vitamina E ili organskog selena (Sel-Plex-a) + 100 IJ vitamina E.

Na kraju ogleđa pojedinačno je merena masa brojlera, brojleri su zaklani, trupovi obrađeni (pripremljeno za roštilj), ohlađeni, izmereni i rasečeni u osnovne delove. Uzeti su uzorci mesa (meso grudi i jetre) za utvrđivanje sadržaja selena. Izmerena je masa osnovnih delova (merenja su izvršena na automatskoj vagi sa tačnošću $\pm 0,05$ g). Grudi su iskoštene, a zatim su pojedinačno merena tkiva (meso, koža, kosti). Na osnovu izvršenih merenja izračunat je randman (%) iz mase brojlera pre klanja i mase obrađenog trupa, kao i u grudima odnos mesa, kostiju i kože.

Na kraju tova, 42. dana, sadržaj selena u mesu grudi brojlera kretao se od 0,34 mg/kg do 0,43 mg/kg. Koncentracija selena je kod O-III grupe bila značajno ($p < 0,01$) veća u odnosu na grupu koja je dobijala neorganski oblik selena, odnosno kontrolnu. Koncentracija selena u jetri brojlera bila je na kraju ogleđa (42. dan) od 0,50-0,63 mg/kg značajno ($p < 0,01$) viša u odnosu na kontrolnu grupu.

Prosečne mase trupova brojlera su bile od $1243,32 \pm 166,23$ g (K) do $1470,37 \pm 120,00$ g (O-III). Sve ogleđne grupe su imale značajno veću masu trupa u odnosu na kontrolu, pri čemu je masa trupa O-III grupe bila veoma značajno veća ($p < 0,01$). Najniži prinos mesa utvrđen je kod kontrolne grupe (65,31 posto), a najviši kod treće ogleđne grupe (69,24 posto). Kontrolna grupa je imala statistički veoma značajno ($p < 0,01$) niži prinos mesa u odnosu na O-III grupu koja je hranom dobijala i organski oblik selena sa 100 IJ vitamina E.

Procentualna zastupljenost (72,85 posto) mišićnog tkiva u grudima bila je kod O-III grupe značajno veća ($p < 0,05$) u odnosu na zastupljenost (69,53 posto) mišićnog tkiva u grudima kontrolne grupe brojlera. Zastupljenost kože grudi je bila

značajno veća ($p < 0,01$) kod kontrolne grupe (9,64 posto) u odnosu na ogledne grupe (6,86 posto; 7,34 posto; 7,35 posto).

Dodavanje organskog oblika selena i povećane količine vitamina E u smešama hrane za brojlere pruža mogućnosti postizanja boljeg kvaliteta mesa kao i boljih parametara prinosa mesa brojlera.

Ključne reči: selen, vitamin E, brojler, proizvodni rezultati

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INFLUENCE OF SELENIUM AND VITAMIN E ON BROILER MEAT QUALITY AND CARCASS RATIO

Markovic Radmila, Baltic M. Z., Petrujkić B., Sefer D.

In this paper effects of broiler meal supplementation with organic and inorganic forms of selenium and different amounts of vitamin E on broiler meat quality and meat yield were monitored. The trial was performed on a total number of 240 animals divided into 4 groups. It lasted 42 days and was divided into 3 phases. First phase lasted 21, second 14 and the third seven days.

Broilers were fed with three types of complete feed mixtures of standard raw and chemical composition for broiler feeding that met or exceeded the nutrient recommendations for growing broilers (NRC, 1998). Complete starter feed mixture was used from 1st to 21st day, mixture for growth from 21st until 35th day and mixture for final growth from 35th until 42nd day, respectively. During the trial to the control group of broilers (C) was given a feed with supplemented inorganic selenium (sodium selenite) 0.3 ppm plus 20 IU of vitamin E, experimental group (E-I) was feed supplemented with organic selenium (Sel-Plex) 0.3 ppm plus 20 IU of vitamin E, experimental group (E-II) was fed a meal supplemented with 0.3 ppm inorganic selenium (sodium selenite) plus 100 IU vitamin E.

Body mass of each broiler was checked at the end of the trial, broilers were slaughtered, carcasses processed (barbecue ready), chilled, measured and cut into basic parts. At that time samples of breast meat and liver were collected for determination of selenium content. Breast meat was de-boned and separate measurements of each tissue was done (meat, skin and bones). Randmane and ratios of meat: bones were calculated on the basis of body mass prior to slaughter and mass of processed carcass.

At the end of the experiment (42nd day) the selenium content in breast meat was from 0.34 mg/kg to 0.43 mg/kg. Concentration of selenium in E-III group was significantly higher ($p < 0.01$) compared to the group which was fed inorganic selenium and the control group. Concentration of selenium in the broiler liver ranged on day 42 of the trial from 0.50 to 0.63 mg/kg which was significantly different compared between groups ($p < 0.01$).

Average mass of carcasses was lowest in group C 1243.32 ± 166.23 g and highest in group E-III 1470.37 ± 120.00 g. All experimental groups have had a significantly higher mass of carcass compared to control, mass of E-III group was significantly higher ($p < 0.01$).

The lowest meat yield was determined in the control group (65.31%), and highest in E-III group (69.24%). The control group had a significantly lower meat yield ($p < 0.01$) compared to E-III group which was fed organic selenium (0.3 ppm) plus 100 IU vitamin E.

Percentage of muscle tissue in E-III group was 72.85 % which is significantly higher ($p < 0.05$) compared to the control group of broilers (69.53%). Percentage of breast skin was significantly higher ($p < 0.01$) in the control (9.64%) compared to experimental groups (E-I 6.86 %; E-II 7.34%; E-III 7.35%).

Addition of organic selenium and high amounts of vitamin E in broiler feed mixtures gives the possibility to achieve better quality meat and higher meat yield.

Key words: Selenium, Vitamin E, Broiler, Productive results

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UTICAJ VRSTE MASTI U HRANI ZA PILIĆE NA VREDNOST PEROKSIDNOG BROJA I SADRŽAJ SLOBODNIH MASNIH KISELINA U PILEĆEM MESU

Cvrk Ramzija, Bašić M., Sadadinović Jasminka, Božić A.,
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Modifikacije u proizvodnji pilećeg mesa, u pogledu uticaja na sastav masnih kiselina radi obogaćivanja pilećeg mesa polinezasićenim masnim kiselinama (PUFA), poželjne su zbog nutritivnog uticaja na zdravlje ljudi, ali značajno povećavaju podložnost pilećeg mesa procesu oksidacije. Oksidacija lipida je glavni uzrok smanjenja kvaliteta mesa i značajan faktor održivosti mesa i proizvoda od mesa.

Cilj ovog istraživanja je određivanje vrijednosti peroksidnih brojeva i sadržaja slobodnih masnih kiselina u uzorcima pilećeg mesa, u zavisnosti od vrste masti koja je korišćena za omašćivanje hrane za piliće.

U radu su ispitivani uzorci dvije grupe od po 100 pilića tovnog hibrida Cobb 500. Obe grupe su držane u istom objektu i hranjene koncentratnim smesama istog sirovinskog sastava i istih nutritivnih svojstava, sa jedinom razlikom u kvalitetu i sastavu masnoće (svinjska mast i suncokretovo ulje) koja se koristila pri proizvodnji hrane za tov pilića, u količini od 5,0 posto. Pilići su bili u standardanom tovu 42 dana i takozvanom produženom tovu 56 dana. Nakon uzorkovanja i klaničke obrade pilića, pileće meso je skladišteno u hladnjači na temperaturi od -18°C , u periodu od 60 dana. Oksidativni status mesa procijenjivan je u primarnoj fazi oksidacije određivanjem vrijednosti peroksidnog broja i sadržaja slobodnih masnih kiselina. Ispitivani su uzorci bijelog i crvenog pilećeg mesa.

Rezultati ispitivanja su pokazali značajno veće vrijednosti peroksidnog broja kod crvenog mesa u odnosu na bijelo meso, što pokazuje da je crveno meso (batak sa karabatakom podložnije procesu oksidacije od bijelog pilećeg mesa), grudi ($P < 0,05$). Takođe, dobijene su veće vrijednosti sadržaja slobodnih masnih kiselina u crvenom mesu u odnosu na bijelo meso. Ove razlike su značajnije kod upotrebe biljne masti, tj. suncokretovog ulja.

Ključne riječi: oksidacija masti, pileće meso, peroksidni broj, slobodne masne kiseline

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EFFECT OF FAT SOURCE IN BROILER DIET ON PEROXIDE VALUE AND FREE FATTY ACIDS CONTENT IN CHICKEN MEAT

Cvrk Ramzija, Basic M., Sadadinovic Jasminka, Bozic A.,
Corbo Selma, Pucarevic Mira

Modification in chicken meat production according to the influence on fatty acids content, for the purpose of polyunsaturated fatty acid enriched meat (PUFA) is nutritionally desirable, but it increases susceptibility of meat oxidation. Lipid oxidation is a major cause of chicken meat quality deterioration. Lipid oxidation is an important determinant of shelf life of meat and meat products.

The aim of this research was to determine peroxides values and free fatty acids content in chicken meat samples depending on fat source in broiler diet.

The research was carried out on chickens of Cobb 500 provenience, which were divided into two groups of 100 broilers each. Chickens reared in equal conditions, and fed diets with identical nutritional content, with different in quality and source of used fat (lard and sunflower oil) containing 5% of fat, and fattening until 42 days (standard fattening) and 56 days (prolonged fattening). After sampling, broilers were slaughtered and their carcasses stored at - 18°C during 60 days period.

The oxidative status of meat can be assessed on the basis of primary oxidation, by measurements of peroxide value and free fatty acids content. In this study we investigated samples of chicken breast and chicken thigh muscles.

The results showed a significantly higher peroxide value of chicken thigh muscle then breast muscle ($P < 0.05$). Moreover, we obtained higher values of free fatty acids in thigh muscles then breast muscles. These differences were more significant when vegetable oil - sunflower oil were used.

Key words: fats oxidation, chicken meat, peroxide value, free fatty acids.

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KVALITET ODREZAKA KAO REZULTAT TRIMOVANJA SVINJSKIH POLUTKI

Tatulov Yu., Sus Irina, Mittelshtein Tatiana

Na osnovu naučnih istraživanja određeni su principi trimovanja svinjskog mesa i rasecanja. Razvijen je plan rasecanja svinjskih polutki. Proučene su biološka vrednost, senzorna i funkcionalna svojstva mesa sa različitih delova svinjske polutke.

Dobijeni podaci omogućiće organizovanje efikasnog, namenski orijentisanog iskorošćenja svinjske polutke što bi trebalo da se odrayi na cenu, što je vrlo vžno sa ekonomskog i socijalnog stanovišta.

Ključne reči: trimovanje svinjskog mesa, senzorna i funkcionalna svojstva, trupovi, šema rasecanja

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QUALITY OF CUTS PRODUCED AS A RESULT OF DRESSING OF PORK CARCASSES

Tatulov Yu., Sus Irina, Mittelshtein Tatiana

Based on the results of scientific investigations the principles of dressing of pork and the borders of separation of cuts have been determined; pork sides cutting pattern into cuts has been developed; food and biological value, sensory and functional properties of meat from different parts of pork carcasses were studied.

The obtained data will allow organize efficient, purpose-oriented use of pork carcasses and carry out differentiated price policy that is of great economic and social importance.

Key words: dressing of pork, sensory and functional properties, carcasses, borders of separation

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ODREĐIVANJE SADRŽAJA VITAMINA B₆ U MESU ŽIVINE NAKON PRIMENE ZEOLITA U ISHRANI

Basić Zorica, Kilibarda Vesna, Resanović Radmila, Maksimović M.

Zeoliti su kristalni, hidratizirani aluminosilikati alkalnih i zemnoalkalnih katjona, koji poseduju „beskonačnu” trodimenzionalnu kristalnu strukturu. Pogodni su adsorberi i karakterišu se sposobnošću da gube i primaju vodu i izmenjuju neke od svojih konstitucionih katjona. Zeoliti nalaze sve širu primenu u veterinarskoj i humanoj medicini. Kao dijetetski suplementi nalaze se na tržištu Evrope od 1998. godine. Preparati na bazi zeolita koriste se radi adsorpcije aflatoksina i sprečavanja aflatoksikoze, kao i pojavljivanja aflatoksina u jajima i mesu živine, goveda, ovaca i svinja. S druge strane, obavljena su ispitivanja uticaja zeolita samo na sadržaj vitamina A i E u krvi i u tkivu goveda i ovaca.

Vitamini se nalaze u namirnicama u malim količinama, ali njihov značaj je veliki. Naš cilj je bio da ustanovimo da li zeolit ima uticaja na resorpciju, odnosno koncentraciju vitamina B₆ u mesu nakon njegove primene u ishrani 30 brojlera. U toku šest nedelja kontrolna grupa brojlera hranjena je osnovnom hranom, a brojleri eksperimentalne grupe hranom sa 0,2 posto dodatog zeolita. Sadržaj vitamina B₆ određen je primenom reverzno-fazne HPLC (High performance liquid chromatography) metode tipa jonskog para sa fluorescentnim detektorom, nakon kisele i enzimske hidrolize uzoraka mesa. Rezultati pokazuju da, nakon primene 0,2 posto zeolita u ishrani brojlera nema statistički značajne razlike u sadržaju vitamina B₆ u mesu u odnosu na meso brojletra kontrolne grupe.

Ključne reči: zeolit, vitamin B₆ grupe, HPLC

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THE DETERMINATION ON VITAMINE B₆ CONTENT IN CHICKEN MEAT AFTER IN-FEED INCLUSION OF ZEOLITE

Basic Zorica, Kilibarda Vesna, Resanovic Radmila, Maksimovic M.

Zeolites are crystal, hydrated aluminosilicates of alkali-metal and alkaline-earth-metal cations which possess an “infinite” three-dimensional crystal structure. Zeolites are suitable absorbers, and are characterized by an ability of losing and accepting water and interchanging some of their own constitutional cations. Zeolites are more and more used in veterinary and human medicine. As a dietary supplement, they have been present on the European market since 1998. Zeolite-based products

are used to adsorb aflatoxines and prevent aflatoxicosis and the appearance of aflatoxins in eggs, poultry meat, beef, mutton and pork. On the other hand, examinations the influence of zeolite of vitamin A and vitamin E content in the blood and tissue of beef and sheep have been carried out.

Vitamins are found in small amounts in natural foodstuffs, but their significance is great. Our aim was to determine if zeolite has any influence on resorption, i.e. concentration of B6 vitamin in meat after feed supplementation. Thirty chickens were assigned to two groups. During six weeks, the control group was fed with a basic diet, while 0.2% of zeolite was added to the experimental group's diet. Vitamin B6 content was determined by reverse-phase HPLC method of ion pair type with fluorescence detector, after acid and enzymatic hydrolysis has been applied to meat samples. Results show that, after adding 0.2% of zeolite to chicken diet, there was no statistically significant difference in vitamin B6 contents, compared with the control group.

Key words: zeolite, vitamin B6, HPLC

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HOLESTEROL OKSIDI U PILEĆOJ JETRENOJ PAŠTETI SA DODATKOM KOENZIMA Q₁₀ I ASKORBINSKE KISELINE

Polak T., Žlender B., Gašperlin Lea

Glavni cilj istraživanja je bio da se utvrdi uticaj dodatka koenzima Q₁₀ i askorbinske kiseline, pojedinačno ili zajedno, na sprečavanje oksidativnog kvara u pileći jetreni pašteti, koji se može odraziti u smanjenom formiranju produkata oksidacije holesterola i očuvanju senzorskog kvaliteta paštete. Formirane su bile tri grupe pilećih jetrenih pašteta: kontrolna grupa (C), bez dodatka antioksidanata; grupa (Q₁₀), sa dodatkom koenzima Q₁₀ (0,2 g/kg) i grupa (Q₁₀AA), sa dodatkom iste količine Q₁₀ i askorbinske kiseline (2 g/kg). Svi proizvodi su bili pasterizovani (82 °C). Ustanovljeno je četiri produkta oksidacije holesterola, 7 α -, 7 β -, 20- i 25-HC. Funkcija koenzima Q₁₀ kao odstranjivača radikala holesterol oksida u ovoj studiji nije bila statistički potvrđena (C = 3,26 mg/kg vs. Q₁₀ = 2,86 mg/kg). Najefikasnija je bila kombinacija Q₁₀AA, gdje je formiranje produkata oksidacije holesterola ispod granice detekcije. Dodatak koenzima Q₁₀ je uticao na sniženje sadržaja holesterola u pašteti nakon pasterizacije.

Ključne reči: pileća jetrena pašteta, koenzim Q₁₀, askorbinska kiselina, holesterol oksidi

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CHOLESTEROL OXIDES IN CHICKEN LIVER PÂTÉ SUPPLEMENTED WITH COENZYME Q₁₀ AND ASCORBIC ACID

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The main purpose of this study was to determine whether supplemental addition of coenzyme Q₁₀ and ascorbic acid, each alone or together, could prevent oxidative damages in chicken liver pâté, as reflected in reduced formation of cholesterol oxidation products (COP) and in well-preserved sensorial quality. Three separate groups of chicken liver pâtés were formed: control (C) without added antioxidants, group (Q₁₀) supplemented with coenzyme Q₁₀ (0.2 g/kg) and group (Q₁₀AA) with added Q₁₀ (0.2 g/kg) and ascorbic acid (2 g/kg). All products were pasteurized (82 °C). Four COPs, including 7 α -, 7 β -, 20- and 25-HC, were found. COP radical scavengers' function of coenzyme Q₁₀ alone was not statistically conformed (C = 3.26 mg/kg vs. Q₁₀ = 2.86 mg/kg). Most efficient was the combination Q₁₀AA where formation of COPs was below the limit of detection. Supplementation of coenzyme Q₁₀ affected cholesterol level in pâté after pasteurization.

Key words: meat product, pâté, coenzyme Q₁₀, ascorbic acid, cholesterol oxides

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**POBOLJŠANJE KONZISTENCIJE I STABILNOSTI FINO
USITNJENIH BARENH KOBASICA OD SVINJSKOG MESA
DODATKOM EMULGATORA I STABILIZATORA**

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Rađenović Nikolina

Senzorna svojstva prehrambenih proizvoda utiču na celokupni kvalitet i prihvatljivost proizvoda od strane potrošača. Cilj ovog rada bio je da se ispita uticaj odabranih aditiva sa funkcionalnim svojstvom emulgatora i stabilizatora, na konzistenciju, teksturu i stabilnost fino usitnjenih barenih kobasica od svinjskog mesa u tipu pariske kobasice u toku skladištenja. Uzorci su proizvedeni u industrijskim uslovima, prema specifikaciji proizvođača, i to kontrolni uzorak (f) i eksperimentalni uzorci sa dodatkom odabranih mešavina aditiva i to za svaki uzorak zasebno kako sledi: (a) 0,3 posto mešavine stabilizatora (Carrageenan E407; Locust bean gum E410); (b) 0,3 posto mešavine stabilizatora (Carob germ flour; Cellulose gum E466); (c) 0,3 posto mešavine emulgatora i stabilizatora (sodium alginate E401; Calcium sulphate E516; Sodium stearate E470a; Tetrasodium diphosphate E450). Senzorna ocena karakteristika kvaliteta i prihvatljivosti proizvedenih eksperimentalnih kobasica sprovedena je 7 dana i 35 dana nakon proizvodnje. Rezultati sprovedenih ispitivanja pokazali su da dodavanje 0,3 posto mešavine stabilizatora Carob germ flour and Cellulose gum u uobičajene sastojke korišćene za izradu kobasica, značajno utiče na poboljšanje konzistencije, teksture, stabilnosti i ukupne prihvatljivosti proizvoda posle 7 dana i posle 35 dana od proizvodnje, u poređenju sa kontrolnim uzorcima fino usitnjenih barenih kobasica od svinjskog mesa u tipu pariske kobasice proizvedenih prema specifikaciji proizvođača.

Ključne riječi: kobasice od svinjskog mesa, aditivi, kvalitet, senzorna analiza

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**CONSISTENCY AND STABILITY IMPROVEMENT OF FINELY
COMMUNUTED PORK SAUSAGE BY THE ADDITION OF
EMULSIFIERS AND STABILISERS**

Grujić Slavica, Grujić R., Savanović Danica, Odžaković Božana,
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Sensory characteristics of a food product have an influence on overall quality and consumers' product acceptance. The aim of the study was to investigate the influence of selected additives functioning as emulsifiers and stabiliser on consist-

ency, texture and stability of finely comminuted boiled pork sausages “parizer” type during storage. Samples were produced in industrial conditions according to the producer’s specification: control sample (f) and experimental samples with selected additive blends were added separately to each: (a) 0.3% blend of stabilizers (Carrageenan E407; Locust bean gum E410); (b) 0.3% blend of stabilizers (Carob germ flour; Cellulose gum E466); (c) 0.3% blend of emulsifier and stabilizers (sodium alginate E401; Calcium sulphate E516; Sodium stearate E470a; Tetrasodium diphosphate E450). Sensory evaluation of quality characteristics and acceptance produced experimental sausages were realized 7 and 35 days after production. The results of the study shown that addition of 0.3% blend of stabilizers Carob germ flour and Cellulose gum to the usual sausage ingredients, significantly improves consistency, texture, stability and overall product acceptance 7 days and 35 days after production, compared to the control finely comminuted pork sausages “parizer” type produced according to the producer’s specification.

Key words: pork sausages, additives, quality, sensory analysis

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TEHNOLOŠKI I NUTRITIVNI KVALITET BARENIH KOBASICA IZRAĐENIH SA DODATKOM OMEGA-3 MASNIH KISELINA

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Savatić Snežana

U ovom radu analiziran je uticaj dodatka omega-3 masnih kiselina na kvalitet fino usitnjenih barenih kobasica. Takođe, ispitan je i uticaj prehrambenih vlakana, kao nosača omega-3 masnih kiselina, na senzorni i nutritivni kvalitet fino usitnjenih barenih kobasica.

Tržišno-potrošački kvalitet ispitan je po parametrima i kriterijumima Pravilnika o kvalitetu i drugim zahtevima za proizvode od mesa („Sl. list” SCG, br. 33/2004) i Pravilnika o deklarisanju i označavanju upakovanih namirnica („Sl. list” SCG, br. 4/2004).

Analizom dobijenih rezultata ispitivanja pokazatelja tehnološkog, nutritivnog, kao i senzornog kvaliteta ispitanih proizvoda zaključeno je da ispitani proizvodi zadovoljavaju osnovne parametre kvaliteta po važećem Pravilniku (2004) i da dodatak omega-3 masnih kiselina i prehrambenih vlakana u nadev fino usitnjenih barenih kobasica pozitivno utiče na nutritivni i senzorni kvalitet proizvoda, te da se izrađena „Fitnes” kobasica sa omega-3 masnim kiselinama i prehrambenim vlaknima, može da okarakteriše kao proizvod smanjene energetske vrednosti, proizvod koji je izvor vlakana i koji sadrži omega-3 masne kiseline.

Ključne reči: barene kobasice, tehnološki i nutritivni kvalitet, omega-3 masne kiseline

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TECHNOLOGICAL AND NUTRITIONAL QUALITY OF COOKED SAUSAGES PRODUCED WITH ADDITION OF OMEGA 3-FATTY ACIDS

Petrovic Ljiljana, Sojic B., Dzinic Natalija, Tomovic V., Salitrezic P.,
Savatic Snezana

The influence of addition of omega –3 fatty acids on quality of finely cominuted cooked sausages was analysed in this paper. The influence of dietetic fibers as vehicles of omega-3 fatty acids on sensory and nutritional quality of finely comminuted cooked sausages was analysed too.

Quality for market/consumers was assessed by the criteria and parameters according to the Regulations on quality and other demands for meat products (Sl. list SCG, No. 33/2004) and Regulations for declaration and marking of packed food (Sl. list SCG, No. 4/2004).

It was concluded, after analysing obtained result indices for technological, nutritional, and sensory quality of tested products that the products fulfill basic parameters of quality according to the active Regulations (2004), and that addition of omega-3 fatty acids and dietetic fibers in stuffing of fine comminuted cooked sausages had positive influence on nutritional and sensory quality of the product, and that the produced "Fitness sausage" with omega-3 fatty acids and dietetic fibers may be classified in the group of products with lower energy value, which is source of dietetic fibers which contains omega-3 fatty acids.

Key words: cooked sausages, technological and nutritional quality, omega-3 fatty acids

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UTICAJ DODATKA FUNKCIONALNE SMEŠE ALGINATA/GLICERIDA NA KVALITET FINO USITNJENIH BARENH KOBASICA

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Markuš K.

U današnje vreme, bez primene aditiva prerada mesa bi izgubila industrijsko obeležje, a kao već tradicionalni dodaci u preradi mesa mogu da se smatraju funkcionalni dodaci na bazi biljnih proteina, odnosno sojinih proteina.

Proteini soje se uspešno primenjuju u industriji mesa, jer je njihova funkcionalnost prilagođena zahtevima tehnoloških procesa u preradi (emulgovanje, vezivanje vode). Međutim, utvrđeno je da soja, kod jednog dela ljudske populacije izaziva alergijske reakcije, te se sve više nameće potreba za drugim funkcionalnim dodacima.

Hidrokoloidi sa svojim karakteristikama da vezuju velike količine vode i modifikuju teksturu proizvoda imaju sve veći značaj u industriji mesa. Danas se na tržištu nalaze hidrokoloidi poput karagenana, a u novije vreme i alginata. Pošto proteini soje imaju dobra i emulgujuća svojstva, kao zamena može da se koristi funkcionalna smeša koja sadrži i neki emulgator. U tom smislu alginati u funkcionalnoj smeši sa gliceridima se sve više primenjuju u svetu u izradi nekih grupa proizvoda od mesa, gde se u zavisnosti od njihovog sastava očekuju željene karakteristike proizvoda (vezivanje masti i vode, tekstura, mazivost), a kod nas o tome nema podataka.

U ovom radu ispitan je uticaj dodatka izolata soje, kao standardni proizvod (K), i dodatka funkcionalne smeše na bazi alginata i glicerida u eksperimentalnim grupama (O_1 i O_2) gotovih proizvoda u tipu fino usitnjenih barenih kobasica na: senzorni, tehnološki i nutritivni kvalitet proizvoda. Na osnovu dobijenih rezultata ispitivanja zaključeno je da je senzorni kvalitet ogledne grupe O_2 (sa dodatkom funkcionalne smeše na bazi alginata i glicerida kao proizvod male energetske vrednosti) najbolje ocenjen, a slede uzorci kontrolne i ogledne grupe O_1 . Takođe je zaključeno da je najmanja nežnost (13,23 N) i najveća čvrstoća (5,97 N) uzoraka viršle ogledne grupe O_2 , odnosno najmanje čvrstoće (5,03N) su uzorci viršle ogledne grupe O_1 .

Ključne reči: alginati, gliceridi, barene kobasice, kvalitet

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EFFECT OF FUNCTIONAL MIXTURE ALGINATE/GLYCERIDE ADDITION ON QUALITY OF COOKED SAUSAGES

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Tomovic V., Markus K.,

Without additives nowadays meat production would lose the industrial status. Traditional functional ingredients in meat production are plant proteins, i.e. soy proteins. Soy proteins are effectively used in meat production because of their ability to bind water and form emulsions. However, it has been verified that soy can cause an allergic reaction in a specific group of people. Hence there is a need for new functional ingredients.

Hydrocolloids due to their ability to bind water, form gels and modify the texture of a product. Most popular on the market is carrageen, as well as alginates. Since soy proteins have both good water binding capacity and emulsion forming ability functional mixtures for soy replacement, beside hydrocolloids, must also contain emulsifiers. Due to that alginates can be combined with glycerines in functional mixtures for production of meat products with defined characteristics of water and fat binding properties, as well as defined texture characteristics. There are no data about the usage of this kind of functional mixture in domestic scientific literature.

In this paper the addition of soy isolates (as a control sample - K), and addition of functional mixture on the basis of alginates and glycerines (experimental groups O₁ and O₂) in the production of cooked sausages were investigated. Sensory, technology and nutritive qualities were determined. According to the results it can be concluded that marks for sensory evaluation were highest for the experimental group O₂ (experimental group made with addition of functional mixture, and with lower energy value). Also, according to the results of texture measurements it can be concluded that the lowest tenderness (13.23N), and highest hardness (5.97N) were for sample O₂, and, opposite the lowest hardness (5.03N) was for sample O₁.

Key words: alginates, glycerides, boiled sausages, quality

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NOVI TEHNOLOŠKI PROCES KONZERVISANJA PROIZVODA OD OVČIJEG MESA UZ BILJNE DODATKE PAKOVANOG U AMBALAŽI OD POLIMERA

Krylova Valentina, Mandjijeva Natalia

Razvijene su recepture konzervisanih namirnica mesa uz dodatak povrća, koje se sastoje od ovčetine uz dodatak leguminoza, balansirane prema proteinima i koje imaju visoku hranljivu vrednost. Korišćen je višeslojni polimer kao ambalažni materijal koji ima karakteristike visoke barijere.

Radi određivanja režima procesa sterilizacije, proučavan je proces zagrevanja uz korišćenje polimera, različitih sastava slojeva, kao i upotrebe vertikalnih i horizontalnih autoklava.

Razvijeni su režimi sterilizacije uz uštedu energije koji su obezbeđivali održivost proizvoda do 12 meseci. Ispitivana je zdravstvena ispravnost i kvalitet namirnice posle proizvodnje i skladištenja.

Ključne reči: konzervisana hrana, ambalažni materijali od polimera, sterilizacija, bezbednost, hranljiva vrednost hrane, održivost hrane

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NEW PROCESS TECHNOLOGY OF MEAT-PLANT CANNED PRODUCTS WITH MUTTON IN POLYMER CONSUMER PACK

Krylova Valentina, Mandjijeva Natalia

Formulations of meat-plant canned foods, consisting of mutton and leguminous plant ingredients, balanced on protein and featuring high food value have been developed. A selection among consumer packs from multi-layer polymer materials with high barrier properties has been done.

To determine the regimes of sterilization a process of heating of recipe mixes has been studied, using the polymer materials of consumer packs with different composition of layers, and with vertical and horizontal position of the products in the autoclave.

Energy-saving regimes of sterilization of canned foods have been developed, ensuring shelf life of products up to 12 months. Safety and food value of products after their production and storage have been evaluated.

Key words: Canned foods, consumer pack from polymer materials, sterilization, safety, food value, shelf life of foods

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INFLUENCE OF REGIMES ON STERILIZATION ON MICROSTRUCTURE, STRUCTURAL AND MECHANICAL PROPERTIES OF MUSCLE TISSUE AND DIGESTIBILITY OF CANNED BEEF, MANUFACTURED IN POLYMER CONSUMER PACKAGE

Krylova Valentina, Khvylya S., Eder A.

Energy- saving regimes of sterilization of canned products "Stewed beef" in modern consumer pack from multi-layer polymer materials with high barrier properties, have been developed.

Special features of microstructure of muscular tissue, dynamics of structural-mechanical properties of beef and digestibility of products on the whole, depending on regimes of sterilization, have been studied.

Key words: sterilization, sterilizing effect, digestibility, microstructure, structural-mechanical properties, muscle tissue

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UTICAJ RAZLIČITI REŽIMA STERILIZACIJE NA MIKROSTRUKTURU, STRUKTURNE I MEHANIČKE KARAKTERISTIKE MIŠIĆNOG TKIVA I NA SVARLJIVOST KONZERVIRANE GOVEDINA PAKOVANE U POLIMERSKU AMBALAŽU

Krylova Valentina, Khvylya S., Eder A.

Za konzervisanje proizvoda "Stewed beef", pakovanih u savremenu ambalažu od višeslojnih polimera sa dobrim karakteristikama nepropustljivosti razvijeni su režimi sterilizacije uz uštedu energije.

Proučene su specijalne karakteristike mikrostrukture mišićnog tkiva, dinamika strukturno-mehaničkih karakteristika govedine kao i ukupna svarljivost proizvoda, u zavisnosti od režima sterilizacije.

Ključne reči: sterilizacija, efekat sterilizacije, svarljivost, mikrostruktura, strukturno-mehaničke karakteristike, mišićno tkivo

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SVOJSTVA AMBALAŽNIH MATERIJALA ZA PAKOVANJE FERMENTISANIH KOBASICA POD VAKUUMOM I U MODIFIKOVANOJ ATMOSFERI

Lazić Vera, Krkić Nevena, Petrović Ljiljana, Tasić Tatjana, Ikonić P.,
Savatić Snežana, Šojić B.

Ambalažni materijali i ambalaža su neophodan pratilac prehrambenih proizvoda. Meso i proizvodi od mesa su veoma osetljivi na delovanje spoljašnjih faktora kao što su svetlost, kiseonik, vlaga, mikroorganizmi. Zaštitu od ovih uticaja, kao i očuvanje nutritivnih svojstava za deklarisan rok upotrebe, pruža im pravilno odabrana ambalaža i primenjeni uslovi pakovanja.

Da bi se produžila održivost i obezbedio optimalni kvalitet fermentisane kobasice se nakon zrenja, mogu da pakuju u barijerne folije pod vakuumom ili u MAP-u.

Fermentisane kobasice se najčešće pakuju u polimne ambalažne materijale. Ovi ambalažni materijali mogu da budu barijerni ili visokobarijerni, sa mogućnošću termoskupljanja, različitog sastava i osobina, proizvedeni različitim tehnologijama.

Pakovanje se može da se izvde pod atmosferskim uslovima, vakuumu ili modifikovanoj atmosferi (MAP).

Cilj ovog rada je prikaz mogućnosti pakovanja fermentisanih kobasica, kao i rezultati ispitivanja fizičko-mehaničkih i barijernih svojstava različitih polimernih ambalažnih materijala, koje koristi naša industrija, ili se mogu koristiti za ove namene.

Dobijeni rezultati ukazuju da se prema karakteristikama kobasica, željenoj održivosti, uslovima pakovanja, mogu da odaberu ambalažni materijali, koji će optimalno očuvati fermentisane kobasice.

Ključne reči: ambalažni materijali, barijerna svojstva, pakovanje, modifikovana atmosfera, fermentisane kobasice

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CHARACTERISTICS OF PACKAGING MATERIALS FOR PACKAGING OF FERMENTED SAUSAGES IN VACUUM AND IN MODIFIED ATMOSPHERE

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Packaging material is necessary associate with food products. Meat and meat products are very sensitive to the influence of external factors as it is light, oxygen, moisture, microorganisms. Protection from these influences and preservation of nutritive characteristics for declared expiry date is assured by carefully chosen packaging material and application of packaging condition.

For the prolongation of shelflife and assurance of optimal quality, fermented sausage can be packed, after ripening in barrier foils in vacuum or in MAP.

Fermented sausages are usually packed in polymer packaging materials. These packaging materials can be with barriers and with the higher barriers with the possibilities for thermal shrinking, of various composition, properties and produced by the different technologies.

Packaging can be carried out in atmospheric condition, vacuum or in the modified atmosphere (MAP).

The aim of this paper is presentation of packaging possibilities of fermented sausages, and results of studying of physico-mechanical and barrier properties of different polymer packaging materials which are used in our meat industry or can be used for these purpose.

The obtained results indicate that according to the characteristics of the sausages, desired shelflife, packaging conditions, packaging materials which can optimally preserve fermented sausages can be chosen .

Key words: packaging materials, barrier properties, packaging, modified atmosphere, fermented sausages

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UPOREDNO ISPITIVANJE ODRŽIVOSTI OHLAĐENOG I RASEČENOG MESA PAKOVANOG U VAKUUM TERMOSKUPLJAJUĆE KESE OD BIAKSIJALNO ORIJENTISANOG BARIJERNOG FILMA SA 7 I 9 SLOJEVA

Petrović Z., Nastasijević, I., Dragica Karan, Velebit, B.

Vakuum pakovanje svežeg mesa je dokazana tehnologija pakovanja i, kao takva, ona je veoma dobro usvojena od strane proizvođača svežeg mesa, pogona za pakovanje, veletrgovaca, korisnika usluga, takozvanih „servisa za hranu“, supermarketa i u ograničenom obimu u kasapnicama. Prilikom planiranja ispitivanja postojala je potreba za produženu održivost proizvoda na tržištu, te je, stoga, bilo potrebno koristiti materijal sa veoma dobrim barijernim svojstvima za kiseonik. Izbor je bio novi biaksijalno orijentisani višeslojni film, debljine 45 mikrona, komponovan od poliamidnih i poliolefinskih slojeva koji su dali čvrstinu filmu uključujući i jedinstveni EVOH sloj u kompoziciji filma, koji dodatno poboljšava barijernost za kiseonik. Termoskupljajuće svojstvo filma postignuto je biaksijalnom orijentacijom, čime je obezbeđena izvanredna adhezija filma na površinu konfekcioniranog mesa i fizičko sprečavanje migracije mesnog soka, a time i produženje održivosti.

Vakuum pakovanje utiče na poboljšanje stabilnosti mesa tokom produženog perioda skladištenja pri temperaturama između 0–2° C sprečavanjem užeglosti masnog tkiva i eliminisanjem nastanka kvara u aerobnim uslovima, isključivanjem kiseonika sa površine mesa i iz samog pakovanja.

Cilj ovog ispitivanja bio je da se napravi poređenje održivosti junećeg i svinjskog ohlađenog mesa (otkošteni vrat), koja su bila zapakovana u vakuum-termoskupljajuće kese napravljene od kombinovanog 7-slojnog i 9-slojnog biaksijalno orijentisanog polimernog filma. Upakovano meso čuvano je pri temperaturi < 2° C, radi procene dinamičkih promena aerobne flore (TVC) – indikatora nivoa procesne higijene, kao i *Lactobacillus* spp. – indikatora kvara mesa. Rezultati, u radu, odnose se na period praćenja održivosti do 35. dana od dana pakovanja.

Juneće otkoštено meso. Na kraju perioda praćenja održivosti, procenjene vrednosti TVC i *Lactobacillus* spp. kretale su se u intervalu između 8,16 i 7,15 log cfu/cm² i 7,28 i 5,75 log cfu/cm², u kesama sa 7, odnosno 9 slojeva. Registrovan je veći broj mikroorganizama u uzorcima sa većom inicijalnom kontaminacijom; uočeno je da je povećanje broja mikroorganizama u 9-slojnoj kesi manjeg obima, u odnosu na 7-slojnu. Rezultati su pokazali da se može postići veoma dobar nivo održivosti korišćenjem 9-slojne termoskupljajuće kese, uzimajući u obzir mikrobiološki nivo od 7,15 log cfu/cm² (TVC) i 5,75 log cfu/cm² (*Lactobacillus* spp.) i prihvatljivi kvalitet mesa za konzumiranje.

Svinjsko otkoštено meso. Na kraju perioda praćenja održivosti, procenjene vrednosti TVC i *Lactobacillus* spp. kretale su se u intervalu između 7,74 i 7,40 log cfu/cm² i 5,78 i 4,48 log cfu/cm² u kesama sa 7, odnosno 9 slojeva. Zanimljivo je

zapažanje da nivo *Lactobacillus* spp. pokazuje nagli pad nakon 25. dana čuvanja; ovo se, posebno, odnosi na pakovanja u 9-slojnoj kesi- 0,72 log cfu/cm². U oba slučaja, rezultati su pokazali da je moguće postići veoma dobar nivo održivosti od 35 dana, pri datim uslovima čuvanja, korišćenjem oba tipa kesa, mada je očigledno da su rezultati bolji u 9-slojnoj kesi, 7,40 log cfu/cm² (TVC) i 4,48 log cfu/cm² (*Lactobacillus* spp.).

Dobijeni rezultati ukazuju, da, u dobrim proizvodnim uslovima (hladan lanac/skladištenje) i stalnom verifikacijom higijene klanja i otkoštavanja (GHP/GMP), termoskupljajuće vakuum pakovanje u 7-slojnoj i 9-slojnoj barijernoj kesi daju veoma dobre rezultate u pogledu produžene održivosti i organoleptičkih svojstava ovako upakovanog ohlađenog junećeg i svinjskog mesa.

Ključne reči: održivost, crveno meso, vakuum, termoskupljajuće kese, mikrobiološki nivo

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THE SHELF-LIFE AND MICROBIAL LEVELS OF CHILLED RED MEAT PRIMAL CUTS PACKED IN VACUUM THERMO SHRINKABLE POUCHES WITH 7 AND 9 LAYERS

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Vacuum packaging is a proven technology that is widely accepted by meat processors, wholesalers, food service customers, supermarkets and, to a limited extent, by retail butchers. To obtain extended shelf-life of packed meat, a high oxygen barrier film is desired. A biaxially oriented multilayer film composed of PA and polyolefin layers and EVOH one keeps high strength and high oxygen barrier. Thermo shrinking capability of such structures obtained by biaxially stretching provides excellent film adhesion on the meat cut surface, thus physically keeping it away from migration of meat juices and prolonging shelf life.

The vacuum packaging improves the stability of meat during prolonged chilled storage at the temperatures between 0 – 2°C, by slowing the rancidity of fat and eliminating aerobic spoilage by excluding oxygen from the meat surface and packaging itself.

This research is aimed to compare the shelf-life of beef and pork chilled primal cuts (i.e. neck) packed under the vacuum in thermo shrinkable pouches made from biaxially oriented barrier films with 7 and 9 layers. The packed meat was kept at temperatures < 2°C in order to assess the dynamics of changes in the aerobic flora (TVC) – indicators of process hygiene level, as well as, *Lactobacillus* spp. – indicators of meat spoilage. The results were monitored up to 35th day of storage.

Beef primal cuts. At the end of the shelf-life test, the estimated levels of TVC and *Lactobacillus* spp. were 8.16 and 7.15 log cfu/cm², and 7.28 and 5.75 log cfu/

cm², in the pouches with 7 and 9 layers, respectively. The higher microbial levels occurred in primal cuts with higher initial microbial contamination; increase of microbial levels was at slower rate in pouches with 9 layers. These results showed that shelf-life of at least 35 days can be obtained using thermo shrinkable pouches with 9 layers, taking into consideration that microbial levels of 7.15 log cfu/cm² (TVC) and 5.75 log cfu/cm² (*Lactobacillus* spp.) were still acceptable from the perspective of consumption / meat quality.

Pork primal cuts. At the end of the shelf-life test, the estimated levels of TVC *Lactobacillus* spp. were 7.74 and 7.40 log cfu/cm², and 5.78 and 4.48 log cfu/cm², in the pouches with 7 and 9 layers, respectively. Interestingly, the *Lactobacillus* spp. levels suddenly decreased after 25th day, in particular, in the 9 layer pouch – 0.72 log cfu/cm². In both cases, the results showed that shelf-life of at least 35 days can be obtained using both - thermo shrinkable pouches with 7 and 9 layers, although better results (lower microbial levels) were obtained using of 9 layer pouches, i.e. 7.40 log cfu/cm² (TVC) and 4.48 log cfu/cm² (*Lactobacillus* spp).

Therefore, under proper manufacturing conditions (cold chain / storage temperature) and on-going verification of the slaughter and boning process hygiene (GHP/GMP), the vacuum packaging in thermo shrinkable pouches with 9 layers, certainly has a good potential to provide extended shelf-life of beef and pork chilled primal cuts.

Key words: shelf-life, red meat, vacuum, thermo shrinkable pouches, microbial levels

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ANTIOKSIDATIVNE KARAKTERISTIKE ETERIČNOG ULJA ČETINARA

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U radu su ispitivane antioksidativne karakteristike eteričnog ulja različitih vrsta četinarara (drveno zelenilo i plodovi četinarara – jela, smrča, bor, kleka i duglazija), izolovanog procesom hidrodestilacije i hidrodestilacije uz prethodnu obradu biljne sirovine mikrotalasima. GC i HPLC analizom određene su najzastupljenije komponente kod eteričnog ulja. Radi praćenja antioksidativnog delovanja eteričnog ulja različitih vrsta četinarara određene su vrednosti peroksidnog broja ispitanih uzoraka.

Eterično ulje četinarara poseduje snažnu antioksidativnu građu i aktivnost i može da se kao takvo koristiti kao prirodni antioksidans u prehrambenoj industriji.

Ključne reči: eterično ulje, četinari, antioksidativno djelovanje, primena

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ANTIOXIDANT ACTIVITY OF ESSENTIAL OIL OF CONIFERS

Marjanovic-Balaban Zeljka, Grujic R., Miletic P.

The antioxidant activity of essential oil of various species of conifers (wooded greenery and fruits of conifers- fir, spruce, pine, juniper and Douglas fir) was investigated in this paper. The essential oil was obtained by the method of untreated and microwave- pretreated plant material and analyzed by GC and HPLC. Values of the peroxide number were determined in order to monitor antioxidant activity of essential oils of various species of conifers. The essential oil of conifers showed high antioxidant texture and activity and can itself benefit as a natural antioxidant agent in the food industry.

Key words: essential oil, needles, antioxidant activity, usage

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II TEMATSKA OBLAST
2nd THEMATIC TOPIC

UNAPREĐENJE PROIZVODNJE FERMENTISANIH
KOBASICA
IMPROVEMENT OF FERMENTED SAUSAGES
PRODUCTION

II-1

MIKROBIOLOŠKA I FIZIKO-HEMIJSKA SVOJSTVA SIROVINA ZA IZRADU TRADICIONALNO FERMENTISANIH KOBASICA

Borović Branka, Trbović Dejana, Rašeta M., Vesković-Moračanin Slavica, Saičić Snažana, Stefanović S., Janković S.

Autohtoni fermentisani proizvodi od mesa, uz ostale domaće proizvode, predstavljaju značajno obeležje kulture, navika i tradicije naše zemlje. Kod nas se u zavisnosti od podneblja na tradicionalan način proizvodi više vrsta kobasica, kao što su: sremska kobasica (Vojvodina, pretežno Srem), levačka (region Levča) i užička (obronci Zlatibora).

U sastav sremske kobasice ulazi svinjsko meso, slanina (čvrsto masno tkivo) i začini, dok se za levačku koriste podjednake količine svinjskog i govedeg mesa i čvrstog masnog tkiva. Pripremljeni nadevi za ove dve vrste kobasica pune se u svinjska tanka creva.

Užička kobasice se izrađuje od govedeg, male količine svinjskog mesa, čvrstog masnog tkiva i začina, a nadev se puni u goveđa tanka creva.

Na kvalitet tradicionalno fermentisanih kobasica utiče mnogo faktora kao što su: izbor sirovine, metaboličke aktivnosti prisutne epifitne mikroflore (proteolitičko i lipolitičko delovanje) i fizičko-hemijske promene nastale u toku procesa dimljenja, zrenja i sušenja mesa.

U radu su ispitivana mikrobiološka i fiziko-hemijska svojstva sirovina (mesa, masnog tkiva, soli, šećera i začina). Mikrobiološka ispitivanja obuhvatila su higijensku ispravnost sirovina (prisustvo enterobakterija, *L. monocytogenes*, *St. aureus*, klostridije, pseudomonas vrste, kvasci i plesni) i prisustvo epifitne mikroflore, koja svojom fermentativnom aktivnošću utiče na konačna svojstva proizvoda.

Paralelno sa ovim ispitivanjima, vršena su i fiziko-hemijska ispitivanja, koja su obuhvatila: sadržaj vode, belančevina, masti, NaCl, NaNO₂, kao i pH i aW vrednosti.

Gore navedena ispitivanja vršena su nultog dana proizvodnje kod svake vrste kobasica, koje su za potrebe Projekta izrađene u tri vremenski odvojena perioda.

Ključne reči: sirovine, tradicionalno fermentisane kobasice, mikrobiološka i fiziko-hemijska svojstva

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Napomena: Rezultati rada su deo istraživačkog Projekta: „Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnosti njihove primene u industriji mesa”, Ev. br. 20127, koji je finansiralo Ministarstvo nauke Republike Srbije.

MICROBIOLOGICAL AND PHYSICO-CHEMICAL PROPERTIES OF THE RAW MATERIAL USED FOR THE PRODUCTION OF TRADITIONALLY FERMENTED SAUSAGES

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Autochthonous fermented meat products, along with the other national products, represent a significant landmark of the culture, habits and tradition in our country. Depending on the region, in Serbia, various types of sausages are produced in the traditional way such as “Sremska” sausage (Vojvodina, mainly Srem region), “Levacka” sausage (Levca region) and “Uzicka” sausage (Zlatibor region).

Composition of “Sremska” sausage is pork, bacon and spices, while “Levacka” sausage is made from equal parts of pork and beef, and bacon. Fillings of these sausages are stuffed into the small pork intestine.

“Uzicka” sausage is made from beef, small quantities of pork, bacon and spices. The filling is stuffed into beef’s small intestine.

Many factors influence the quality of traditionally fermented sausages such as the choice of raw material, the metabolic activity of the present epiphytic microflora (proteolytic and lipolytic action) and physico-chemical changes that occur during the processes of smoking, ripening and drying of the product.

This paper investigates microbiological and physico-chemical properties of the raw material (meat, fatty tissue, salt, sugars and spices). Microbiological investigations consisted of food safety parameters (presence of enterobacteria, *L. monocytogenes*, *St. aureus*, Clostridium species, Pseudomonas species, yeasts and moulds) and the presence of epiphytic microflora which influences the product’s final properties by its metabolic activity.

Along with these investigations, physico-chemical investigations were carried out: water, protein and fat content, NaCl, NaNO₂, determination of pH and a_w values.

These investigations were carried out on the 0th day of production on each type of sausage manufactured at three time periods for the needs of the Project.

Key words: raw material, traditionally fermented sausages, microbiological and physico-chemical properties

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Note: *The results presented in this paper are part of the research project: “Technological and Protective Properties of Autochthonous Strains of Lactic Acid Bacteria Isolated from Traditionally Fermented Sausages and Possibilities of their Application in the Meat Industry” No. 20127 financed by Ministry of Science of Republic of Serbia.*

II-2

ZASTUPLJENOST VRSTA BMK I MIK TOKOM IZRADE SREMSKE KOBASICE

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Sremska kobasica je tipičan predstavnik fermentisanih kobasica na našim prostorima i tradicionalno se proizvodi u domaćinstvima ili manjim zanatskim objektima. Proizvodi se od svinjskog mesa, slanine (čvrstog masnog tkiva) i začina. Specifični začini u izradi „sremske“ kobasice su aleva paprika i beli luk.

Uzorci „sremske“ kobasice proizvedeni su u industrijskim uslovima, u A.D. „Yuhor“ Jagodina, po recepturi i tehnologiji proizvođača, a u skladu sa tradicionalnim načinom proizvodnje.

Karakteristike ove proizvodnje su bile da je pored nitritne soli, saharoze, paprike i belog luka, upotrebljen i ekstrakt crnog bibera

Nadev kobasica je punjen u svinjska tanka creva. Kobasice su dimljene po hladnom postupku i podvrgavane su procesima sušenja i zrenja, čime je dobijen proizvod visokog kvaliteta.

Proizvodnja ovog fermentisanog proizvoda rezultat je metaboličke aktivnosti prisutnih, i u mesu adaptiranih, bakterija, mikroflora začina i prirodnih omotača kao i aktivnosti enzima iz usitnjenog mesa.

Cilj rada je bio izolovanje bakterija mlečne kiseline (BMK) i bakterija familije *Micrococcaceae* (MIK), kao i njihova što potpunija identifikacija.

U različitim fazama zrenja, počev od dana izrade kobasica (0, 2, 4, 7, 14. i 21. dana), klasičnim mikrobiološkim metodama izolovano je 150 BMK i 50 MIK. Konačna identifikacija izolata je vršena biohemijskim testovima, API – 50CHL i API – Staph.

Rezultati ispitivanja su pokazali da dominantnu mikrofloru, u toku procesa izrade „sremske“ kobasice čine sledeće vrste: *Lactobacillus delbruecki ssp. delbruecki*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Lb. Curvatus*, *Ln. Mesenteroides ssp. Cremoris*, *Pediococcus pentosaceus*, *Lb. Cellobiosus*, *Lb. delbruecki ssp. Bulgarius*, *Lb. Plantarum*, *Lb. Brevis*. Iz familije *Micrococcaceae* najčešće zastupljene vrste su bile: *Staphylococcus xylosus* i *Micrococcus spp.*

Ključne reči: sremska kobasica, BMK, MIK, klasične mikrobiološke metode, API identifikacija

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Napomena: Rezultati rada su deo istraživačkog Projekta: “Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnosti njihove primene u industriji mesa”, Ev. br. 20127, koje je finansira Ministarstvo nauke Republike Srbije.

OCCURRENCE OF LAB AND MIC SPECIES DURING THE PRODUCTION OF „SREMSKA” SAUSAGE

Borovic Branka, Velebit B., Jankovic Vesna, Veskovic-Moracanin Slavica, Tomicevic Sanja, Jovanovic Suncica, Petrovic Vesna

„Sremska” sausage is a typical representative of fermented sausages in our country and it is traditionally produced in households or small manufactures. It consists of pork, bacon and spices. Specific spices used in the production of “Sremska” sausage are ground paprika and garlic.

Samples of “Sremska” sausage are produced in industrial conditions in A. D. “Yuhor”, Jagodina by the recipe and technology of the producer, in accordance with the traditional way of production.

A characteristic of the production process was that, besides nitrite salt, saccharose, paprika and garlic, black pepper extract was used.

Sausage filling was stuffed into pork small intestine. Sausages were smoked by the cold procedure followed by drying and ripening. The final product was of high quality.

The production of this, fermented product, is the result of the metabolic activity of present and adapted bacteria in meat, spices microflora and natural casings, as well as the activity of enzymes from chopped meat.

The aim of this paper was to isolate lactic acid bacteria (LAB) and bacteria from *Micrococcaceae* family (MIC), as well as their identification.

In various ripening stages from the starting point of sausages production (0th, 2nd, 4th, 7th, 14th and 21st day of production), 150 species of LAB and 50 species of MIC was isolated by classical microbiological methods. Final identification of isolates was carried out using biochemical tests API-50 CHL and API-Staph.

The investigation results showed that dominant microflora during the production of «Sremska» sausage consists of the following species: *Lactobacillus delbruecki ssp. delbruecki*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Lb. Curvatus*, *Ln. Mesenteroides ssp. Cremoris*, *Pediococcus pentosaceus*, *Lb. Cellobiosus*, *Lb. delbruecki ssp. Bulgaricus*, *Lb. Plantarum*, *Lb. Brevis*. The most frequent species from *Micrococcaceae* family were: *Staphylococcus xylosum* and *Micrococcus spp.*

Key words: „Sremska” sausage, LAB, MIC, classical microbiological methods, API identification

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Note: *The results presented in this paper are part of the research project: “Technological and Protective Properties of Autochthonous Strains of Lactic Acid Bacteria Isolated from Traditionally Fermented Sausages and Possibilities of their Application in Meat Industry” No. 20127 financed by Ministry of Science of Republic of Serbia.*

II-3

**POSTUPCI IZOLOVANJA I IDENTIFIKACIJE BMK I MIK
IZ „LEVAČKE” KOBASICE**

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“Levačka” kobasica je tradicionalno fermentisani proizvod od mesa, koji je karakterističan za područje centralne Šumadije, Levča. Izrađuje se od podjednake količina goveđeg i svinjskog mesa uz dodatak čvrstog masnog tkiva i prirodnih začina. Nadev se puni u svinjska tanka creva. Senzorna svojstva gotovog fermentisanog proizvoda rezultat su sastava nadeva, prisutne epifitne mikroflora, prirode omotača, procesa fermentacije, kao i mikroklimatskih karakteristika regiona u kome nastaje. S obzirom da do sada u literaturi nema podataka o mikrobiološkom profilu ove vrste kobasice, cilj rada je bio da se tokom proizvodnje (0, 2, 4, 7, 14. i 21. dana) izoluju i identifikuju različite vrste bakterija mlečne kiseline (BMK) i bakterija familije *Micrococcaceae* (MIK).

Iz tri fermentacije, koje su vršene u odvojenim vremenskim periodima, izdvojeno je 150 izolata BMK i 50 izolata MIK. Izolacija i identifikacija BMK i MIK vršena je klasičnim mikrobiološkim metodama, uz ispitivanje određenih morfoloških i biohemijskih osobina izolata. Konačna identifikacija vršena je upotrebom biohemijskih kitova, API-50 CHL i API-Staph.

Dominantnu BMK mikrofloru „levačke” kobasice činile su sledeće vrste: *Lactobacillus delbrueckii ssp. delbrueckii*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Lb. curvatus*, *Pediococcus pentosaceus*, *Ln. mesenteroides ssp. cremoris*, *Lb. plantarum*, *Lb. cellobiosus*, *Lb. fermentum*, *Lb. collonoides*.

Staphylococcus xylosum i *Micrococcus spp.* su bile najčešće zastupljene bakterije familije *Micrococcaceae*.

Ključne reči: levačka kobasica, BMK, MIK, klasične mikrobiološke metode, API identifikacija.

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Napomena: Rezultati rada su deo istraživačkog Projekta: “Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnosti njihove primene u industriji mesa”, Ev. br. 20127, koga je finansiralo Ministarstvo nauke Republike Srbije.

ISOLATION AND IDENTIFICATION PROCEDURES OF LAB AND MIC FROM „LEVACKA” SAUSAGE

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Obradovic D., Petrovic Vesna

„Levacka” sausage is a traditionally fermented meat product characteristic for the region of central Sumadija – Levca. It is produced from equal quantities of beef and pork with the addition of firm fatty tissue and natural spices. Filling is stuffed into pork small intestine. Sensory properties of the finished fermented product are the result of filling composition, present epiphytic microflora, nature of the casing, fermentation, as well as climatic conditions of the region in which it is produced. Since there is yet no data in the available literature on the microbiological profile of this type of sausage, the aim of this paper was to isolate and identify different species of lactic acid bacteria (LAB) and bacteria belonging to the family of *Micrococcaceae* (MIC) during the production process (on 0th, 2nd, 4th, 7th, 14th and 21st day of production).

From the three fermentations carried out in separate time periods, we isolated 150 isolates of LAB and 50 isolates of MIC. Isolation and identification of LAB and MIC was accomplished by using classical microbiological methods with investigation of certain morphological and biochemical properties of the isolates. The final identification was carried out by using biochemical kits API-50 CHL and API-Staph.

Dominant LAB microflora of “Levacka” sausage consisted of the following species: *Lactobacillus delbrueckii ssp. delbrueckii*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Lb. curvatus*, *Pediococcus pentosaceus*, *Ln. mesenteroides ssp. cremoris*, *Lb. plantarum*, *Lb. cellobiosus*, *Lb. fermentum*, *Lb. collonoides*.

Staphylococcus xylosus i *Micrococcus spp.* were the most frequent bacteria from *Micrococcaceae* family.

Key words: “Levacka” sausage, LAB, MIC, classical microbiological methods, API identification

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Note: *The results presented in this paper are the part of the research project: “Technological and Protective Properties of Autochthonous Strains of Lactic Acid Bacteria Isolated from Traditionally Fermented Sausages and Possibilities of their Application in Meat Industry” No. 20127, financed by Ministry of Science of Republic of Serbia.*

PROMENE EPIFITNE MIKROFLORE TOKOM IZRADE FERMENTISANIH KOBASICA

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Obradović D., Radulović Zorica

Bakterije mlečne kiseline (BMK) imaju esencijalnu ulogu kod najvećeg broja namirnica čija se proizvodnja, u osnovi, zasniva na mlečnoj fermentaciji. Za proizvodnju fermentisanih proizvoda od mesa, uglavnom sirovih (fermentisanih) kobasica, koristi se široki spektar vrsta ovih bakterija, bilo da su deo slučajno prisutne mikroflore ili posebno selekcionisanih i dodatih mikroorganizama – starter kultura.

Tradicionalna proizvodnja fermentisanih proizvoda od mesa zasniva se na aktivnosti epifitne („divlje“) mikroflore, pri čemu je sam proces fermentacije spontan i nekontrolisan, pa je i kvalitet takvih proizvoda na tržištu neujednačen i bez izraženih senzornih svojstava. Tokom procesa izrade, u fazama dimljenja, fermentacije, zrenja i sušenja dolazi do karakterističnih smena prisutne autohtone mikroflore. U kobasicama uskog dijametra ove promene su veoma intenzivne.

Da bi utvrdili tokove ovih promena, postavili smo zadatak da u tri tradicionalne fermentisane kobasice („sremska“, „levačka“ i „užička“) pratimo dinamiku promene epifitne mikroflote u toku procesa izrade i fermentacije navedenih kobasica.

Rezultati istraživanja su pokazali da se ukupan broj aerobnih mezofilnih bakterija (UBB), u sve tri ispitivane kobasice, povećava do sedmog, odnosno četrnaestog dana.

Broj bakterija mlečne kiseline (BMK) se tokom procesa fermentacije povećava, zavisno od vrste ispitivanih kobasica, do kraja procesa („užička“), odnosno do sedmog dana („sremska“ i „levačka“).

Broj enterokoka se intenzivno smanjuje do sedmog dana fermentacije, kod svih uzoraka ispitivanih kobasica.

Isti karakter promene utvrđen je kod broja nepatogenih stafilokoka i mikrokoka.

Ključne reči: tradicionalno fermentisane kobasice, epifitna mikroflora, UBB, BMK, MIK, enterokoke

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Napomena: Rezultati rada su deo istraživačkog Projekta: „Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnosti njihove primene u industriji mesa“, Ev. br. 20127, koje finansira Ministarstvo nauke Republike Srbije.

CHANGES OF EPIPHYTIC MICROFLORA DURING THE PRODUCTION OF FERMENTED SAUSAGES

Borovic Branka, Velebit B., Veskovic-Moracanin Slavica, Jankovic Vesna, Obradovic D., Radulovic Zorica

Lactic acid bacteria (LAB) play an essential role in foodstuffs production which is based on lactic fermentation. A wide spectrum of these species is used for the production of fermented meat products, mainly raw (fermented) sausages, whether they are a part of accidentally present microflora or specially selected and added microorganisms – starter cultures.

Traditional production of fermented meat products is based on the activity of epiphytic „wild“ microflora, where the fermentation process is spontaneous and uncontrolled. Consequently, the quality of these products on the market is uneven and without pronounced sensory properties. During the production process, in the stages of smoking, fermentation, ripening and drying, characteristic changes in the present autochthonous microflora take place and are very intensive in narrow diamener sausages.

In order to determine the flow of these changes, we have set the task to follow the dynamics of epiphytic microflora changes during the production and fermentation of three types of traditionally fermented sausages („Sremska“, „Levacka“ and „Uzicka“ sausages).

The investigation results showed that total viable count of aerobic mesophilic bacteria (TVC) is increased up to the 7th and 14th day in all three types of sausages.

The count of lactic acid bacteria (LAB) increased during the fermentation process, depending of the sausage type: in «Uzicka» sausage to the end of the process and in „Sremska“ and „Levacka“ sausages to the 7th day of investigation.

Count of *Enterococcus spp* decreases intensively up to the 7th day of fermentation in all investigated sausages samples.

The same changes have been observed in changes of count of non-pathogenous staphylococci and micrococci.

Key words: Traditionally fermented sausages, epiphytic microflora, TVC, LAB, MIC, enterococci

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Note: *The results presented in this paper are the part of the research project: "Technological and Protective Properties of Autochthonous Strains of Lactic Acid Bacteria Isolated from Traditionally Fermented Sausages and Possibilities of their Application in Meat Industry" No. 20127 financed by Ministry of Science of Republic of Serbia.*

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**DOMINANTNA MIKROFLORA TOKOM PROIZVODNJE
UŽIČKE KOBASICE**

Vesković-Moračanin Slavica, Velebit B., Borović Branka,
Turubatović L., Brković N.

Proizvodnja „užičke“ kobasice karakteristična je za područje Zlatibora, koje se odlikuje posebnom ružom vetrova i nadmorskom visinom. Proizvodi se u individualnim domaćinstvima i manjim zanatskim objektima. Podaci iz literature, vezani za tradicionalan način proizvodnje ove kobasice, su oskudni.

Ispitivana „užička“ kobasica izrađena je u domaćinstvu Nikole Brkovića, iz sela Kačer na obroncima Zlatibora.

Nadev kobasice je izrađen od goveđeg i svinjskog mesa, čvrstog masnog tkiva, nitrinne i kuhinjske soli, i punjen je u goveđa tanka creva. Proizvodnja „užičke“ kobasice (faze hladnog dimljenja i procesi zrenja) trajala je 21 dan.

Cilj ispitivanja je bio da se u različitim fazama proizvodnje (0, 2, 4, 7, 14. i 21. dan) „užičke“ kobasice, proizvedene na tradicionalan način, izoluju različite vrste bakterija mlečne kiseline (BMK) i bakterija familije *Micrococcaceae* (MIK).

Izolacija i identifikacija sojeva BMK i MIK vršena je klasičnim mikrobiološkim metodama uz potvrdu API testom. Dobijeno je 150 izolata BMK i 50 izolata MIK iz tri fermentacije (tri ponavljanja).

Utvrđeno je da dominantnu mikrofloru u toku procesa zrenja „užičke“ kobasice čine sledeće vrste BMK: *Lactobacillus delbruecki ssp. delbruecki*, *Lactococcus lactis ssp. lactis*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Ln. mesenteroides ssp. cremoris*, *Lb. delbruecki ssp. bulgaricus*, *Lb. brevis*, *Lb. fermentum*, *Lb. curvatus*.

Ključne reči: užička kobasica, BMK, MIK, API identifikacija.

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Napomena: Rezultati rada su deo istraživačkog Projekta: „Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnosti njihove primene u industriji mesa“, Ev. br. 20127, koji je finansira Ministarstvo nauke Republike Srbije.

DOMINANT MICROFLORA DURING THE PRODUCTION OF „UZICKA” SAUSAGE

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Turubatovic L., Brkovic N.

The production of „Uzicka“ sausage is typical of the Zlatibor region, specific for its wind rose and altitude. The sausage is produced in households and small manufactures. There are very few data available from literature related to the traditional way of production of this sausage type.

The investigated „Uzicka“ sausage was manufactured in the household of Nikola Brkovic from the village of Kačar located in the Zlatibor region.

Sausage filling was made from beef and pork, firm fatty tissue, nitrite salt, common salt and stuffed into beef small intestine. The production of «Uzicka» sausage lasted 21 days (stages of cold smoking and ripening processes).

The aim of the investigation was to isolate various species of lactic acid bacteria (LAB) and bacteria from *Micrococcaceae* family (MIC) from the traditionally produced «Uzicka» sausage in various stages of production (0th, 2nd, 4th, 7th, 14th and 21st day).

Isolation and identification of LAB and MIC strains was carried out using classical microbiological methods with the confirmation by the API test. 150 isolates of LAB and 50 isolates of MIC were obtained from three fermentations (three repetitions).

It is determined that dominant microflora during the ripening process of “Uzicka” sausage consists of the following LAB species: *Lactobacillus delbruecki ssp. delbruecki*, *Lactococcus lactis ssp. lactis*, *Leuconostoc mesenteroides ssp. mesenteroides*, *Ln. mesenteroides ssp. cremoris*, *Lb. delbruecki ssp. bulgaricus*, *Lb. brevis*, *Lb. fermentum*, *Lb. curvatus*.

Key words: “Uzicka” sausage, LAB, MIC, API identification.

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Note: *The results presented in this paper are the part of the research project: “Technological and Protective Properties of Autochthonous Strains of Lactic Acid Bacteria Isolated from Traditionally Fermented Sausages and Possibilities of their Application in Meat Industry” No. 20127, financed by Ministry of Science of Republic of Serbia.*

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**SASTAV MASNIH KISELINA U TRADICIONALNIM
KOBASICAMA SA ZLATIBORA**

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U jugo-zapadnoj Srbiji (Mačkat, Zlatiborski region), dimljeni proizvodi od mesa se još uvek proizvode na tradicionalan način. Tokom procesa dimljenja u čajnoj i sremskoj kobasici, koje su proizvedene u navedenom regionu, ispitan je sadržaj masnih kiselina. U ispitanim uzorcima čajne kobasice, dokazano je prisustvo 26 masnih kiselina, dok je u uzorcima sremske kobasice dokazano prisustvo 27 masnih kiselina. U obe vrste proizvoda, mononezasićene masne kiseline su bile predominantne, sa zastupljenošću od 48%. U uzorcima i sremske i čajne kobasice, najveće količine zasićenih masnih kiselina (ZMK), mononezasićenih masnih kiselina (MNMK) i polinezasićenih masnih kiselina (PNMK) poticale su od C16:0, C18:1 cis n-9, C18:2 cis n-6, respektivno. Odgovarajući procenti za navedene masne kiseline su iznosili 24,3 (ZMK), 40,6 (MNMK), 10,1 (PNMK), u čajnoj kobasici i 23,9 (ZMK), 40,5 (MNMK) i 11,0 (PNMK), u sremskoj kobasici. Odnos (MNMK + PNMK)/ZMK u dimljenoj čajnoj kobasici je, u proseku, iznosio 1,5, dok je odnos PNMK/ZMK iznosio, u proseku, 0,3. U slučaju dimljene sremske kobasice ovaj odnos je, u proseku, iznosio 1,6 za (MNMK + PNMK)/ZMK i 0,3 za PNMK/ZMK. Odnos $\Sigma n-6/\Sigma n-3$ bio je sličan u čajnoj (13,9) i sremskoj (13,0) kobasici.

Ključne reči: masne kiseline; kobasice; hemijski sastav

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**FATTY ACID COMPOSITION OF TRADITIONAL
SAUSAGES FROM ZLATIBOR**

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In the south-west Serbia (Mackat, Zlatibor region) smoked meat products are still produced in traditional manner. Cajna and sremska sausage, produced in the mentioned region, have been analysed concerning their fatty acid (FA) content during process of smoking. Twenty six FA were determined in the analysed cajna sausage samples. Twenty seven FA were determined in sremska sausage samples. The monounsaturated FA (MUFA) were predominant in both sausage samples (48%). C16:0, C18:1 cis n-9 and C18:2 cis n-6 were present in the highest content in saturated FA (SFA), MUFA and polyunsaturated FA (PUFA) respectively, both in cajna and sremska sausage samples. The percentages of these FA were: 24.3, 40.6, 10.1

in cajna sausage, respectively and 23.9, 40.5, 11.0 in sremska sausage, respectively. The ratio of (MUFA + PUFA) / SFA in smoked cajna sausage was 1.5, in average, while PUFA / SFA ratio was 0.3, in average. In case of smoked sremska sausage this ratio was, in average, 1.6 for (MUFA + PUFA) / SFA and 0.3, in average, for PUFA / SFA. $\Sigma n-6 / \Sigma n-3$ ratio was similar in cajna (13.9) and sremska sausage (13.0).

Key words: Fatty acids; Sausage; Chemical composition

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FIZIČKO-HEMIJSKA SVOJSTVA FERMENTISANIH KOBASICA USKOG DIJAMETRA

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U radu su prikazane fizičko-hemijske promene tokom procesa proizvodnje tradicionalno fermentisanih kobasica. Ispitivanja su vršena u uzorcima "sremske" i "levačke" kobasice, proizvedene u industrijskim uslovima, i uzorcima „užičke” kobasice, koja je proizvedena u porodičnom domaćinstvu. U toku procesa zrenja i fermentacije kobasica, praćene su promene određenih fizičko-hemijskih parametara: sadržaja proteina, masti, vode, pepela, natrijum hlorida, nitrita i nitrata, pH i aktivnosti vode (a_w vrednost). Uzorci su uzimani neposredno posle punjenja nadeva u prirodno crevo, tj. 0. dana proizvodnje, a potom 2., 4., 7., 14. i 21. dana proizvodnje kobasica. Ogled je ponovljen tri puta.

Dobijeni rezultati su prikazani kao srednje vrednosti ispitivanja.

Utvrđeni sadržaj masti u uzorcima „sremske” i „levačke” kobasice, 21. dana ispitivanja, je bio 46,4 posto, odnosno 48,5 posto. Znatno niži sadržaj masti je utvrđen u uzorcima „užičke” kobasice (30,7 posto).

Tokom procesa proizvodnje, sadržaj vlage, u svim ispitivanim kobasicama, se postepeno smanjivao. Gubitak vlage od 0-og do 21. dana iznosio je 38,8 posto, u uzorcima „užičke” kobasice, a u „sremskoj” i „levačkoj” kobasici utvrđeni gubitak vlage je bio 56,6 posto, odnosno 57,6 posto. Sadržaj vlage, na kraju proizvodnje, u „užičkoj” kobasici, je iznosio 36,4 posto, a u „sremskoj” i „levačkoj” kobasici je bio 23,1 posto, odnosno 22,3 posto.

Promena a_w vrednosti je bila u direktnoj korelaciji sa procesom gubitka vlage, i iznosila je 0,868, za uzorke „užičke” kobasice, odnosno 0,799 i 0,790, za uzorke „sremske” i „levačke” kobasice.

Vrednosti pH nadeva ispitivanih kobasica su bili u funkciji procesa zrenja. Od početnih ujednačenih vrednosti pH, za „sremsku” i „levačku” kobasicu (5,84 i 5,99), sledio je intenzivan pad do 7. dana fermentacije, nakon čega su vrednosti ostale nepromenjene. Utvrđena pH vrednost 21. dana ispitivanja kod uzoraka užičke kobasice je bila 4,94, dok je kod „sremske” i „levačke” kobasice bila je 5,44, odnosno 5,47.

Sa stepenom gubitka vode, povećavao se sadržaj natrijum hlorida. Veći sadržaj soli utvrđen je u „užičkoj” kobasici, i na kraju proizvodnje, iznosio je 4,78 posto, dok je sadržaj soli u „sremskoj” i „levačkoj” kobasici iznosio 3,78 posto, odnosno 3,80 posto.

Utvrđena fizičko-hemijska svojstva fermentisanih kobasica su karakteristična za ovu vrstu proizvoda, pri čemu uzorci "sremske" i "levačke" kobasice, proizvedene u industrijskim uslovima, imaju ujednačen karakter promena.

Ključne reči: tradicionalna proizvodnja, „užička” kobasica, „sremska” kobasica, „levačka” kobasica, parametri kvaliteta

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Napomena: Ovo istraživanje je rađeno u okviru projekta 20127, “Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalno fermentisanih kobasica i mogućnost njihove primene u industriji mesa”, Ev. br. 20127, koji Programom istraživanja u oblasti tehnološkog razvoja za period 2008-2010. godine, finansira Ministarstvo nauke Republike Srbije.

PHYSICAL AND CHEMICAL CHANGES OF SMALL – DIAMETER FERMENTED SAUSAGES

Trbovic Dejana, Saicic Snezana, Stefanovic S., Jankovic S.,
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In this paper are shown the physical and chemical changes during the process of production of traditionally fermented sausages. The studies were carried out on samples of “Sremska” and “Levacka” sausage produced under industrial conditions and samples of “Uzicka” produced in a household. During the fermentation and maturation process parameters such as: protein content, fat content, water, ash sodium chloride, nitrates, nitrites, pH, water activity (aw) were followed. Samples were taken on the day of stuffing (day 0) and on days 2, 4, 7, 14, 21 of production. The experiment was repeated three times.

The obtained results are given as average values.

The estimated fat content in samples of “Sremska” and “Levacka” on day 21 was 46.4% and 48.5%, respectively. The fat content in the “Uzicka” was lower (30.7%).

During the maturation process the moisture content in all tested samples slowly decreased. The moisture loss from day 0 to day 21 was 38.8% for “Uzicka”, and 56.6% and 57.6% for “Sremska” and “Levacka”, respectively. At the end of the production the moisture content in “Uzicka” was 36.4% and in “Sremska” and “Levacka” was 23.1% and 22.3%, respectively.

Changes in aw value were in direct correlation with the moisture loss and was 0.868 for “Uzicka” and 0.799 and 0.790 for “Sremska” and “Levacka”, respectively.

pH values of the stuffing were in the function of the maturation process. Starting with the levelled pH values for “Sremska” and “Levacka” (5.84 and 5.99) a sharp drop was recorded by the 7th day. Thereof, values remained unchanged. The pH value on day 21 was for “Sremska” 4.94, “Sremska” 5.44 and “Levacka” 5.47.

As water was lost so increased the sodium chloride content. The highest concentration was established in the “Uzicka” at the end of the production (4.78%),

while the salt content in the “Sremska” and “Levačka” was 3.78 and 3.80%, respectively.

The determined physico – chemical values of the fermented sausages are characteristic to thi type of production. The “Sremska” and “Levačka” produced under industrial conditions had more homogenous parameter values.

Key words: traditional production, „užička” sausage, „sremska” sausage, „levačka” sausage, quality parameters

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Note: *Results are part of a research project: „Technological and protective characteristics of autochthonous bacterial lactic acid strains isolated from traditionally fermented sausages and the possibility for their application in meat industry”, Ev. No. 20127, financed by the Ministry of Science, Republic of Serbia.*

**UTICAJ KVALITETA CRVENE ZAČINSKE PAPRIKE NA BOJU
PETROVSKE KLOBÁSE - TRADICIONALNE SUVE
FERMENTISANE KOBASICE -**

Petrović Ljiljana, Ikonić P., Jokanović Marija, Džinić Natalija,
Tomović V., Tasić Tatjana

Crvena začinska paprika svojom dominantnom bojom utiče na formiranje boje proizvoda u čijoj izradi se koristi. Pored formiranja prijatne boje, crvena začinska paprika ima veoma značajnu ulogu i u formiranju karakterističnog ljutog ukusa Petrovske klobáse, a u fermentisanom i osušenom proizvodu i ukupne arome.

U ovom radu ispitan je kvalitet začinske paprike različitih proizvođača, koja je korišćena pri proizvodnji tradicionalne suve fermentisane kobasice – Petrovske klobáse. Takođe je ispitan uticaj kvaliteta paprike na boju i održivost boje Petrovske klobáse nakon 50, 80 i 120 dana tradicionalnog procesa proizvodnje. Instrumentalno određena boja ispitivanih uzoraka paprike, izražena u CIE L*a*b* sistemu, kretala se u intervalu od 34,66 do 40,79 za L* vrednost, odnosno od 40,91 do 45,24 za a* vrednost. Svetloća boje svežeg preseka uzoraka petrovske klobáse, odnosno L* vrednost, 50. dana proizvodnje kretala se od 37,95 do 42,87, sa tendencijom smanjenja tokom daljeg procesa proizvodnje, odnosno nastajanja sve tamnije boje. Pokazatelj udela crvene i zelene boje (a* vrednost) u istoj fazi proizvodnje fermentisanih kobasica, kretao se u rasponu od 25,39 do 34,91. Tokom sledećih sedamdeset dana sušenja i zrenja uočena je tendencija smanjenja i ove vrednosti.

U radu je uočena jasna korelacija između kvaliteta, odnosno svetloće boje (L* vrednosti) i udela crvene boje (a* vrednosti) u paprici i u gotovom proizvodu - Petrovskoj klobási.

Ključne reči: Petrovska klobása, crvena začinska paprika, boja

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Napomena: *Istraživanja su finansirana sredstvima MNTR u okviru projekta 20037-TR*

INFLUENCE OF QUALITY OF RED PEPPER ON COLOUR OF “PETROVSKA KLOBÁSA” – TRADITIONALLY MADE DRY FERMENTED SAUSAGE

Petrovic Ljiljana, Ikonic P., Jokanovic Marija, Dzinic Natalija,
Tomovic V., Tasic Tatjana

Red spicy pepper with its dominate red color influence yhe forming of product color. Beside forming of pleasant color, red spicy pepper has very significant role in formation of characteristic hot taste of “Petrovska klobása”, and in fermented and dry product in formation of overall flavor.

Quality of red spicy pepper from various producers which was used in production of this tradionaly made dry fermented sausage “Petrovska klobása” was tested in this paper. Beside that influence of pepper quality of color and stability of color of the “Petrovska klobása” after 50,80 and 120 days of traditional process of production. Instrumentaly evaluated color of the sausage samples expressed in CIE L*a*b* system was in range of 34.66 to 40.79 for L* value. e.g. from 40.91 to 45.24 for a* value. Lightness of color of fresh cross section of “Petrovska klobása”, e.g. L* value, on 50. day of production was in range from 37.95 to 42.87, with the tendency of decrease during further production process, formation of darker color. Indicator of proportion of red and green color (a* value) in the same phase of production was in range from 25.39 to 34.91. During the next seventy days of drying and ripening tendency of decrease of this value was noticed.

The clear correlation between quality e.g. color lightness (L* value) and indicator of proportion of red color (a* value) in pepper and in finished product - “Petrovska klobása” was noticed.

Key words: Petrovska klobása, red spicy peper, color

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Note: *Investigations support by Ministry of science and technological development of Republic of Serbia, within project No. 20037-TR*

SENZORSKE KARAKTERISTIKE TRADICIONALNO FERMENTISANIH KOBASICA

Karan Dragica, Vesković-Moračanin Slavica, Parunović N., Rašeta M.,
Babić Jelena, Đorđević Mirjana, Tadić R.

U radu su prikazani rezultati senzorske ocene suvih fermentisanih kobasica – „sremske“, „levačke“ i „užičke“, koje su proizvedene u skladu sa tradicionalnim načinom izrade.

„Levačka“ i „sremska“ kobasica proizvedene su u industrijskim uslovima proizvodnje, u A.D. „Yuhor“ Jagodina, a domaća „užička“ u individualnom domaćinstvu Brković Nikole iz sela Kačer na Zlatiboru.

„Sremska“ kobasica je proizvedena od svinjskog mesa prve i druge kategorije, čvrstog masnog tkiva, nitritne soli, saharoze, oleorezina ljute i slatke paprike, ekstrakta crnog bibera i belog luka. Nadev je punjen u tanka svinjska creva.

Sastav „levačke“ kobasice je bio sličan „sremskoj“, osim što je u nadev dodato i govede meso druge kategorije.

„Užička“ kobasica je proizvedena od govedeg i svinjskog mesa, mlevenog govedeg mesa, čvrstog masnog tkiva, nitritne i kuhinjske soli i S77 (Alimenta).

Za sve navedene kobasice je bilo karakteristično da su dimljene po hladnom postupku i da su sušene na vazduhu. Procesi zrenja i fermentacije ispitivanih kobasica je trajao 21 dan.

Pomoću kvantitativnog deskriptivnog testa, na skali intenziteta od 1 do 10, na kraju fermentacije, ocenjena su organoleptička svojstva kobasica (boja, koherentnost-povezanost mišićnog i masnog tkiva, miris, kvalitet masnog tkiva, kiselost, sočnost, nežnost-mekoća, ukupni ukus, naknadni ukus i ukupna prihvatljivost).

Grupa od pet ocenjivača je činila panel za ocenu organoleptičkih svojstava. Ocenjivačima su prethodno testirana čula pomoću „testa za utvrđivanje osećaja ukusa“ i „testa za otkrivanje i prepoznavanje mirisa“.

Na osnovu rezultata senzorske analize i dobijenih prosečnih srednjih vrednosti za svako ispitivano organoleptičko svojstvo, utvrđeno je da su sve tri ispitivane kobasice (svaki ogled je ponovljen tri puta) imale poželjna organoleptička svojstva, karakteristična za suve fermentisane kobasice, proizvedene na tradicionalan način.

Ključne reči: senzorska analiza, sremska, levačka, užička, kobasica

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Napomena: Rezultati rada su deo istraživačkog Projekta: „Tehnološke i protektivne osobine autohtonih sojeva bakterija mlečne kiseline izolovanih iz tradicionalnih fermentisanih kobasica i mogućnost njihove primene u industriji mesa“, Ev. br. 20127, koje finansira Ministarstva nauke, Republike Srbije.

SENSORY CHARACTERISTICS OF TRADITIONALLY FERMENTED SAUSAGES

Karan Dragica, Veskovic-Moracanin Slavica, Parunovic N., Raseta M.,
Babic Jelena, Djordjevic Mirjana, Tadić R.

In this paper are shown the results of sensory analysis of dried fermented sausages – „Sremske“, „Levačke“ and „Užičke“, which are produced in accordance to the traditional methods.

„Levačka“ and „sremska“ sausage are produced under industrial conditions in A.D. „Yuhor“ in Jagodina, and the „Uzička“ was produced under manufacture conditions in the household of Brković Nikola, village Kačer on mount Zlatibor.

Sausage „Sremska“ is produced from pork meat of first and second class, firm fat tissue, nitrite salt, saccharose, oleorezins of hot and sweet peppers, black pepper and onions. The filling was stuffed into the pig's small intestines.

The content of the „Levačka“ sausage was similar to the „Sremska“, with the exception that in the filling class II beef was added, as well.

The „Užička“ sausage was produced from beef and pork meat, minced beef, firm fatty tissue, nitrites, kitchen salt and S77 (Alimenta).

For all the named sausages was characteristic that they were smoked under the cold procedure and dried on air. The processes of maturation and fermentation lasted for 21 days.

With the aid of the quantitative descriptive test, on a intensity scale from 1 to 10, at the end of the fermentation the organoleptic characteristics were marked (color, coherency, binding of muscle and fat tissue, smell, acidity, quality of fat tissue, juiciness, softness, total taste, after-taste, overall acceptance)

The voting panel consisted of a group of five. Members of the panel were previously tested by the „test for assessing the sense of taste“ and „test for the detection and recognition of odors“. Based upon the results of the sensory analysis it was established that all three sausages (each test was repeated three times) had desirable organoleptic features typical for the dry fermented sausages produced by the traditional methods.

Key words: sensory analysis, sremska, levačka, užička, sausage

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Note: Results are part of a research project: „Technological and protective characteristics of autochthonous bacterial lactic acid strains isolated from traditionally fermented sausages and the possibility for their application in meat industry“, Ev. No. 20127, financed by the Ministry of Science, Republic of Serbia.

BANIJSKA KOBASICA – PROIZVOD SA TRADICIJOM

Baltić Ž. M., Baltić Tatjana, Mitrović Radmila,
Mitrović-Stanivuk Milena, Popović Lj.

Banijska kobasica je proizvod karakterističan za Baniju, područje Hrvatske između reka Gline, Kupe, Save i Une i tzv. „suve međe“, odnosno granice sa Bosnom i Hercegovinom. Umeće izrade ovog proizvoda koji se proizvodi isključivo u domaćinstvima, prenosilo se sa predaka na potomke iz generacije u generaciju. Izradi ovog proizvoda od mesa pristupalo se uvek sa odgovornošću i ljubavlju, a sa ponosom se nudio najdražim i najuglednijim gostima. Od 1995. godine brojne izbegle porodice i na novim ognjištima, u Srbiji, nastavile su sa tradicijom izrade banijske kobasice.

Banijska kobasica se priprema od svinjskog mesa (najbolje od svinja mase preko 150 kg), očišćenog od masnog i vezivnog tkiva, a u zavisnosti od stepena očišćenosti i količine masnog tkiva, može da se doda i čvrsto masno tkivo leđa. Nekad se meso (u vreme kada je mašina za mlevenje bila retkost) usitnjavalo sečenjem bradvom ili nožem. Meso za banijsku kobasicu se grubo usitnjava (otvori na ploči- šajbni mašina za mlevenje su najčešće 10 mm). Običaj je i danas da se dodato čvrsto masno tkivo secka u kockice nožem. Nadev se priprema mešanjem mesa sa solju i hladnim vodenim ekstraktom mlevenog belog luka i vrućim vodenim ekstraktom mlevene ljute paprike. Količina dodate soli egzaktno se ne meri, kao što se ne određuje ni količina dodatih začina. Višekratnim probama sirovog nadeva posle mešanja utvrđuje se da li je ukus “pogođen”. Do pojave veštačkih omotača nadev banijske kobasice punjen je u svinjska debela creva, slepo crevo i zadnje crevo. U novije vreme banijska kobasica puni se i u veštačke omotače prečnika 55 do 80 mm. Hladno dimljenje i sušenje obavlja se, uglavnom, na tavanima (potkrovlju) kuća, što je moguće dalje od dimnjaka. Pri tom, količina dima reguliše se otvaranjem prozora (ako ih ima) na tavanu ili podizanjem crepa na više mesta na krovu. Banija obiluje bukovim i grabovim drvetom, tako da se ono uglavnom koristilo za zagrevanje kuće, a dim izlazio na tavan. Danas se, banijska kobasica, dimi najčešće u specijalizovanim pušnicama, hladnim dimom dobijenim sagorevanjem bukovog drveta (strugotina). Zrenje banijske kobasice, u zavisnosti od dijametra creva, traje u prirodnim (nekontrolisanim) uslovima temperature, vlažnosti i cirkulacije vazduha od 75 do 120 dana. Gotov proizvod se nekad (danas sve ređe) čuvao u tamnim i hladnim podrumima uvijen u hartiju. Danas se, najčešće, čuva zamrznut. Običaj je da se kulen (nadev punjen u slepo crevo) čuva do sledeće godine, tj. sezone i servira za doručak onog dana kada se obavlja klanje svinja, obrada mesa i proizvodnja kobasica. To je, najčešće, vreme zadnje nedelje novembra ili prve nedelje decembra meseca.

Prema našim rezultatima banijska kobasica punjena u debelo i zadnje svinjsko crevo sadrži, u proseku, (n=20) 24,59±1,41 posto vode, 41,16±1,68 posto masti, 29,57±1,41 posto proteina, 4,68±0,51 posto pepela i 3,29±0,49 posto kuhinjske

solu. Prosečna energetska vrednost je 2.024,00±51,95 kJ na 100 g, od čega je učešće masti u ukupnoj energetskej vrednosti 1.521,41±62,90 kJ (75,17%), a proteina 502,62±23,92 kJ (24,83%).

Obzirom na dugu tradiciju, specifičnost proizvodnje i osobine gotovog proizvoda banijska kobasica ima uslove da bude proizvod zaštićen oznakom geografskog porekla. Međutim, to bi mogli da učine, međutim, samo oni Banijci koji i danas tamo žive.

Ključne reči: banijska kobasica, proizvodnja, kvalitet, tradicija.

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BANIJSKA SAUSAGE – A PRODUCT WITH TRADITION

Baltic Z. M., Baltic Tatjana, Mitrovic Radmila, Mitrovic-Stanivuk Milena, Popovic Lj.

Banijska sausage is a product characteristic for Banija, the region in Croatia located between rivers Glina, Kupa, Sava and Una, so-called “suve medje”, the border with Bosnia and Hercegovia. The knowledge of manufacturing this product, which is solely made in households, is passed on from one generation to another. The production of this meat product was always handled with love and care, and was proudly offered to the dearest and most important guests. From 1995. many of the refugee families in Serbia continued with this traditional production of Banijska sausage.

Banijska sausage is made of pork meat (best if pigs with a weight more than 150kg are used), cleaned from fat and connective tissue, and depending of the level of cleanliness and assessment of fat tissue quantity, firm fatty tissue from the back may be added. Some time ago (when the appliance for meat grinding was rare), knives were used for meat cutting. Meat for Banijska sausage is cut into large pieces. Even today the custom of cutting firm fatty tissue from the back with the knife is present. Stuffing is made by mixing meat with salt and cold watery extract of onion and hot watery extract of grind chilly pepper. The amount of salt used is not exact, as well as the amount of used spices. With multiple degustation of raw stuffing after mixing, determines if the taste is satisfactory. Before the use of artificial coating, the mixture was stuffed into pigs intestines. Recently, Banijska sausage has an artificial coating, with a diameter from 55 to 80mm. Cold smoking and drying is conducted mostly in the attics of houses, as far away from the chimneys as possible. And the smoke quantity is controlled by opening of windows on attics (if possible). Banija is rich in beech wood, so these types of wood were mainly used for house heating and the smoke exited through the attic. Today Banijska sausage is mostly smoked in specialized facilities, with cold smoke gained by beech burning. Maturation of Banijska sausage depends of the diameter of the coating and in natural (uncontrolled) temperature, air and humidity conditions lasts between 75 to 120 days. The finished

product was once kept in dark and cold basements warped in paper. Today is usually kept frozen. The custom is that the “kulen” (mixture stuffed in the appendix) is kept until the next year, i.e. season and is served for breakfast on the day when pigs are slaughtered, meat is processed and sausages are produced. Most commonly it was the last Sunday of November or first Sunday of December.

According to our results Banijska sausage stuffed into pig's intestines has in average (n=20) $24,59 \pm 1,41\%$ of water, $41,16 \pm 1,68\%$ of fat, $29,57 \pm 41\%$ of proteins, $4,68 \pm 0,51\%$ of ashes and $3,29 \pm 0,49\%$ of salt. The average energetic value is $2.024,00 \pm 51,95\text{kJ}$ in 100g of which $1.521,41 \pm 62,90\text{kJ}$ (75,17%) goes to the energy value of fat and $502,62 \pm 23,92\text{kJ}$ (24,83%) goes to the energy value of proteins.

In the perspective of the long tradition, uniqueness of production and characteristics of final product, Banijska sausage fulfills all the requirements to be a product with protected label of geographic origin. However this can be done only by the people still living in Banija.

Key words: banijska sausage, production, quality, tradition.

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HEMIJSKI I SENZORNI POKAZATELJI KVALITETA KULENA I SREMSKE KOBASICE

Živković D., Perunović Marija, Stajić S., Jovanović Marijana

Suve fermentisane kobasice su jedna od najcenjenijih i najkvalitetnijih grupa proizvoda od mesa. One su, dodatno, vrlo profitabilne za industriju mesa, a takođe, mogu biti interesantne i za nastup na inostranim tržištima. Kulen i sremska kobacica su naši autohtoni proizvodi iz ove grupe, specifični za region Srema. Iako su ovo proizvodi kod kojih je ostvarena zaštita oznake geografskog porekla, na tržištu postoji neusaglašenost u pogledu izgleda i pojedinih faktora kvaliteta.

Ovim radom smo želeli da ispitamo hemijske i senzorne pokazatelje kvaliteta kulena i sremske kobasice, različitih proizvođača, prisutnih na beogradskom tržištu. Ispitano je 11 uzoraka kulena i 19 uzoraka sremske kobasice.

Dva uzorka kulena ne zadovoljavaju propisane zahteve u pogledu sadržaja proteina mesa od minimum 22%. Svi ispitivani uzorci sremske kobasice zadovoljavaju zahteve propisane Pravilnikom o kvaliteu i drugim zahtevima za proizvode od mesa (Sl. list SCG, br. 33/2004).

Postoji velika raznolikost i neusaglašenost u pogledu senzornog kvaliteta proizvoda koji se proizvode pod istim imenom sremska kobacica.

Ključne reči: kulen, sremska kobacica, hemijski pokazatelji kvaliteta, senzorni kvalitet.

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Napomena: Rad je finansiran iz sredstava projekta «Unapređenje sistema upravljanja bezbednoću i kvalitetom u procesima proizvodnji tradicionalnih proizvoda od mesa sa ostvarenom zaštitom geografskog porekla», ev.br. BT20121 koji finansira Ministarstvo za nauku i tehnološki razvoj Republike Srbije

CHEMICAL AND SENSORY QUALITY PARAMETERS OF KULEN AND SREMSKA SAUSAGE

Zivkovic D., Perunovic Marija, Stajic S., Jovanovic Marijana

Dry fermented sausages are one of the highest quality and most valuable group of meat products. They are also very profitable for the meat industry and they can be interesting for foreign markets as well. Kulen and Sremska sausages are our traditional products from this group indigenous to the region of Srem. Although these products have the protected designation of origin, there is inconsistency on the market in terms of appearance and certain quality factors.

In this paper we wanted to examine the chemical and sensory quality parameters of Kulen and Sremska sausages from different producers presented at the Belgrade market.

We studied 11 samples of Kulen and 19 samples of Sremska sausage. Two samples of Kulen do not satisfy the prescribed requirements in respect of the protein content of minimum 22%. All examined samples of Sremska sausage meet the requirements prescribed by the Regulatvesi for Quality and Other Requirements for Meat Products (Official Journal of Serbia-Montenegro, No. 33/2004).

There is great diversity and discrepancies when it comes to sensory quality of products produced under the same name of Sremska sausage.

Key words: Kulen, Sremska sausage, chemical parameters of quality, sensory quality.

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Note: *Paper is part of the project «Unapređenje sistema upravljanja bezbednoću i kvalitetom u procesima proizvodnji tradicionalnih proizvoda od mesa sa ostvarenom zaštitom geografskog porekla», No BT20121, financed by Ministry of Science and Technological Development of the republic of Serbia*

III TEMATSKA OBLAST
3rd THEMATIC TOPIC

HAZARDI U PROIZVODNJI I PRERADI MESA
HAZARDS IN MEAT PRODUCING AND
PROCESSING

III-1

OPŠTA KARAKTERIZACIJA MIKROFLORE KOŽE GOVEDA

Antić D., Blagojević B., Dučić M., Mitrović Radmila, Nastasijević I., Bunčić S.

Koža goveda predstavlja najznačajniji izvor mikrobiološke kontaminacije mesa trupova goveda na liniji klanja. Stoga, glavni cilj ove studije bio je da karakteriše kvantitet, glavne grupe i distribuciju bakterijske mikroflore na koži goveda za klanje.

Uzorkovanje koža zaklanih goveda (po pet mesta na svakoj koži) vršeno je u jednoj komercijalnoj klanici u Srbiji, metodom pomoću briseva sunderima, sa ciljem da se utvrde ukupna mikroflora (ukupan broj bakterija, UBB), indikatori fekalne kontaminacije (broj *Enterobacteriaceae* i prevalenca generičke *E. coli*), kao i prisustvo *Salmonella*. Dodatno, ispitivana je i „vertikalna distribucija“ (između gornjeg i donjeg sloja dlake) opšte mikroflore (UBB i *Enterobacteriaceae*) na dlaci kože zaklanih goveda.

Ukupno, na ispitivanim kožama, prosečan TVC bio je $>6 \log \text{ cfu/cm}^2$ (sa maksimalnim vrednostima i do $8 \log \text{ cfu/cm}^2$), prosečan broj *Enterobacteriaceae* bio je $>4 \log \text{ cfu/cm}^2$, dok je prevalenca generičke *E. coli* iznosila 100%. Međutim, različiti faktori su imali uticaja na rezultate. TVC i broj *Enterobacteriaceae* bili su, značajno, viši kod mlađih nego kod starijih životinja kao i kod goveda iz pojedinih geografskih regiona, u odnosu na druge regione. Takođe, nivoi TVC i *Enterobacteriaceae* bili su viši kod goveda sa suvom i čistom kožom u odnosu na goveda koja su imala mokru i prljavu kožu. *Salmonella* spp. nije utvrđena ni na jednoj ispitivanoj koži goveda. TVC i broj *Enterobacteriaceae*, kao i prevalenca generičke *E. coli*, bili su najviši na metakarpusu i grudima, u odnosu na vrat, but i slabinu. Nije utvrđena značajna razlika u TVC, broju *Enterobacteriaceae* i broju generičke *E. coli* između gornjih i donjih slojeva dlake na vizuelno čistoj koži zaklanih goveda.

Rezultati ove studije predstavljaju prvu detaljniju naučnu informaciju o opštoj mikroflori kože zaklanih goveda u Srbiji i neophodni su za dalji razvoj efikasnih antimikrobnih tretmana kože goveda, u cilju unapređenja mikrobiološke bezbednosti govedeg mesa.

Ključne reči: koža; meso; mikrobiološka kontaminacija; *Salmonella*; fekalni indikatori; goveda.

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GENERAL CHARACTERISATION OF THE MICROFLORA OF CATTLE HIDES

Antic D., Blagojevic, B., Ducic M., Mitrovic Radmila, Nastasijevic I., Buncic S.

Cattle hide is considered to be the main source of microbial contamination of dressed beef carcasses on the slaughterline. Consequently, the aim of the present study was to characterise the levels, the main groups and the distribution of bacterial microflora on cattle hides at slaughter.

Cattle hides (five areas on each) of slaughtered cattle (at a commercial abattoir in Serbia) were sampled by sponge-swabs to determine total microflora (Total viable count; TVC), faecal indicators (*Enterobacteriaceae* counts and prevalence of generic *Escherichia coli*) and occurrence of *Salmonella*. In addition, “vertical distribution” (i.e. between top and lower layers of the hair) of general microflora (TVC and *Enterobacteriaceae*) on cattle hide’s hair was examined.

Overall on examined hides, the mean TVC was $>6 \log \text{ cfu/cm}^2$ (maximum values up to $8 \log \text{ cfu/cm}^2$), the mean *Enterobacteriaceae* count was $>4 \log \text{ cfu/cm}^2$ and the prevalence of generic *E. coli* was 100%. However, the results were affected by some variable factors. TVC and *Enterobacteriaceae* counts were significantly higher in younger than in older animals and in cattle from some geographical regions than from others. Furthermore, TVC and *Enterobacteriaceae* levels were higher on dry and clean than on wet and dirty hides. *Salmonella* spp. was not found on any cattle hide examined. TVC and *Enterobacteriaceae* counts, as well as the prevalence of generic *E. coli*, were the highest on brisket and metacarpus areas of cattle hides, as compared with neck, rump and flank areas. No significant differences in TVC, *Enterobacteriaceae* and generic *E. coli* were found between top and lower layers of the hair on visually clean hides.

The study provides the first detailed scientific information on general microflora of hides of slaughtered cattle in Serbia, necessary for further developments of effective antimicrobial treatments of cattle hides to improve microbial safety of beef.

Key words: hide; meat; microbial contamination; *Salmonella*; faecal indicator organisms; beef.

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PRENOS MIKROFLORE SA KOŽE GOVEDA NA MESO PUTEM DIREKTOG KONTAKTA

Antić D., Dučić M., Blagojević B., Mitrović Radmila, Nastasijević, I., Bunčić S.

Dobro je poznata činjenica da je koža goveda najznačajniji izvor mikrobiološke kontaminacije mesa trupova goveda na liniji klanja (uključujući i sa alimentarnim patogenima). Unakrsna mikrobiološka kontaminacija mesa trupova sa kože tokom operacije njenog skidanja, dešava se direktnim (kontaktno) ili indirektnim (preko opreme i/ili aerosola) putem, ali detaljnijih kvantitativnih informacija o tome nema (posebno u pogledu direktnog kontakta).

U ovom istraživanju, ispitivana je dinamika prenosa opšte mikrofloze sa kože na meso putem direktnog kontakta, kao i efekti nekih odabranih faktora na prenos (suva/mokra koža, mršavo/masno meso, slabiji/jači pritisak, vreme kontakta i trenje).

Tokom direktnog kontakta između vizuelno čistih komada kože i sterilnog mesa, samo se mala proporcija ukupne mikrofloze kože (TVC) prenosila na meso (<0.1% u proseku). U velikom broju slučajeva (ali ne i uvek), na meso su se takođe prenosili i indikatori fekalne kontaminacije (*Enterobacteriaceae* i generička *E. coli*). Kada se posmatra ukupni trend u rezultatima, prenos mikrofloze sa kože na meso se pojačavao u slučaju jačeg pritiska i ukoliko je koža bila mokra. Međutim, visoka varijabilnost i međusobni uticaj ispitivanih faktora uzrokovali su da ovi trendovi nisu bili statistički značajni.

Ukupno, iako se samo mali procenat ukupne mikrofloze kože prenosio na meso putem direktnog kontakta, usled veoma visoke mikrobiološke kontaminacije koja uobičajeno postoji i na vizuelno čistoj koži (6-8 log/cm²), broj bakterija koji se na mesu nalazi posle kontakta je još uvek veoma relevantan sa stanovišta bezbednosti mesa. Stoga, kontakt između kože i mesa se mora potpuno izbeći tokom skidanja kože, ili se pre toga mora izvršiti dekontaminacija same kože.

Ključne reči: koža, meso, skidanje kože, unakrsna kontaminacija trupova

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TRANSMISSION OF HIDE MICROFLORA ONTO MEAT VIA CONTACT

Antic D., Ducic, M., Blagojevic B., Mitrovic Radmila, Nastasijevic I., Buncic S.

It is widely accepted that the key source of microbial contamination including with food-borne pathogens of bovine carcass meat is the hide. Microbial hide-to-meat cross-contamination occurring during skinning operation can be through direct (via contact) or indirect (via tools and/or aerosols) routes, but related quantitative information – particularly for the former route - is scarce.

In the present study, transfer ratios of general microflora from hide onto meat via direct contacts, as well as the effects of some selected factors (dry/wet hide, lean/fatty meat, lower/higher pressure, contact duration and friction) on the ratios, were investigated.

Direct contact between visually clean pieces of cattle hide and sterile meat resulted in only a relatively small proportion of hide TVC was transmitted onto meat (<0.1% on average). In a number of such cases (but not always), faecal indicator organisms (*Enterobacteriaceae* and generic *E. coli*) were also transmitted onto meat. When considering overall trends of the results, the microbial transmission was often enhanced by higher pressure and when the hide was wet. However, large variabilities and co-interference of the hide- and contact-related factors caused that these trends largely were not statistically significant.

Overall, although a relatively small proportion of hide microflora is transferred onto meat via direct contact, because very high microbial levels on hide exist even on visually clean hides (6-8 log/cm²), the counts of bacteria remaining on meat post-contact are still very relevant for meat safety. Therefore, hide-meat contact must be either totally prevented during, or hide must be decontaminated before, skinning of carcasses.

Key words: hide, meat, skinning, carcass cross-contamination

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**TRETMAN U CILJU “IMOBILIZACIJE” MIKROFLORE
NA KOŽI GOVEDA**

Antić D., Blagojević B., Dučić M., Mitrović Radmila, Nastasijević, I., Bunčić S.

S obzirom da se mikrobiološka unakrsna kontaminacija mesa trupova goveda redovno dešava sa kože tokom procesa klanja i obrade na klanicama, dekontaminacioni tretmani kože posle klanja, a pre njenog skidanja smatraju se veoma efikasnim načinom za smanjenje i/ili eliminaciju mikrobiološke kontaminacije sa kože, a sve u cilju unapređenja bezbednosti mesa trupova goveda. Različite metode antimikrobnih tretmana – sa ciljem da ubiju i/ili uklone patogene – su korišćene za dekontaminaciju kože goveda. Dosad postignute mikrobiološke redukcije na koži, pod komercijalnim uslovima u klanicama, iznosile su oko 2-3 log. Međutim, poznato je da koža goveda može biti kontaminirana mikroorganizmima (uključujući i alimentarne patogene) i u daleko višim nivoima.

U cilju poboljšanja efikasnosti dekontaminacionih tretmana kože, u sadašnjoj studiji je ispitivan novi, alternativni pristup: fiksacija mikroorganizama na dlaci. Između više potencijalnih sredstava za fiksaciju mikroflora na dlaci kože, eksperimentalno su ispitani prirodna, jestiva smola poreklom od insekata (Shellac, u daljem tekstu Šelak) i lak za kosu koji se upotrebljava u kozmetičke svrhe (oba sredstva se nalaze u slobodnoj prodaji).

Ključne reči: koža; dekontaminacija kože; *Escherichia coli* O157; goveda; trup

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**TREATMENT TO “IMMOBILIZE” MICROFLORA
ON CATTLE HIDES**

Antic D., Blagojevic B., Ducic M., Mitrovic Radmila, Nastasijevic, I., Buncic S.

Because hide-to-meat microbial cross-contamination of bovine carcasses regularly occurs during slaughter and dressing of cattle at commercial abattoirs, post-slaughter but pre-skinning decontamination treatments of cattle hides are considered as a potentially effective way to reduce and/or eliminate microbial contamination from the hides, so to improve microbial safety of beef carcasses. Various antimicrobial treatment techniques – aimed at killing and/or removing pathogens – have been considered for decontamination of cattle hides. Microbial reductions on hides achieved to date under the commercial abattoir conditions were up to 2-3 logs. How-

ever, it is known that bovine hides can be contaminated with microorganisms including pathogenic bacteria at higher levels.

To improve the effectiveness of the hide decontamination treatments, a novel, alternative approach was explored in the present study: microbial fixation on the hair. Amongst a range of potential microflora-on-hide fixation compounds, an insect-produced, natural, food-grade resin (Shellac) and a hair spray for cosmetic purposes (both commercially available) were experimentally evaluated.

The greatest reductions of general, natural microflora on hides (total viable count of bacteria-TVC, *Enterobacteriaceae* counts and generic *E. coli* counts) were achieved by spray-treatment with the Shellac solution in ethanol. The mechanism of the Shellac treatment included a combination of immobilization of bacteria on hair by the resin and the bactericidal action of the ethanol. Comparably, the rinse-vacuum treatment with the sanitizer and the hair spray treatment were less effective. The Shellac solution treatment was also effective in reducing the prevalence (3.7-fold reduction) of naturally-occurring *E. coli* O157 on hides, as well as in reducing the counts of this pathogen when artificially inoculated on hide.

The results of the study provided a “proof of concept” for the use of microbial fixation treatment within the hide decontamination strategy to improve beef safety.

Key words: Hide; hide decontamination; *Escherichia coli* O157; beef; carcass.

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**PUTEVI UNAKRSNE KONTAMINACIJE I FAKTORI
VIRULENCIJE ZA *E. coli* O157:H7 I *Salmonella* spp.
PRI KLANJU GOVEDA: PODACI IZ LITERATURE**

Nastasijević I., Baltić Tatjana, Spirić Danka, Raseta M., Erdeljan M., Antić D.,
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Escherichia coli O157:H7 i *Salmonella* spp. su zoonotski alimentarni patogeni koji mogu da budu nošeni i fekalno izlučivani od strane zdravih goveda i unakrsno kontaminiraju goveđe trupove u toku procesa klanja. Međusobni odnos između ovih patogena u toku klanja goveda je nepoznat. Konačno određivanje korelacije između mikroorganizama i puteva unakrsne kontaminacije trupova zahteva izolaciju tih patogena iz istog uzorka, budući da se nivoi bakterija mogu značajno razlikovati u odnosu na pojedinačnu životinju ili trup.

Escherichia coli O157:H7 je tokom poslednje dve decenije bio patogen od značaja za industriju mesa. Prvi slučajevi hemolitičkog uremičkog sindroma (HUS) i hemoragičkog kolitisa (HC) izazvanog *E. coli* O157:H7 su bili u vezi sa konzumacijom nedovoljno termički obrađenog mlevenog goveđeg mesa, tokom ranih 80`ih godina. *Salmonella* spp. je već dugo poznata kao važan zoonotski patogen od ekonomskog značaja za životinje i ljude. Najdominantniji serovari u vezi sa kontaminacijom trupova goveda su *Salmonella Typhimurium* i *Salmonella Dublin*.

Glavni putevi unakrsne kontaminacije goveđih trupova u klanici se odnose na kontakte životinja-životinja i životinja-površine-životinja u depou; kao i unakrsne kontakte u toku faze klanja (boks za omamljivanje: koža-površine-koža; skidanje kože: koža-trup; evisceracija: sadržaj digestivnog trakta-trup; oprema/alati: radna postolja/noževi/testera za rasecanje-trup; radnici: ruke/odeća-trup; i vazduh: prašina/aerosoli-trup). Iz perspektive javnog zdravlja i izloženosti potrošača, dominantni faktori virulencije za odnosne patogene su: *vtx1*, *vtx2/vtx2c*, *eae*, *hly* (*E. coli* O157:H7) i *invA* (*Salmonella* spp.).

Dostupni podaci u vezi sa unakrsnom kontaminacijom goveđih trupova u klanici i njihovim faktorima virulencije, u Srbiji, su nedovoljni.

Stoga je prijavljen odnosni projektni predlog. Ciljno istraživanje će biti sprovedeno u cilju obezbeđenja osnovnih podataka o mogućim putevima za unakrsnu kontaminaciju goveđih trupova sa *E. coli* O157:H7 i *Salmonella* spp., u klanicama u Srbiji, i uticaj na javno zdravlje kroz determinaciju njihovih faktora virulencije.

Ključne reči: *E. coli* O157:H7, *Salmonella* spp., unakrsna kontaminacija, goveđi trupovi, faktori virulencije.

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THE ROUTES OF CROSS-CONTAMINATION AND VIRULENCE FACTORS OF *E. COLI* O157:H7 AND *SALMONELLA* SPP. IN CATTLE SLAUGHTER: LITERATURE DATA

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Escherichia coli O157:H7 and *Salmonella* spp. are zoonotic foodborne pathogens that are carried and excreted with feces by healthy cattle and may cross-contaminate beef carcasses during the slaughter process. The relationships between these pathogens throughout cattle slaughter are unknown. The definite determination of correlations between microorganisms and routes of carcass cross-contamination requires the recovery of the pathogens from a single sample since bacterial loads can differ significantly per animal or carcass.

Escherichia coli O157:H7 has been a pathogen of concern to the meat processing industry for two decades. First cases of hemolytic uremic syndrome (HUS) and hemorrhagic colitis (HC) caused by *E. coli* O157:H7 were associated with consumption of undercooked ground beef in the early 1980s. *Salmonella* spp. has long been recognized as an important zoonotic pathogen of economic significance in animals and humans. The most predominant serovars associated with contamination of cattle carcasses are *Salmonella* Typhimurium and *Salmonella* Dublin.

The main routes in abattoir cross-contamination of cattle carcasses are related to animal-animal and animal-surfaces-animal contacts during depot phase; and cross-contacts during slaughter phase (stunning box: hide-surface-hide; dehidating: hide-carcass; evisceration: gut content-carcass; equipment/tools: working stations/knives/splitting saws-carcass; workers: hands/clothes-carcass; and airborne: dust/aerosols-carcass). From the perspective of public health and consumer exposure, the predominant virulence factors for related pathogens are: *vtx1*, *vtx2/vtx2c*, *eae*, *hyl* (*E. coli* O157:H7) and *invA* (*Salmonella* spp.).

Available data regarding in abattoir cross contamination of cattle carcasses and their virulence factors, in Serbia, are scarce.

Therefore, the related project proposal has been submitted. The targeted research will be carried out to obtain the baseline data on possible routes for *E. coli* O157:H7 and *Salmonella* spp. cross-contamination of cattle carcasses, in Serbian abattoirs, and the impact on public health through determination of their virulence factors.

Key words: *E. coli* O157:H7, *Salmonella* spp., cross-contamination, cattle carcasses, virulence factors.

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**OCENA PREVALENCE I KONCENTRACIJE *E. COLI* O157:H7
I *SALMONELLA* SPP. U/NA GOVEĐEM FECESU, KOŽI,
TRUPOVIMA I MLEVENOM GOVEĐEM MESU POMOĆU
IMUNOMAGNETSKE SEPARACIJE I METODA DIREKTOG
ZASEJAVANJA: PODACI IZ LITERATURE**

Nastasijević I., Baltić Tatjana., Spirić Danka, Mitrović Radmila

Salmonella i *Escherichia coli* O157:H7 svake godine, prema procenama, izazivaju 151995 (31,1/100000 populacije) i 2905 potvrđenih slučajeva (0.6/100000 populacije) gastroenteritisa, respektivno, u državama članicama EU.

Poljoprivredna proizvodna sredina i životinje, uključujući svinje, živinu, i naročito goveda, su poznati rezervoari za *Salmonella* i *E. coli* O157:H7. Mleveno goveđe meso je prepoznato kao način prenošenja ovih patogena kod brojnih alimentarnih epidemija.

Brojne studije o mikrobiološkoj procesnoj higijeni pri klanju goveda su pokazale da je inicijalna kontaminacije kože u jakoj korelaciji sa posledičnim zagađenjem trupova, usled unakrsne kontaminacije (među- i/ili unutrašnja koža-trup kontaminacija) u toku obrade.

Jedan od aspekata za tačno određivanje prevalencije patogena u goveđem fecesu, koži, trupovima i mlevenom goveđem mesu je upotreba senzitivnih metoda za detekciju. Uvođenje Imunomagnetske separacije (IMS) je značajno unapredilo mogućnost za detekciju prisustva ovih patogena u relativno niskim koncentracijama, iz različitih matriksa. Ova tehnika uključuje selektivna obogaćenja na specifičnoj temperaturi inkubacije, magnetske kuglice obložene sa antitelima *E. coli* O157 ili *Salmonella* spp. za efektivno vezivanje ćelija patogena prisutnih u matriksu, zasejavanje na selektivne podloge, biohemijsku konfirmaciju i "dry spot" aglutinaciju.

Takođe, korišćenje metoda direktnog zasejavanja i specifičnih selektivnih podloga može da redukuje vreme potrebno za dobijanje pouzdanih rezultata o prevalenciji i enumeraciji patogena. Metod filtracije preko hidrofobne grid membrane (HGFM) i metod spiralnog zasejavanja na ploču (SPCM) predstavljaju brze alate za utvrđivanje nivoa patogena.

Metodi za direktnu enumeraciju su prikladni za visok protok pri obradi uzoraka i utvrđeno je da manje koštaju u određivanju prisustva *Salmonella* i *E. coli* O157:H7 u uzorcima prikupljenim u toku uzgoja i klanja goveda. Stoga, ovi brzi metodi za pouzdanu detekciju *E. coli* O157:H7 i *Salmonella* spp. u uzorcima goveđeg fecesa, kože, trupova i mlevenog goveđeg mesa mogu da budu razvijeni i rutinski korišćeni u pogonskim laboratorijama u industriji mesa, u Srbiji.

Ključne reči: *E. coli* O157:H7, *Salmonella* spp., imunomagnetska separacija, direktno zasejavanje

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EVALUATION OF *E. COLI* O157:H7 AND *SALMONELLA* SPP. PREVALENCE AND CONCENTRATIONS IN / ON CATTLE FECES, HIDES, CARCASSES AND GROUND BEEF BY IMMUNOMAGNETIC SEPARATION AND DIRECT PLATING METHODS: LITERATURE DATA

Nastasijevic I., Baltic Tatjana., Spiric Danka, Mitrovic Radmila

Salmonella and *Escherichia coli* O157:H7 are estimated to cause 151995 confirmed cases (31.1/100000 population) and 2905 confirmed cases (0.6/100000 population) of gastroenteritis, respectively, each year in the EU member states.

The agricultural environment and animals, including swine, poultry, and predominantly cattle, are noted reservoirs of *Salmonella* and *E. coli* O157:H7. Ground beef has been implicated as a mode of transmission for these pathogens in a number of food-borne disease outbreaks.

Many studies on the microbiological hygiene process of cattle at slaughter have shown that initial hide contamination is strongly correlated with subsequent carcass contamination, due to cross-contamination (inter- and/or intra hide-to-carcass contamination) during processing.

One aspect of determining accurate assessments of pathogen prevalence on cattle feces, hides, carcasses and raw (ground) beef is the use of sensitive detection methods. Introduction of Immunomagnetic Separation (IMS) has substantially improved the ability to detect the presence of these pathogens at relatively low levels from a variety of matrices. This technique includes selective enrichments at specific incubation regime, magnetic beads covered with *E. coli* O157 or *Salmonella* spp. antibodies for the effective capture of the pathogen cells presented in the matrix, subsequent plating onto selective media, biochemical confirmation and dry spot agglutination.

However, the use of direct plating methods and specific selective media can reduce the time needed to obtain reliable results, both – on prevalence and enumeration of pathogens. The hydrophobic grid membrane filtration (HGFM) method and the spiral plate count method (SPCM) are rapid tools for the estimation of pathogen load.

The direct enumeration methods are suitable to high flow sample processing and were found to be cost-effective for the estimation of *Salmonella* and *E. coli* O157:H7 in samples collected during cattle production and beef processing. Therefore, these rapid methods for reliable detection of *E. coli* O157:H7 and *Salmonella*

spp. in fecal, hide, carcass and ground beef samples may be introduced and routinely used at in-plant laboratories within meat industries in Serbia.

Key words: *E. coli* O157:H7, *Salmonella* spp., immunomagnetic separation, direct plating

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UPOREDNI PRIKAZ NALAZA BAKTERIJA *SALMONELLA* VRSTE U ŽIVINSKOM MESU NA PIJACAMA I U KLANICAMA ZA KLANJE ŽIVINE NA PODRUČJU VSI ‘SUBOTICA’ U PERIODU OD 2006. DO 2008. GODINE

Sabo Z., Kilibarda Nataša, Kiškarolj F., Pižurica A.

Snadbevanje trpeze živinskim mesom sa pijaca predstavlja ustaljenu naviku jednog dela potrošača koji prednost daju kupovini od poznatog proizvođača. Iako takvo meso potiče, uglavnom, iz manjih jata i stavlja se u promet na specifičan način, pre nego što stigne do trpeze prođe niz kontrola.

U toku tova nekoliko puta se obavlja pregled na salmonelu. Poslednje ispitivanje na salmonelu obavlja se dve nedelje pred klanje, jer se na klanici prima živina samo iz jata koje je „slobodno“ od salmoneloze. Na klanici se obavlja veterinarsko-sanitarni pregled kao i mikrobiološka kontrola dnevnog klanja na prisustvo bakterija *Salmonella* vrste. Poslednja kontrola se sprovodi u prometu prilikom prodaje na pijacama, kada se, takođe, uzimaju uzorci za mikrobiološka ispitivanja.

Cilj naših ispitivanja je bio da se utvrdi da li postoji uporednost nalaza bakterija *Salmonella* vrste u mesu na klanicama za klanje živine i u mesu živine na pijacama u toku dva sukcesivna dana posle klanja. Uzorci su ispitivani prema Pravilniku o metodama vršenja mikrobioloških analiza i superanaliza životnih namirnica (Sl. list SFRJ br. 25/80), a rezultati ispitivanja su tumačeni prema Pravilniku o mikrobiološkoj ispravnosti namirnica u prometu (Sl. list SRJ br.26/93).

U periodu od 2006. do 2008. godine sa pijaca je ispitano 376 uzoraka živinskog mesa, na području VSI „Subotica“. Bakterije *Salmonella* vrste su utvrđene u 36 (9,57 posto) uzoraka. Analizom mikrobioloških rezultata klanja tokom dva dana koja su predhodila pozitivnom nalazu na pijacama utvrđeno je da 20 (55,55 posto) uzoraka uopšte nije zaklano u klanicama, devet (25,00 posto) uzoraka je bilo negativno, a sedam (19,44 posto) uzoraka je bilo pozitivno na salmonelu.

Rezultati ispitivanja na prisustvo bakterija *Salmonella* vrste ukazuju na to da je više od polovine (55,55 %) pozitivnih uzoraka živinskog mesa koje je uzorkovano na pijacama zaklano nelegalno u neregistrovanim objektima. Negativni nalazi (25,00 posto) u klanicama upućuju na sličan zaključak, tj. da poreklo živine zaklane u klanicama i uzorkovane na pijacama nije isto. Prema zakonima, *Commission Regulation (EC) No. 2073/2005* da bi rezultati bili validni, trebalo bi da se ispita veći broj uzoraka (n , broj jedinica koje sačinjavaju uzorak = 50; c , broj uzoraka čija je vrednost između m i $M = 7$; granična vrednost = odsustvo u 25 g zbirnog uzorka kože vrata).

Ključne reči: *Salmonella*, živinsko meso, pijace, klanice

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**COMPARATIVE PREVIEW ON THE OCCURRENCE OF
SALMONELLA SPP. IN POULTRY MEAT SAMPLED ON OPEN
MARKETS AND POULTRY SLAUGHTERHOUSES IN THE
DISTRICT OF VSI "SUBOTICA" IN THE PERIOD
FROM 2006. TO 2008.**

Sabo Z., Natasa Kilibarda, F. Kiskarolj, Pižurica A.

Supplying the dining table with poultry meat from open markets represents a fixed habit of a group of customers who prefer purchasing from well known producers. Although that meat mainly arises from smaller flocks and is put on the market in a specific manner, it passes through a chain of controls before it arrives to the dining table.

During fattening, control of the presence of *Salmonella spp.* in flocks is conducted several times. The last control should be done a fortnight before slaughtering and only flocks that are free of salmonellosis can leave the farm. At the slaughterhouse, besides regular veterinary examination, microbiological control on the presence of *Salmonella spp.* is also performed on a daily basis. The next microbiological control is to be done on the markets during the sale.

The aim of our investigations has been to determine the frequency of detecting microbiologically inadequate poultry meat in the slaughterhouses and later on open markets two days after slaughtering. Samples were investigated in accordance with the Regulations on microbiological analyses and super analysis of food (Yugoslav Official Register, Nr. 25/80). Results of the testing were interpreted in accordance with the Regulations on microbiological correctness of food on sale (Yugoslav Official Register, Nr. 26/93.)

During the period of investigation, from 2006 to 2008, 376 samples of poultry meat were examined in the area of VSI "Subotica". The *Salmonella spp.* was found in 36 (9.57%) samples. The microbiological analysis of these samples taken in the slaughterhouses two days before their positive result of *Salmonella spp.* on open markets shows that 20 samples (55.55%) were not slaughtered in slaughterhouses at all, 9 samples (25.00%) were then negative, and 7 samples (19.44%) were positive to Salmonella.

The results of testing for the presence of *Salmonella spp.* indicate that more than half (55.55%) of the positive samples of poultry meat which was sampled on the markets was illegally slaughtered in unregistered facilities. The negative samples (25.00%) in the slaughterhouses show that the origin of the poultry slaughtered in slaughterhouses is not the same as the poultry sampled on the markets. According to regulations, Commission Regulation (EC) no. 2073/2005 when interpreting the results, the number of samples whose findings are on a tolerant level would increase (n - number of units comprising the sample = 50; c - number of sample units giving values between m and M = 7; limits = absence in 25 g of a pooled sample of neck skin).

Key words: *Salmonella spp.*, poultry meat, open markets, slaughterhouses.

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**METICILIN-REZISTENTAN STAPHYLOCOCCUS AUREUS
– NOVA PRETNJA BEZBEDNOSTI HRANE**

Velebit B., Janković Vesna, Borović Branka

Početakom 70-ih godina prošlog veka u bolničkom okruženju prvi put se pojavio meticilin-rezistentan soj *Staphylococcus aureus* (MRSA). Ova bakterija, inače saprofit na koži i sluzokožama ljudi i životinja, tokom prošlog veka stekla je rezistenciju prema beta-laktamskim antibioticima. U poslednjih nekoliko godina izolovani su prvi sojevi MRSA koji genotipski i fenotipski nisu karakteristični za sojeve izolovane iz nozokomijalnih infekcija. Epidemiološkim ispitivanjima utvrđeno je da ovi sojevi potiču od životinja koje se koriste za proizvodnju hrane. Dominantan soj CC938, nepoznatog porekla, masovno je prisutan kod svinja, ali izolovan je i kod goveda i živine u zemljama sa intenzivnom proizvodnjom hrane, kao što su Austrija, Belgija, Danska, Francuska, Holandija, Kanada, Nemačka. EU je, preko svojih referentnih laboratorija, pokrenula programe ispitivanja prevalencije i bezbednosti hrane kontaminirane MRSA.

Ključne reči: MRSA, bezbednost hrane, novi patogeni

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**METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS – A
NEW THREAT TO FOOD SAFETY**

Velebit B., Janković Vesna, Borović Branka

In the early 1970's a methicillin-resistant strain of *Staphylococcus aureus* (MRSA) occurred within the hospital environment. The bacterium otherwise present on human skin and mucosa as saprophytic flora has acquired during the last century resistance to beta-lactam antibiotics. In recent years MRSA strains occurred which were not phenotypically and genotypically characteristic as strains isolated from cases of nosocomial infections. Epidemiological surveys indicated that these strains originated from animals used in food production. Dominant strain CC938 of unknown origin was widely spread among the population of pigs, cattle and chicken, mostly in countries having intensive food production such as Austria, Belgium, Denmark, France, The Netherlands, Canada and Germany. Recently, EU by virtue of MRSA reference laboratories, has initiated surveillance programs and investigations of safety regarding MRSA-contaminated food.

Key words: MRSA, food safety, emerging pathogens

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***Campylobacter* spp. U LANCU ŽIVINSKOG MESA I OCENA EKSPozICIJE POTROŠAČA: PODACI IZ LITERATURE**

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Kampilobakteriozu kod ljudi izazivaju termofilni sojevi *Campylobacter* spp. (*C. jejuni*, *C. coli* i *C. lari*). Primarni prirodni rezervoar termofilnih *Campylobacter* vrsta je digestivni trakt domaćih i divljih ptica/sisara.

Campylobacter spp. danas predstavlja ozbiljan problem javnog zdravlja na nivou EU, odnosno najčešće utvrđen patogen kod alimentarnih epidemija ljudi. Tako je u 2007. godini incidenca oboljevanja u EU bila na nivou od 45,2/100.000 populacije, odnosno 200.507 registrovanih/prijavljenih slučajeva oboljenja, što predstavlja povećanje broja obolelih od skoro 25.000 slučajeva, u odnosu na prethodnu godinu.

Campylobacter spp. putem fekalne ekskrecije od strane klinički zdravih ptica/sisara dospeva u lanac hrane i kontaminira namirnice (meso, nepasterizovano mleko/mlečni proizvodi i ponekad – ribe/proizvodi od ribe). Glavni izvori infekcije kod ljudi su živinsko meso/proizvodi od živinskog mesa (*C. jejuni*) i to najčešće usled unakrsne kontaminacije: „ready-to-eat“ proizvoda (proizvodi spremni za konzumiranje); ruku, u toku pripremanja hrane i konzumiranjem nedovoljno termički obrađenog živinskog mesa.

Campylobacter jejuni izaziva gastroenteritis, sa inkubacijom od 2–5 dana i kliničkim manifestacijama poput vodene, ponekad hemoragične dijareje, abdominalnih bolova, groznice, mučnine i povraćanja. U najtežim slučajevima može doći i do letalnog ishoda usled respiratornih i neuroloških disfunkcija. Infektivna doza može da bude manja od 500 CFU/g.

Živinsko meso postaje fekalno kontaminirano sa *Campylobacter* spp., poreklom iz gastrointestinalnog trakta živine, u toku procesa klanja i to unakrsnom kontaminacijom trupova. Najkritičnije radne operacije u toku klanja i obrade su: šurenje, čupanje perja, evisceracija, pranje i hlađenje. U gotovom proizvodu (ohlađeni trup živine) kontaminacija ovim zoonotskim patogenom se pojavljuje na celoj površini trupa. Prema dostupnim podacima iz literature, *Campylobacter* spp. je najčešće izolovan sa sledećih regija trupa: koža vrata (89% uzoraka), abdominalna šupljina (93% uzoraka) i ispod kože (75% uzoraka). Kod pozitivnih trupova, broj *Campylobacter* spp. je nakon klanja, obrade i hlađenja na nivou od 100–1000 CFU/cm² i uočena je veća učestalost ovog patogena u predelu kože vrata i kloakalne regije.

Primena dobre higijenske i dobre proizvođačke prakse u toku procesa klanja i obrade umanjuje unakrsnu kontaminaciju trupova sa *Campylobacter jejuni* (npr: uklanjanje fekalnog sadržaja i perja sa trupova i opreme). „Sigurno“ pakovanje gotovog proizvoda treba da spreči transfer bakterija tokom rukovanja i pripremanja hrane. Upotreba „dodatno“ hlorisane vode, za dekontaminaciju opreme kontamini-

rane fekalnim sadržajem živine/trupovima iz *Campylobacter* – pozitivnih jata, takođe umanjuje mogućnost unakrsne kontaminacije trupova.

U Srbiji, prema našem saznanju, ne postoji sistematizovana i pouzdana baza podataka o učestalosti *Campylobacter* spp. u lancu živinskog mesa. U fazi pripreme je projekat koji će imati za cilj utvrđivanje prevalencije ovog zoonotskog alimentarnog patogena u svim fazama lanca živinskog mesa, čime će se obezbediti kvalitetni i pouzdani podaci za ocenu ekspozicije potrošača, u našoj zemlji.

Ključne reči: *Campylobacter* spp., lanac živinskog mesa, ocena ekspozicije potrošača

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***Campylobacter* spp. IN THE POULTRY MEAT CHAIN AND EXPOSURE ASSESSMENT OF CONSUMERS: LITERATURE DATA**

Jovanovic Jelena, Nastasijevi, I., Milijasevic, M., Babic Jelena

Human campylobacteriosis is caused by thermophilic strains of *Campylobacter* spp. (*C. jejuni*, *C. coli* and *C. lari*). The primary natural reservoir of thermophilic *Campylobacter* is the gastrointestinal tract (GIT) of domestic and wild birds/ mammals.

Nowadays, *Campylobacter* spp. is a serious public health problem in the EU, and the most common pathogen found in the human foodborne outbreaks/ epidemics. The overall incidence of campylobacteriosis in the EU, in 2007 was at the level of 45.2/100.000 population, or 200.507 reported cases, which represents an increase by almost 25.000 cases, compared to the previous year.

By faecal excretion from clinically healthy birds/ mammals, *Campylobacter* spp. can enter the food chain and contaminate food (meat/ meat products, unpasteurized milk/milk products and sometimes - fish/fishery products). The main source of human infection are poultry meat/ poultry meat products (*C. jejuni*); due to cross-contamination: ready-to-eat products; hand-to-mouth, during food preparation; and consumption of undercooked poultry meat.

Campylobacter jejuni causes gastroenteritis with an incubation period of 2-5 days and clinical symptoms of watery (sometimes bloody) diarrhea, abdominal pain, fever, nausea and vomiting. The most difficult cases can lead to a lethal outcome due to respiratory and neurological dysfunction. The infectious dose can be less than 500 CFU/g.

Poultry meat becomes contaminated with *Campylobacter* spp., from the poultry GIT during the slaughter process due to cross-contamination of carcasses. The most critical process steps in the slaughter and processing are: scalding, defeathering, evisceration, washing and chilling. In the final product (chilled poultry carcass) the contamination of this zoonotic foodborne pathogen usually appears over

the entire surface of the carcass. According to literature data, *Campylobacter* spp. is usually isolated from the following carcass regions: the abdominal cavity (93% of samples), the neck skin (89% of samples), and under the skin (75% of samples). The levels of *Campylobacter* spp., in positive carcasses - after the slaughter, processing and chilling, are about 100-1000 CFU/cm², with a detected higher occurrence on the neck skin and around the cloacal area.

Application of good hygienic and good manufacture practices (GHP/GMP) during the slaughter and processing can reduce cross-contamination of broiler carcasses with *Campylobacter jejuni*. „Safe“ packaging of the final products should prevent the transfer of bacteria during handling and preparation. The use of „additionally“ chlorinated water, for decontamination of equipment, contaminated by the faecal content originated from poultry GIT or carcasses from *Campylobacter* positive flocks, also reduces the possibility of carcasses cross-contamination.

In Serbia, according to our knowledge, the systematic and reliable database on *Campylobacter* spp. occurrences in the poultry meat chain, are scarce. Therefore, the research project, which should be tailored for determination of the prevalence of this zoonotic foodborne pathogen in all phases of the poultry meat chain, is under preparation. This targeted research will provide quality and reliable baseline data for the exposure assessment of consumers, in our country.

Key words: *Campylobacter* spp., poultry meat chain, exposure assessment, consumers

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METODE IZOLACIJE I SUBTIPIZACIJE *Campylobacter* spp. U LANCU ŽIVINSKOG MESA: PODACI IZ LITERATURE

Jovanović Jelena, Nastasijević I., Mitrović Radmila

Za utvrđivanje učestalosti *Campylobacter* spp. u lancu živinskog mesa potrebno je prikupiti uzorke u svim glavnim fazama/modulima lanca živinskog mesa: 1. farma, 2. klanica, 3. prerada i 4. maloprodaja.

Učestalost *Campylobacter* spp. u uzorcima cekuma ukazuje na prisustvo ovog patogena na nivou farme, dok prisustvo ovog patogena na trupu živine – nakon klanja, obrade i hlađenja i u maloprodaji – ukazuje na unakrsnu kontaminaciju, odnosno neadekvantnu primenu GHP/GMP i HACCP sistema.

Farma. Za utvrđivanje učestalosti ovog patogena prikupljaju se uzorci cekuma, u klanici – nakon evisceracije. Potrebno je nasumično uzeti jedan netaknuti cekum po ptici. Deset cekuma se stavlja u jednu sterilnu kesu. Uzorci cekuma se transportuju u roku od 24h u laboratoriju, na temperaturi $< 4^{\circ}\text{C}$, i odmah se analiziraju.

Klanica. Jedan trup, po proizvodnoj partiji, treba uzeti odmah nakon hlađenja, ali pre dalje obrade (npr: zamrzavanje, rasecanje ili pakovanje). Uzeti uzorak se stavlja u sterilnu kesu, izbegavajući unakrsnu kontaminaciju, i dostavlja u laboratoriju u roku od 24h, na temperaturi $< 4^{\circ}\text{C}$. U laboratoriji se uzorkuje koža sa trupa.

Prerada/maloprodaja. Za utvrđivanje učestalosti ovog patogena se uzima jedan trup, po istom principu kao i u klanici (jedna proizvodna partija ili jedna prodajna partija). Transport i način ispitivanja u laboratoriji je isti kao i u prethodnom slučaju.

Izolacija Campylobacter spp. (ISO 10272-1:2006). Uzorak treba da ima očuvan integritet, odnosno ne sme biti promenjen ili oštećen u toku transporta ili čuvanja. Postupci uključuju selektivno obogaćenje (Bolton bujon) u mikroaerofilnim uslovima i inkubaciju na $37\pm 1^{\circ}\text{C}$ 4-6h, a potom na $41,5\pm 1^{\circ}\text{C}$ tokom $44\pm 4\text{h}$. Nakon inkubacije, obavlja se inokulisanje uzorka na selektivne podloge (mCCD agar, Skirrow, Karmali ili Preston agar). Inokulisane podloge se mikroaerofilno inkubiraju na $41,5^{\circ}\text{C}$, u trajanju od $44\text{h}\pm 4\text{h}$. Nakon inkubiranja se vizuelnim pregledom utvrđuje rast/prisustvo tipičnih, ili sumnjivih kolonija *Campylobacter* spp. Tipične kolonije su sivkaste, često sa metalnim sjajem, pljosnate i vlažne, sa tendencijom širenja (mCCD agar). Mogu se naći i drugi oblici kolonija.

Konfirmacija. Izaberu se 5 tipičnih/sumnjivih kolonija sa selektivnih podloga, obavi se presejavanje na neselektivnu podlogu (Kolumbija krvni agar), inkubira se u mikroaerofilnim uslovima, na $41,5^{\circ}\text{C}$ tokom 24h-48h. Izrasle kolonije potvrđuju se mikroskopskim pregledom, biohemijskim testovima i testovima rasta.

Identifikacija Campylobacter vrsta. U izolovane sojeve *Campylobacter* spp. koji rastu na $41,5^{\circ}\text{C}$, najčešće spadaju *Campylobacter jejuni* i *Campylobacter coli*. Identifikacija *Campylobacter* vrsta se radi preko sledećih testova: katalaza test, reak-

cija osetljivosti na nalidiksinsku kiselinu i cefalotin, test hidrolize hipurita i test hidrolize indoksil acetata.

Subtipizacija Campylobacter spp. Metode koje se koriste za subtipizaciju *Campylobacter* vrsta, imaju za cilj da dokažu poreklo izolata (ljudi, hrana, životinje, životna sredina) i korisno su sredstvo u epidemiološkom istraživanju bolesti izazvanih hranom. Dostupne tehnike su: polimorfizam dužine amplifikovanih fragmenata (AFLP, amplified fragment length polymorphism), gel elektroforeza u pulsirajućem polju (PFGE, pulsed field gel electrophoresis), tipizacija sekvencioniranjem više lokusa (MLST, multi locus sequence typing), komparativna genomska hibridizacija (CGH, comparative genome hybridization) ili DNK array tehnologija.

Ključne reči: *Campylobacter* spp., lanac živinskog mesa, uzorkovanje, izolacija, subtipizacija

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METHODS FOR ISOLATION AND SUBTYPING OF CAMPYLOBACTER SPP. IN THE POULTRY MEAT CHAIN: LITERATURE DATA

Jovanovic Jelena, Nastasijevic, I. , Mitrovic Radmila

To determine the frequency of *Campylobacter* spp. in the poultry meat chain it is necessary to collect samples in all the main phases of the poultry meat chain: 1. farm, 2. slaughterhouse, 3. processing, and 4. retail.

Frequency of *Campylobacter* spp. in caecal samples indicates the presence of pathogens on the farm level, while the presence of pathogens on the poultry carcasses – after the slaughter, processing and chilling, and retail – points to the cross-contamination, or inadequate application of GHP/GMP and HACCP system.

Farm. For establish the frequency of this pathogen, caecal samples are collected in the slaughterhouse – after evisceration. One intact caecum per bird should be taken randomly. Ten caeca are put in a sterile bag, as a pooled sample. Samples should be transported within 24 hours to the laboratory, at a temperature < 4°C, and processed as soon as possible.

Slaughterhouse. One carcass per slaughter batch should be taken immediately after chilling, but before further processing (e.g. freezing, cutting or packaging). The sample is placed in a sterile bag, avoiding cross-contamination, and sent to the laboratory within 24 hours, at < 4°C. In the laboratory, the carcass skin should be removed.

Processing / retailing. To establish the frequency of this pathogen one carcass is taken by the same principle as in the slaughterhouse (one carcass per one retail lot). Transport and testing in the laboratory is the same as in the previous case.

Isolation of Campylobacter spp. (ISO 10272-1:2006). The integrity of the sample should be maintained, without any alterations or damage during transport and storage. The procedure includes selective enrichment (Bolton broth) in microaerophilic conditions, incubation at $37 \pm 1^\circ\text{C}$ for 4 - 6h and, then, at $41.5 \pm 1^\circ\text{C}$ for $44 \pm 4\text{h}$. After incubation, the sample is inoculated on selective media (mCCD agar, Skirrow, Karmali or Preston agar). Inoculated plates are incubated in microaerophilic atmosphere at 41.5°C , for $44\text{h} \pm 4\text{h}$. After incubation, the growth / presence of typical or suspicious colonies of *Campylobacter* spp. are determined by visual examination. Typical colonies are greyish, often with a metallic sheen, flat and moist, with a tendency to spread (mCCD agar). Other forms of colonies can be found, as well.

Confirmation. The 5 typical / suspected colonies should be selected from the selective medium, and streaked to the nonselective medium (Columbia blood agar), incubated in microaerophilic conditions, at 41.5°C , during 24 - 48h. Grown colonies should be confirmed by microscopic examination, biochemical tests and tests of growth.

Identification of Campylobacter species. Of the isolated strains of *Campylobacter* spp. that grow at 41.5°C , the most common are *Campylobacter jejuni* and *Campylobacter coli*. Identification of *Campylobacter* species can be done by the following tests: catalase test, detection of sensitivity to nalidixic acid and to cephaloxin, detection of hippurate hydrolysis and detection of indoxyl acetate hydrolysis.

Subtyping of Campylobacter spp. Subtyping of *Campylobacter* spp. has the aim of proving the source / origin of isolates (e.g. humans, food, animals, environment) and it is an important tool in foodborne epidemiological investigations. Available techniques are: amplified fragment length polymorphism (AFLP), pulsed field gel electrophoresis (PFGE), multi locus sequence typing (MLST), comparative genome hybridization (CGH) or DNA array technology.

Key words: *Campylobacter* spp., poultry meat chain, sampling, isolation, subtyping

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UČESTALOST NALAZA KOLIFORMNIH BAKTERIJA U NAMIRNICAMA ANIMALNOG POREKLA

Pešić-Mikulec Dragana, Vuković Svetlana

Koliformne bakterije pripadaju porodici *Enterobacteriaceae* i vrlo su rasprostranjene u prirodi. U porodici *Enterobacteriaceae* spada 38 rodova, od kojih su najvažniji rodovi, *Escherichia*, *Klebsiella*, *Enterobacter*, i *Citrobacter*. Koliformne bakterije predstavljaju dio normalne mikroflore creva. U odnosu na temperaturu rasta, dele se na fekalne koliformne bakterije i druge koliformne bakterije, koje vode poreklo iz zemlje, biljaka i okoline. Fekalne koliformne bakterije se nalaze u fecesu toplokrvnih životinja i rastu pri temperaturi od 44.°C. Predstavnik grupe fekalnih koliformnih bakterija je *Escherichia coli*. U sanitarnoj mikrobiologiji najvažnije su fekalne koliformne bakterije, jer se izlučuju fekalijama, dospjevaju u otpadne vode a preko njih u prirodne vode koje primaju otpadne vode. Ljudi dolaze u kontakt sa koliformnim bakterijama preko hrane, npr. namirnice životinjskog porekla.

U periodu od dve godine ispitivali smo 8250 uzoraka namirnica životinjskog porekla. Broj pozitivnih uzoraka na prisustvo *Escherichia coli* iznosio je 488. Za jednu godinu broj ispitanih uzoraka je iznosio 4128, a broj pozitivnih uzoraka 282, odnosno 6,83 posto. U drugoj godini je ispitano 4122, a broj pozitivnih uzoraka 206, odnosno 4,99 posto. Detekcija koliformnih mikroorganizama se koristi kao indikator sanitarnih uslova proizvodnje i rukovanja sa namirnicama. Koliformne mikroorganizme smo identifikovali na osnovu morfoloških, kulturnih i biohemijskih osobina, a u skladu sa važećom Zakonskom regulativom.

Prisustvo fekalnih koliformnih bakterija ukazuje da je namirnica bila kontaminirana fekalnim otpadom ljudi, ili životinja. Prisustvo koliformnih bakterija fekalne kontaminacije znači da su i drugi patogeni mikroorganizmi prisutni u namirnici.

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FINDINGS OF COLIFORM BACTERIA IN FOOD OF ANIMAL ORIGIN

Pesic-Mikulec Dragana, Vukovic Svetlana

Coliform bacteria belong to the family *Enterobacteriaceae*, and are very common in nature. The family *Enterobacteriaceae* consists of 38 branches of which the most important are the families *Escherichia*, *Klebsiella*, *Enterobacter*, and *Citrobacter*. Coliform bacteria are part of the normal intestinal microflora. In relation to the growth temperature they either belong to the group of intestinal coliform bacteria or originate from soil, plants or environment. Intestinal coliform bacteria are present

in the excrement of animals and grow at a temperature of 44°C . The representative of this bacteria is *Escherichia coli*. In sanitary microbiology it is the most important bacteria because they are excreted by excrements, reach the waste water through which there are present in natural waters. People come in contact with the bacteria through contaminated food of animal origin.

In a two year period we examined 8250 samples of food of animal origin, the number of positive samples for the presence of *Escherichia coli* was 488. During the first year the number of samples examined was 4128 and the number of positive samples was 282 or 6.83%. In the second year we examined 4122 samples and the number of positive samples was 206 or 4.99%. Detection the coliform microorganisms is used as an indicator of the sanitary conditions of production and food handling. *E. Coli* was identified on the basis of morphological, biochemical and other properties in accordance with the valid legal regulations.

Intestinal coliform bacteria and their presence indicates that the food was contaminated by waste water, and / or excreta of human or animal origin. Contamination with these bacteria indicates the presence of other pathogen bacteria in the food, as well.

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**PRIMENA ENROFLOKSACINA U ŽIVINARSTVU KAO
POTENCIJALNI RIZIK ZA BEZBEDNOST HRANE – REZIDUE
VETERINARSKIH LEKOVA U JESTIVIM TKIVIMA**

Petrović Jelena, Stefanović S., Baltić M. Ž., Ratajac R., Rackov Olga

Danas su u nauci o bezbednosti hrane definisane dve glavne opasnosti koje nastaju kao direktna posledica primene anitimikrobnih lekova: rezidue u jestivim tkivima i razvijanje rezistencije zoonotskih patogena. Enrofloksacin je antimikrobni lek iz grupe fluorohinolona. U Srbiji je registrovan za upotrebu kod živine. Cilj eksperimentalnih ispitivanja je eliminisanje rizika po zdravlje potrošača na osnovu praćenja sadržaja rezidua enrofloksacina i njegovog glavnog metabolita ciprofloksacina u tkivima lečenih brojlera. U ogledu je ispitano prisustvo rezidua u mesu i jetri pilića koji su tretirani propisanim, terapijskim dozama enrofloksacina. Sadržaj rezidua je izmeren metodom HPLC/Fl (Tečna hromatografije visoke performanse sa fluorescentnim detektorom). Tokom pet dana aplikovanja leka, i prva tri dana karence, koncentracije enrofloksacina i ciprofloksacina su bile veće od MDK vrednosti (MDK–maksimalno dozvoljene količine), propisanih u EU.

Nakon propisanog aplikovanja antimikrobnih lekova sadržaj rezidua u jestivim tkivima opada do dozvoljenih vrednosti (manje od MDK) tokom propisanog perioda karence od sedam dana. Međutim, i nakon isteka karence rezidue se zadržavaju u jestivim tkivima, u dužem vremenskom periodu. Rezidue enrofloksacina mogu da se dokažu u mesu sve do devetog dana od prekida terapije, dok se u jetri zadržavaju mnogo duže. Tek 22. dana od prekida terapije nije potvrđeno prisustvo rezidua u jetri.

Ključne reči: bezbednost hrane, enrofloksacin, živina, rizik, rezidue

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**USAGE OF ENROFLOXACINE IN POULTRY PRODUCTION, AS
A POTENTIAL RISK FOR FOOD SAFETY – VETERINARY DRUG
RESIDUES IN EDIBLE TISSUES**

Petrovic Jelena, Stefanovic S., Baltic M. Z., Ratajac R., Rackov Olga

The most important side effects of antimicrobial drugs usage are veterinary drug residues in edible animal tissues and development of resistance in food borne pathogens. Enrofloxacin is a fluoroquinolone licensed in Serbia for use in poultry

treatment. The aim of this study was to examine the target tissue residues of enrofloxacin and its main metabolite ciprofloxacin, in order to eliminate health risks for the consumers. The presence of residues in the muscle and liver after prescribed administration of enrofloxacin to chickens was studied in our experiment. HPLC/FI was used for the detection of enrofloxacin and ciprofloxacin residues. During the 5 days administration period, and the first three days of the withdrawal period, enrofloxacin and ciprofloxacin concentrations in breast muscle and liver exceeded the EU MRL values (MRL-maximum residue limit). After correct application of the antimicrobial drug, tissue residue levels decreased to permitted quantities (below MRL) within the prescribed withdrawal period of seven days. However, even after the withdrawal period residues are still present in edible animal tissues. Residues of enrofloxacin can be detected in meat nine days after the end of treatment and residues in the liver are present much longer. Residues were detected in the liver up to 22 days post treatment.

Key words: therapy, enrofloxacin, poultry, risk, safety food, residues

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PREGLED REZULTATA ANALIZA ZDRAVSTVENE ISPRAVNOSTI ZAMRZNUTIH FILETA *Pangasius hypophthalmus*

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Pangasius (Pangasius hypophthalmus) ili kako je još zovu, suči som ili azijski som, je slatkovodna riba koja se intenzivno gaji u delti reke Mekong u Vijetnamu. Zamrznuti fileti ove ribe su u poslednjih nekoliko godina prisutni na tržištu Srbije. Cilj ovog rada je da prikaže rezultate analiza zdravstvene ispravnosti zamrznutih fileta *Pangasius hypophthalmus* koji su uveženi u Srbiju u periodu od novembra 2007. do marta 2009. godine. Ukupno je analizirano 89 uzoraka. U sklopu ovih analiza rađena su mikrobiološka ispitivanja, koja su obuhvatila *Salmonella* vrste, koagulaza pozitivne stafilokoke, sulfitoredujuće klostridije, *Proteus* vrste, *E. coli* i ukupan broj aerobnih mezofilnih bakterija. Urađena su i ispitivanja na prisustvo rezidua hloramfenikola. Od hemijskih kontaminenata ispitivano je prisustvo organohlorinih pesticida (lindan, HCH alfa i beta izomer, aldrin i dieldrin, heptahlor i heptahlorepoksid, DDT, endrin, HCB, hlordan), polihlorovanih bifenila (PCB), arsena i teških metala (olovo–Pb, kadmijum–Cd, živa–Hg). Ispitivanja su uključila i senzornu ocenu i utvrđivanje prisustva parazita u filetima pangasiusa.

Svi ispitani uzorci fileta su ispunili zahteve propisane važećim pravilnicima iz datih oblasti. Sa aspekta bezbednosti hrane, analizirani fileti pangasiusa su dobrog kvaliteta, sa koncentracijom hemijskih kontaminenata ispod dozvoljenih granica, bez povećanog broja ispitivanih mikroorganizama, bez prisustva parazita i bez organoleptičkih nedostataka koji bi doveli do odbijanja proizvoda.

Ključne reči: fileti pangasiusa, zdravstvena ispravnost, mikroorganizmi, hemijski kontaminanti

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REVIEW OF FOOD SAFETY PARAMETERS OF FROZEN *Pangasius hypophthalmus* FILLETS

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Pangasius (Pangasius hypophthalmus), or how it is called, sutchi catfish or asian catfish, is a freshwater fish that is intensively bred in the Mekong delta in Vietnam. Frozen fillets of this fish are present on the Serbian market in the last few years. The aim of this paper is to present the results of the analyses of sanitary proprieties of

pangasius filets that were imported to Serbia in the period from November 2007 to March 2009. A total of 89 samples was analyzed. Microbiological analyses included *Salmonella* species, coagulase positive staphylococci, sulphate-reducing clostridia, *Proteus* species, *E.coli* and the total number of aerobic bacteria. Scanning of chloramphenicol residues was conducted also. The presence of chemical contaminants such as organochlorine pesticides (lindane, HCH alpha and beta isomers, aldrin, dieldrin, heptachlor, heptachlor epoxide, DDT, endrin, HCB, chlordane), polychlorinated biphenyls (PCB), arsenic (As), heavy metals (lead-Pb, cadmium-Cd, mercury-Hg) was examined. Sensory evaluation and determination of the presence of fish parasites in filets of sutchi catfish were included in tests.

All analyzed samples met the requirements prescribed by the regulations in these areas. As regards safety aspects, the quality of the analysed samples was good, with concentrations of chemical contaminants below tolerable limits, with no increase in the number of investigated microorganisms and parasites, as well as without sensorial deficiency that would lead to the rejection of products.

Key words: filets of suchi catfish, sanitary propriety, microorganisms, chemical contaminants

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IMUNOENZIMSKA ISPITIVANJA I REZIDUE VETERINARSKIH LEKOVA: POUZDANOST TRENUTNO DOSTUPNIH TEST KITOVA, PRISTUPI PROCESU VALIDACIJE I BUDUĆI RAZVOJ

M. Paleologo, F. Tamburlini, T. Vatai

Rezidue veterinarskih lekova spadaju u pitanja bezbednosti hrane. Dok su neke rezidue toksične za potrošače, zloupotrebe drugih, poput antibiotika mogu doprineti pojavi rezistentnih bakterija, što otežava borbu sa izvesnim infektivnim bolestima. Još od 1980-ih, Codex Alimentarius i vlade mnogih zemalja su propisali maksimalne nivoe rezidua lekova u hrani animalnog porekla. Da bi se osiguralo da ovi nivoi u namirnicama (meso, mleko, jaja i med) ne prelaze zakonom propisane vrednosti, mora se sprovesti veliki broj ispitivanja. Primenom metoda kao što su GC, LC-MS, LC-MS/MS itd. broj uzoraka koji se istovremeno može obraditi je dosta nizak. Zbog toga se primenjuju metode visoke propusne moći, uglavnom imunoenzimska ispitivanja. Poslednjih godina razvijeni su kako brze metode koji se primenjuju u terenskim uslovima, tako i laboratorijske metode. Obe su često dostupne u vidu komercijalnih kitova.

Brza imunoenzimska ispitivanja se uglavnom primenjuju u analizama mleka, naročito u zapadnim zemljama, dok su tradicionalni ELISA kitovi razvijeni za meso, morske plodove i med. Glavni nedostatak trenutno dostupnih test kitova je njihova selektivnost. Da bi se ispitao određeni matriks na klasu lekova, potrebno je koristiti nekoliko kitova što ima za posledicu trijažni proces koji zahteva mnogo vremena i finansijskih sredstava. U nekim slučajevima, veoma je važna brza i laka priprema uzorka što vodi pojavi interferenci, pogrešnoj interpretaciji rezultata i lažno pozitivnim rezultatima. Pažljiva optimizacija, validacija i rutinska kontrola kvaliteta imunoenzimskih metoda se zahtevaju u cilju eliminacije lažno negativnih rezultata i održavanja broja lažno pozitivnih rezultata na razumnom nivou. Nažalost, dok se ulažu veliki resursi u razvoj, validaciju i obezbeđivanje kvaliteta konfirmatornih instrumentalnih metoda, naponi koji se odnose na trijažne metode su nedovoljni. Odluka EU 2002/657 koja propisuje kriterijume kvaliteta za analitičke metode u oblasti rezidua ne daje u dovoljnoj meri smernice rutinskim laboratorijama za složenu validaciju ELISA kitova. Veoma često, da bi uštedele na resursima, laboratorije validuju test kitove samo korišćenjem obogaćenih uzoraka i obavljaju rutinska ispitivanja ne uzimajući u obzir podatke o validaciji. Da bismo ukazali na rizike koje ovakav pristup donosi, pozvaćemo se na primere 19-nortestosterona, zeranola kao i β -agonista. Takođe ćemo prezentovati rezultate testova kompetentnosti laboratorija u kojima se vidi razlika između trijažnih i konfirmatornih metoda, kao što je «Progetto Trieste». Sve veća dostupnost prirodno kontaminiranih kontrolnih uzoraka bilo u cilju izvođenja testova kompetentnosti, bilo u vidu sertifikovanih referentnih materijala omogućiće da se test kitovi validuju na pouzdaniji način.

Uvođenje automatskih ELIZA analizatora (robota) olakšava istovremenu upotrebu više test kitova u jednoj analizi. Na ovaj način, omogućena je brza trijaža na veliki broj rezidua veterinarskih lekova. U bliskoj budućnosti, «multiplex bead suspension» imunoenzimske analize, koje omogućavaju izvođenje više analiza u istoj mikrotitar jedinici, predstavljaju obećavajuću tehnologiju.

Ključne reči: rezidue veterinarskih lekova, ELISA, validacija, test kompetentnosti

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“IMMUNOASSAYS AND VETERINARY DRUG RESIDUES: RELIABILITY OF CURRENTLY AVAILABLE TEST KITS, VALIDATION APPROACHES AND FUTURE DEVELOPMENTS”

M. Paleologo, F. Tamburlini. T. Vatai

Veterinary drug residues are a food safety issue. Some residues are toxic for the consumers, while the abuse of others, like antibiotics, could bring to the selection of resistant strains of bacteria, making more difficult to fight certain infectious disease. Since the Eighties, CODEX Alimentarius and the governments of many countries have regulated the maximum levels of drug residues in food of animal origin. In order to guarantee the compliance of foodstuffs (meat, milk, eggs and honey) a huge number of tests must be performed. By instrumental methods (GC or LC-MS, LC-MSMS, etc.) the number of samples that can be processed simultaneously is quite low. So, high throughput screening methods have been applied, mainly immunoassays. Both rapid field systems and laboratory assays have been developed in the last years and they have often been transformed into industrial products.

Rapid immunoassays have mainly been applied to milk testing, especially in western countries, while “traditional” ELISA kits have been developed for meat, seafood and honey food chains. The main limitation of the currently available test kits is the selectivity; in fact in order to check the compliance of materials for a class of drugs, several kits have to be used, resulting in a time-consuming and expensive screening process. In some cases a critical issue is also the fast and easy sample pre-treatment leading to interferences, overestimation and false positive results. A careful optimization, validation and routine quality control of immunoassay screening is required in order to guarantee the absence of false negative results and to maintain false positive results below a reasonable percentage. Unfortunately, while a huge amount of resources is devoted to development, validation and quality assurance of confirmatory instrumental methods, the efforts on the screening side are quite inferior. The EU Decision 2002/657, that describes the quality criteria for the analytical methods in the residues field, is not sufficient to guide the routine laboratories in the complex work of ELISA kits validation. Quite often, in order to save resources, laboratories are evaluating and validating the kits just using spiked samples and fur-

thermore they manage the routine testing without taking so much into account the validation data. The examples of 19-nortestosterone and zeranol, as well as B-agonists, will be presented in order to show the risk of this approach. Proficiency test results that differentiate between screening and confirmatory methods, like “Progetto Trieste”, will also be shown. The availability of an increasing number of incurred control samples, either “surplus” proficiency tests materials or certified reference materials, will make possible to validate the test kits in a more reliable way.

The introduction of automatic ELISA analyzers (robots) is making easier the simultaneous use of several kits in the same analytical session. In this way the fast broad range screening of veterinary drug residues is possible. In the near future, multiplex bead suspension immunoassays seem to be a promising technology, allowing to perform many assays in the same microtiter well.

Key words: veterinary drug residues, ELISA, validation, proficiency test

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ODREĐIVANJE SADRŽAJA HISTAMINA U UZORCIMA RIBE

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Histamin je biološki aktivni amin koji ima širok spektar fizioloških i patoloških delovanja u organizmu. Ova delovanja ispoljava preko svojih specifičnih receptora, nakon lokalnog oslobađanja u pojedinim tkivima i organima. Zajedno sa još nekim supstancijama, kao što su serotonin, endogeni peptidi, leukotrieni, prostaglandini i citokinini, spada u autakoide, odnosno tkivne ili lokalne hormone.

Egzogeni histamin je proizvod razlaganja aminokiseline histidina koje je uzrokovano rastom određenih bakterijskih vrsta u hrani bogatoj proteinima (riba, sir, mleko, meso, različite vrste vina i pivo).

U ovom radu prikazani su rezultati kvantitativnog i kvalitativnog ispitivanja histamina u komercijalnim uzorcima ribe. Uzorci su analizirani metodom ELISA testa (Immunolab). Za potvrđivanje pozitivnih uzoraka, korišćena je konfirmativna TLC metoda.

Redovna kontrola riba i proizvoda od ribe na prisustvo histamina, edukacija proizvođača i potrošača, kao i ostvarivanje savremenih načela i koncepcije HACCP-a, mogu da smanje potencijalnu opasnost od histaminskog trovanja.

Ključne reči: histamin, riba, ELISA, TLC

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DETERMINATION OF HISTAMINE CONTENT IN FISH SAMPLES

Jankovic Vesna, Brankica Lakicevic, Danka Spiric, Branko V.

Histamine is a biologically active amine with a broad spectrum of physiological and pathological activities in the body. The histamine activity is manifested through its specific receptors after local release in some tissues and organs. Together with some other substances, such as serotonin, endogenic peptides, leukotrienes, prostaglandins and cytokinines, histamine is also classified as autacoids, tissue or local hormone respectively.

Exogenous histamine is a degradation product of the amino acid histidine, caused by growth of certain bacteria species in food rich in proteins, such as fish, cheese, milk, meat, different types of wine and beer.

This paper comprises the results of a possible presence and content of histamine in commercial fish samples of different origin. Samples were tested by ELISA and TLC methods.

Systematic control of fish and fish products with respect to histamine content, education of manufacturers and consumers and veterinary-sanitary control measures together with the implementation of HACCP can minimize the potential risk of histamine poisoning.

Key words: histamine, fish, ELISA, TLC

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UPRAVLJANJE RIZIKOM U IZRADI PROIZVODA OD MESA BEZ ALERGENA

Mirjana Milanović-Stevanović, Olivera Stanković, Jelena Jovanović

Povećanje broja ljudi u svetu alergičnih na različite sastojke hrane uticalo je na stalno proširenje liste sastojaka koji se smatraju alergenima. U Evropskoj uniji tu listu trenutno čini 14 alergena: kikiriki, koštunjavo voće (badem, lešnik, orah, pistaći), jaja, mleko, školjke i rakovi, riba, mekušci, susam, žitarice koje sadrže gluten (pšenica, raž, ječam, ovas), soja, celer, slačica, lupina i sumpor-dioksid i sulfiti. Među ovim sastojcima ima i onih koji se često koriste u izradi proizvoda od mesa (proizvodi od soje, mleka, jaja i pšenice, celer, slačica). Kod osetljivih osoba, bilo da su alergične ili imaju intoleranciju na pojedine sastojke (najčešće na laktozu i gluten), uzimanje hrane koja sadrži ove sastojke, čak i u vrlo malim količinama, može da izazove reakcije u organizmu (mučninu, povraćanje, svrab), ali i burne manifestacije praćene otokom sluzokoža, teškoćama u disanju, gutanju, padu krvnog pritiska, odnosno pojavi anafilaktičkog šoka. Jedini način da osetljive osobe, među kojima je i dosta dece, spreče alergijske reakcije jeste izbegavanje konzumiranja hrane koja sadrži alergene.

Imajući u vidu potrebu osoba sa alergijskim manifestacijama da na pristupačan i jednostavan način dođu do informacija o prisustvu sastojaka, za njih opasnih po zdravlje, zemlje Evropske unije su 2003. godine propisale obavezu posebnog deklarisanja prisustva alergena u prehrambenom proizvodu. Kod nas, za sada, postoji obaveza deklarisanja samo alergena poreklom iz žitarica (pšenica, raž, ječam i ovas).

S obzirom da se alergeni često ne inaktiviraju termičkim procesima i ostalim klasičnim postupcima konzervisanja obavezu proizvođača postaju mnogo veće, radi smanjenja rizika od prisustva neidentifikovanog, pa samim tim, i nedeklarisanog alergena. Garancija i deklarisanje da proizvod ne sadrži alergene podrazumeva uspostavljanje odgovarajućeg postupka upravljanja rizikom. Između ostalog, ovaj postupak sadrži poseban kontrolni plan koji obuhvata upravljanje sirovinama i proizvodnjom, uspostavljanje odgovarajućih proizvodnih procedura radi sprečavanja unakrsne kontaminacije alergenima, primenu odgovarajućih postupaka čišćenja i pranja opreme i pomoćnih sredstava, kontrolu efikasnosti čišćenja i pranja pomoću odgovarajućih savremenih analitičkih metoda, kao i posebnu obuku radnika. Postupak upravljanja rizikom se delimično zasniva na principima dobre proizvođačke i higijenske prakse i može da bude implementiran u HACCP sistem.

Ključne reči: alergeni, hrana, proizvodi od mesa, upravljanje rizikom

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Napomena: Rad je finansiran sredstvima Ministarstva za nauku i tehnološki razvoj Republike Srbije, u okviru projekta „ Unapređenje metoda kontrole bezbednosti i kvaliteta proizvoda od mesa radi potpunije zaštite zdravlja i interesa potrošača“ Ev.broj 20145.

RISK MANAGEMENT IN THE PRODUCTION OF THE MEAT PRODUCT WITHOUT ALLERGENS

Mirjana Milanovic-Stevanovic, Olivera Stankovic, Jelena Jovanovic

Worldwide increase of the number of people with allergies on various food ingredients constantly expands the list of ingredients that are considered allergens. In the European Union currently there is a list of 14 allergens: peanuts, tree nuts (almond, hazelnut, walnut, pistachio), eggs, milk, shellfish and crabs, fish, molluscs, sesame seeds, cereals containing gluten (wheat, rye, barley, oat), soybeans, celery, mustard, lupin and sulphur dioxide and sulphite. Among these ingredients there are also those that are used in the preparation of meat products (soybean, milk, eggs and wheat products, celery and mustard). Sensitive people, whether they are allergic or have an intolerance to certain ingredients (usually to lactose and gluten), by consuming food containing these ingredients, even in very small quantities, can cause adverse body reactions (nausea, vomiting, itching), as well as violent manifestations of swelling of mucous membranes, difficulties in breathing, swallowing, decreased blood pressure and anaphylactic shock. The only way that sensitive people, among them a large number of children, can prevent allergic reactions, is by avoiding consumption of food containing allergens.

From 2003 onwards, member states of the European Union have the obligation to label the presence of specific allergens in food products, bearing in mind the need of people with allergic manifestations for accessible and easy way to get the information about the presence of ingredients dangerous to their health. In our country, manufacturers are obligated to declare only allergens originating from cereals (wheat, rye, barley and oats).

Since allergens are often not inactivated by thermal treatment and other conventional procedures of conservation, obligations of manufacturers are much higher in order to decrease the risk of the presence of non-identified and also non-declared allergens. Warranties and labeling that the product does not contain allergens involves the establishment of appropriate procedure for risk management. Among other things, this process includes a control plan that considers management of raw materials and production, the establishment of appropriate production procedures in order to prevent allergen cross-contamination, the application of appropriate methods for cleaning and sanitation of equipment and supporting assets, control of the efficiency of cleaning and sanitation using appropriate modern analytical methods, and special staff training. The process of risk management is partly based on the principles of good hygiene and good manufacture practice, and may be implemented in the HACCP system.

Key words: allergens, food, meat products, risk management

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Note: *This paper was financially supported by the Ministry of Science and Technological Development of Republic Serbia, within the project „The advancement of analytical methods for safety and quality control of meat products designated for better consumers’ protection“ No. 20145.*

IV TEMATSKA OBLAST
4th THEMATIC TOPIC

BEZBEDNOST I KVALITET
SAFETY AND QUALITY

IV-1

**ULOGA KLANICA U INTEGRISANOM SISTEMU
PROIZVODNJE MESA**

Neel S.,

Integrirani sistem proizvodnje mesa predstavlja lanac koji počinje selekcijom genetskih osobina životinja i sistema uzgoja, a završava se efektivnim marketingom i distribucijom proizvoda visoke vrednosti koji su prihvatljivi za potrošača i poseduju dodatnu vrednost. Duž ovog lanca postoji mnogo učesnika, koji upravljaju procesima uzgoja, selekcije, ishrane, transporta, klanja, prerade, pakovanja, prodaje i distribuiraju proizvode od mesa visoke vrednosti na domaće i međunarodno tržište.

S obzirom da životinje koje ulaze u klanicu nisu identične, kao i da nisu svi proizvodi od mesa pogodni da zadovolje različite zahteve potrošača, neophodno je postojanje sistema za sortiranje i klasifikaciju, kao i alternativnih kanala za marketing. Na primer, životinje čije je meso pogodno za preradu u kobasice nisu pogodne za preradu u meso najvišeg kvaliteta s obzirom na završnu obradu koja je neophodna da privuče potrošače u maloprodaji. Na suprot ovome, životinje sa genetskim potencijalom za visoko kvalitetnim mesom koje je veoma poželjno na tržištu su isuviše vredne da bi se njihovo meso prerađivalo u kobasičarske proizvode. Stoga, integrirani sistem marketinga za crveno meso zahteva koncizan a ipak višeslojni strateški plan koji uključuje razvoj odvojenih proizvodnih linija od kojih svaka ima visok stepen sanitacije, kvaliteta i trajnosti. Klanica igra ključnu ulogu u integrisanju učesnika u lancu snabdevanja, uključujući uzgoj, sporedne procese i sistem ishrane, kao i učesnika u lancu distribucije, uključujući preradu, pakovanje, marketing, transport i izvoz.. Efikasni menadžment klanicom i selekcija životinja poboljšavaju marketing, obezbeđujući visoki i stalan kvalitet kao i bezbedan proizvod za domaće i inostrane potrošače. Ovako kompleksni sistemi zahtevaju efikasni pristup i komunikaciju sa drugim oblastima u integrisanom sistemu marketinga.

U okviru integrisanog marketinga, klanica treba da bude pokretački faktor u selekciji životinja čiji proizvodi treba da zadovolje specifične zahteve za određenim proizvodom. Adekvatna selekcija životinja obezbeđuje sirovinu ujednačenog kvaliteta i omogućava ciljani marketing prema krajnjem potrošaču.

Koordinacija i saradnja na svim nivoima lanca integrisanog sistema marketinga je neophodna za dobije proizvod visoke vrednosti konkurentan na tržištu. Efektivni integrirani marketing podrazumeva vertikalnu integraciju nivoa industrije kao i horizontalnu integraciju i saradnju među klanicama u cilju iskorišćavanja kompetitivnih prednosti lokalno proizvedenih proizvoda.

Ključne reči: crveno meso, klanje, integracija, marketing

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THE ROLE OF THE SLAUGHTERHOUSE IN THE INTEGRATED MEAT SYSTEM

Neel S.

The integrated meat system is a value chain that begins with the selection of animal genetics and breeding systems and ends with the effective marketing and distribution of high-value end products with consumer appeal and added value. Along the integrated value chain are many participants, including those who breed, raise, background, feed, transport, slaughter, process, package, market and distribute the high value meat products to domestic and international markets.

Since not all animals entering the slaughterhouse are identical and not all meat products are suitable for various consumer demands, sorting and classification systems as well as alternative marketing channels are needed. For example, animals suitable for meat processing into sausage are not ideal for high-end consumer sales due to the level of quality and “finish” necessary to attract consumers at the retail counter. Conversely, animals with genetic potential for high quality muscle desired at retail are too valuable to be used in further processed sausage items. As such, the integrated marketing system for red meat requires a concise yet multi-faceted strategic plan for success, including but not limited to differentiated product lines, each with a high level of sanitation, quality and durability. The slaughterhouse plays a critical role in integrating those participants in the supply chain, including breeding, backgrounding and feeding systems, as well as the participants in the distribution chain, including processing, packaging, marketing, transportation and exports. Effective slaughterhouse management and selection of animals will enhance marketing efforts by providing a high quality, consistent, and safe product for effective marketing to domestic and international customers. Systems of this complexity require effective outreach and communication with the other areas of the integrated marketing system.

Within the context of integrated marketing, the slaughterhouse should be the driving factor in the proper selection of animals to fit a specific set of demand drivers and specifications for products. The proper selection of animals will provide for more consistent raw materials, and further allow for targeted marketing efforts to end users.

Coordination and cooperation between all levels of the integrated marketing chain is required for high value products to be successful in competitive markets. Effective integrated marketing includes vertical integration between levels of the industry as well as horizontal integration and cooperation between slaughterhouses to harness the competitive advantages of locally produced products.

Key Words: Red Meat, Slaughter, Integration, Marketing

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IV-2

UPRAVLJANJE ZAŠTITOM ŽIVOTNE SREDINE

Milovanović Ružica

Sa ekološkog stanovišta, zaštita životne sredine se odnosi na ostvarivanje najpovoljnijeg okvira, korišćenja resursa u vremenu i prostoru. Potreba za procenom uticaja na životnu sredinu (Environmental Impact Assessment) nastala je, kao rezultat povećane svesti o nephodnosti zaštite životne sredine, polovinom 20 veka. Tada je već bilo jasno da većina proizvodnih projekata izaziva neželjene posledice u neposrednom životnom okruženju, koje bi mogle, na neki način da se preduprediti. Procena uticaja na životnu sredinu je regulisana pravnim propisima, koji se razlikuju od zemlje do zemlje. U razvijenim zemljama se primenjuju principi dodatnog opozivanja upotrebe po okolinu štetnih proizvoda, oslobađanje od poreza proizvoda pogodnih za okolinu i upotreba najčistijih tehnologija. Nekoliko preporuka predstavljaju osnov pomenutih propisa: da investitor obavlja procenu uticaja na životnu sredinu, da institucija koja dozvoljava realizaciju predložene aktivnosti vrši procenjuje u odnosu na životnu sredinu ili da se organizuje nezavisna institucija koja bi obavila neophodnu procenu. Prema direktivama Evropske unije i naša zemlja ima te obaveze. Jedna od glavnih tačaka ovih programa je analiza životnog ciklusa proizvoda/usluge. Analiza životnog ciklusa meri kakve ekonomske i ekološke posledice ima proizvod tokom njegove proizvodnje, upotrebe i čuvanja. Takva analiza bi dala dobre rezultate u domenu dobijanja i prerade mesa u proizvode za ishranu.

Ključne reči: industrija mesa, tehnologija, ekologija, analiza životnog ciklusa, logistika povratka, zeleni marketing

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MANAGEMENT OF ENVIRONMENT PROTECTION

Milovanović Ruzica

Environment protection, from the ecological point of view. refer to achievement of the best framework resource in time and space. The need for the environmental impact assessment have arised as the result increased awareness of necessity for environment protection in the miidle of twentieth century. In that time it was already apparent that the most of production projects cause unwanted consequences on immediate environment which could in some way be prevented. Environmental impact assessment is regulated by the law which differs from country to country. In developed countries principle of additional taxes on use of the environment harmful products is applied, or no tax for use friendly to environment products and use of clean technologies. There are some recomendations which represent base for the mentioned regulations: that investor may do environmental impact assessment; that

institution may licence realisation of the proposed activity to do environmental impact assessment, or to establish independent institution which would do the necessary assessment. According to EU Directives our country has such obligations. One of the main points of those programmes is assessment of life cycle of products/service. Assessment of the life cycle evaluate the economic and environmental consequences of the product during its production, use and storage. Such assessment would give good results in the domain of obtaining and processing of meat into the products for nutrition.

Key words: meat industry, technology, environment, life cycle assessment, logistic of return, green market

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IV-3

**ZNAČAJ KORPORATIVNE DRUŠTVENE ODGOVORNOSTI
U INDUSTRIJI MESA**

Šarčević Danijela, Janičić Radmila, Turubatović L.

Savremeni trendovi u svetskim poslovnim tokovima i proces globalizacije uslovlili su pojavu koncepta korporativne društvene odgovornosti (Corporate social responsibility–CSR) u svim oblastima poslovanja. Opstanak i profit je postao, u značajnoj meri, uslovljen prepoznavanjem društvene odgovornosti proizvođača od strane potrošača/korisnika, ali i drugih ciljnih javnosti.

Proizvođači iz industrije mesa, već su se susreli sa određenim komponentama CSR-a, kao što su ISO standardi i Analiza opasnosti i kritičnih kontrolnih tačaka – HACCP sistem, čija implementacija u proizvodnju i maloprodajne objekte, za potrošače, predstavlja sigurnost u korišćenju mesa i proizvoda od mesa. Ovaj rad ukazuje na neophodnost razvoja sveobuhvatnog okvira koji bi sadržao osnovne principe implementiranja korporativne društvene odgovornosti (CSR) u elemente poslovanja proizvođača iz industrije mesa. Primena koncepta bi u industriji mesa bila jedinstvena i obuhvatala bi odgovornost u celom lancu snabdevanja. Lanac snabdevanja uključuje zdravlje životinja, zaštite životne sredine, poštenu trgovinu, zdravstvenu bezbednost i kvalitet proizvoda i drugo, što je u radu razmatrano sa aspekta društvene odgovornosti. U radu su date definicije, osnovni principi koncepta i predlozi njegove primene u industriji mesa. Razvoj i implementacija modela, koje proizvođači iz industrije mesa mogu da koriste u primeni društvene odgovornosti, predstavljeni su u formi društvenih inicijativa.

Značaj primene koncepta potkrepljen je činjenicom da je u pripremi i standard društveno odgovornog poslovanja, ISO 26000, koji se u osnovnim principima oslanja na ISO 14001 – standard upravljanja zaštitom životne sredine i međunarodni standard koji se odnosi na unapređenje uslova za rad ISO 8000.

Ključne reči: korporativna društvena odgovornost, poslovanje, proizvođači iz industrije mesa, ISO 26000

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IMPORTANCE OF CORPORATE SOCIAL RESPONSIBILITY IN MEAT INDUSTRY

Sarcevic Danijela, Janicic Ramila, Turubatovic L.

Contemporary trends in global business course and process of globalization resulted in advent of a phenomenon of CSR concept in all business area. Survival and profit of producers has become increasingly dependent on customers/consumers and other target groups' recognition.

Producers from meat industry have already been introduced to certain components of CSR, such as ISO standards and Hazard Analysis and Critical Control Point – HACCP system, the implementation of which in manufacturing and retail industry means security in using meat and meat products for customers. This paper shows necessity of development of one universal framework, which includes basic principles of implementation of CSR in producers from meat industry business.

Application of concept in meat industry would be unique and include responsibility in supply chain which means encompassing elements such as animal health, environmental protection, health security, fair trade, food safety etc, all of which were subject to consideration in terms of corporate responsibility in the paper.

The paper shows definition and basic principles of the concept, with possible ways of its implementation in meat industry. The development and implementation of the model that meat industry producers can use in corporate responsibility practice is given in form of social initiatives.

Importance of this concept application is based on the fact that standard of social responsibility ISO 26000 is being prepared. This standard, in its essence, relies on ISO 14001 – standard of environmental protection management and ISO 8000 – international standard of working conditions improvement.

Key words: CSR, business, meat producers, ISO 26000

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IV-4

**RAZVIJANJE PROGRAMA MONITORINGA NA OSNOVU
PRINCIPA SLEDLJIVOSTI ZA MESO I SIROVINE DOBIJENE
KLANJEM FARMSKIH ŽIVOTINJA**

Tchernukha Irina, Vostrikova Natalia

Kontaminacija sirovina štetnim, nepoželjnim komponentama i mikroorganizmi-
ma je jedan od osnovnih razloga dobijanja proizvoda nižeg kvaliteta, a ponekad
proizvoda opasnih po zdravlje.

Opasnost od kontaminacije hrane i sirovina potencijalno opasnim materijama
može se smanjiti samo korišćenjem efikasnog sistema kontrole bezbednosti hrane
tokom svih faza proizvodnje i prodaje. Zbog toga poboljšanje metoda za procenu
bezbednosti i kvaliteta proizvoda i sirovina ima važnu ulogu.

Svrha istraživanja je bilo proučavanje akumulacije rezidua toksičnih materija u
organima i tkivima farmskih životinja za klanje, i razvijanje programa procene bez-
bednosti pri monitoringu sirovina i proizvoda na osnovu principa sledljivosti.

Ključne reči: farmske životinje za klanje, opasnost od kontaminacije, akumu-
lacija, opasne materije

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**DEVELOPMENT OF MONITORING PROGRAM FOR MEAT AND
RAW MATERIALS OBTAINED FROM FARM SLAUGHTER ANI-
MALS ON THE BASIS OF TRACEABILITY PRINCIPLES**

Tchernukha Irina, Vostrikova Natalia

Contamination of raw materials with harmful, undesirable components and mi-
croorganisms is one of the main causes of production of low-quality and sometimes
dangerous for health products.

The contamination risk for foods and raw materials with potentially dangerous
substances can be reduced only using the effective safety control system of foods on
all stages of their production and marketing. Therefore, improvement of methods of
safety and quality evaluation of products and food raw materials is an urgent prob-
lem.

The purpose of the investigations was the study of accumulation of toxic sub-
stances residues in organs and tissues of farm slaughter animals, and development
of the program of safety indices monitoring of meat raw materials and processed
products on the basis of traceability principles.

Key words: farm slaughter animals, contamination risk, accumulation, dangerous substances

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IV-5

**POREĐENJE MIKROBIOLOŠKOG STATUSA TOPLIH I
HLADNIH SVINJSKIH POLUTKI U ZAVISNOSTI OD METODE
UZORKOVANJA**

Šakota Tamara, Škrinjar Marija, Petrović Ljiljana, Adamović Jasmina

Analiza dobre higijenske prakse u proizvodnji svinjskih polutki, obavljena je praćenjem ukupnog broja aerobnih mezofilnih bakterija, ukupnog broja bakterija porodice *Enterobacteriaceae* i vrsta roda *Salmonella*. Izvršeno je poređenje rezultata dobijenih nakon uzimanja uzoraka destruktivnom metodom i metodom brisa sa toplih i ohlađenih svinjskih polutki. Postoji značajna razlika u ukupnom broju aerobnih mezofilnih bakterija kao i u ukupnom broju bakterija porodice *Enterobacteriaceae* i kod toplih i kod ohlađenih svinjskih polutki, u zavisnosti od metode uzorkovanja. Ne postoji značajna razlika u rezultatima ispitivanja toplih i ohlađenih svinjskih polutki pri uzorkovanju destruktivnom metodom. Postoji značajna razlika u ukupnom broju aerobnih mezofilnih bakterija i ukupnom broju bakterija porodice *Enterobacteriaceae* kao toplih i ohlađenih svinjskih polutki pri uzorkovanju metodom brisa.

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

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**COMPARISON OF THE MICROBIOLOGICAL STATUS OF WARM
AND COOLED PORK CARCASSES IN DEPENDANCE OF THE
SAMPLING METHOD**

Sakota Tamara, Škrinjar Marija, Petrovic Ljiljana, Adamovic Jasmina

Analysis of good hygienic practice in pork carcasses production, has been performed by following the aerobic colony count, Enterobacteriaceae and Salmonellae. Comparison of the results obtained after taking samples by the destructive method and by the swab method from warm and cooled pork sides, has been performed. A significant difference exists in the aerobic colony count and Enterobacteriaceae in warm and cooled pork sides depending on the sampling method. There is no significant difference in the results of warm and cooled pork sides on sampling by the destructive method. A significant difference exists in the aerobic colony count and Enterobacteriaceae from the warm and cooled pork sides at the when sampled by the swab method.

Key words: pork carcasses, destructive method, swab method, microorganisms

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IV-6

UPOREDNA ANALIZA PROIZVODNJE MESA U SRBIJI U PERIODIMA 1991. – 1996. GODINE I 2001. – 2006. GODINE

Jovanović S., Popović Ljuba, Baltić Ž. M., Kilibarda Nataša, Mirilović M.

Za razliku od proizvodnje mesa u svetu i Evropskoj uniji, proizvodnja mesa u Srbiji je od 1991. godine u stalnom opadanju. To se, naročito, odnosi na proizvodnju goveđeg i živinskog mesa. Ukupna proizvodnja mesa u Srbiji, u periodu 1991. – 1996. godina, bila je, u proseku 551,83±21,70 hiljada tona i bila je statistički značajno veća ($p>0,001$) od ukupne proizvodnje mesa u periodu 2001. – 2006. godine (457,83±19,40 hiljada tona). Proizvodnja svinjskog mesa u prvom periodu (1991. – 1996. godine) bila je, u proseku, 265,17±18,33 hiljada tona, a drugom (2001. – 2006. godina) 256,17±18,33 hiljade tona. U poređenim periodima, proizvodnja svinjskog mesa, izražena kao masa toplih polutki, bila je, u proseku 361,17±21,05 hiljada tona (1991. – 1996. godina) i 349,17±12,98 hiljada tona (2001. – 2006. godina). Nije utvrđena statistički značajna razlika između prosečnog obima proizvodnje svinjskog mesa u poređenim periodima, kao što nije utvrđena ni statistički značajna razlika u obimu proizvodnje svinjskog mesa izražena kao masa toplih polutki. Proizvodnja svinjskih masnoća bila je 1991. – 1996. godine, u proseku, 110,17±1,65 hiljada tona što je bilo statistički značajno više ($p>0,01$) nego u periodu 2001. – 2006. godine, kada je proizvodnja svinjskih masnoća bila, u proseku, 87,83±9,33 hiljada tona. Sa smanjenjem proizvodnje goveđeg i mesa živine, od 1991. godine povećavalo se učešće svinjskog mesa u ukupnoj proizvodnji mesa. U periodu 1991. – 1996. godine u ukupnoj proizvodnji mesa svinjsko meso učestvovalo je, u proseku, sa 48,04±2,4 posto, što je bilo statistički značajno manje ($p>0,001$) nego u periodu 2001. – 2006. godine, kada je učešće svinjskog mesa u ukupnoj proizvodnji povećano na 56,01±1,2 %. U 2007. godini u ukupnoj proizvodnji mesa učešće svinjskog mesa je povećano na preko 60 %.

Ključne reči: analiza proizvoda od mesa; svinjsko, goveđe i pileće meso, Srbija

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COMPARATIVE ANALYSIS OF MEAT PRODUCTION IN SERBIA IN THE PERIODS 1991 – 1996 AND 2001 – 2006.

Jovanovic S., Popovic Ljuba, Baltic Z. M., Kilibarda Natasa, Mirilovic M.

Compared to meat production in the world and in ECC, meat production in Serbia is constantly declining since 1991. This applies specially to the beef and poultry productions. The total meat production in Serbia, in the period from 1991 to 1996,

was on average 551.83 ± 21.70 thousand tons and was significantly higher ($p > 0.001$) compared to the meat production in the period 2001. – 2006. (457.83 ± 19.40 thousands tons).

Production of pork was in the first period (1991 – 1996) on average 265.17 ± 18.33 thousand tons, and in the second period (2001 – 2006) 256.17 ± 18.33 thousand tons. In the compared periods meat production (expressed as the mass of warm halves) was on average 361.17 ± 21.05 thousand tons (1991– 1996) and 349.17 ± 12.98 (2001 – 2006). There is no significant difference between the meat production in these two periods, nor between the total mass of produced warm halves.

Production of pork lard was in the period 1991 – 1996 on average 110.17 ± 165 thousand tons, which is significantly higher ($p > 0.01$) compared to 2001 – 2006 ($87,8 \pm 9.33$ thousand tons). As beef and chicken production decreased since 1991 the relative production of pork increased. In the period 1991 – 1996 pork meat production participated with an average of 48.04 ± 2.4 % of total meat production, which was significantly less ($p > 0.001$) compared to the period from 2001 to 2006. In the latter the total pork meat production increased to 56.01 ± 1.2 %. During 2007 pork meat production increased to over 60% of overall meat production.

Key words: meat production analysis; pork, beef, poultry meat, Serbia

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IV-7

**PRILOG POZNAVANJU KLANIČNIH KARAKTERISTIKA JARADI
DOMAĆE BALKANSKE RASE I MELEZI F₁ SA ALPINOM**

Milevska Elena, Stojanovski M., Blažeković Dijana, Dimitrovska Gordana

Ispitivanja su izvedena na jaradima domaće balkanske koze i melezima F₁ generacije domaće koze sa alpino raseom. Prosečna telesna masa jaradi domaće balkanske koze bila je (n=10) 10,84 kg, a jaradi meleza F₁ domaće i alpino rase (n=12) iznosila je 15,97 kilograma.

Cilj ovih ispitivanja bio je da se utvrdi randman klanja jaradi i fizički sastav trupa. Randman klanja kod mase jaradi domaće balkanske koze je 51,94 posto pH₁ mesa je 6,56 i pH₂ 5,90. Randman klanja jaradi meleza F₁ domaće alpino rase iznosio je 57,61 posto, pH₁ mesa je 6,40 i pH₂ je 5,76. Udeo mesa u trupovima kod jaradi domaće balkanske koze je 49,46 posto, masnog tkiva 17,35 posto, i kostiju, 33,19 posto, a meleza F₁ domaće i alpino rase, udeo mesa je 55,57 posto, masnog tkiva 18,19 posto i kostiju 26,54 posto .

Ključne reči: jarad, randman klanja, fizička sastav trupa

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**FURTHER KNOWLEDGE ON CARCASS TRAITS OF
DOMESTIC WHITE KIDS AND THEIR F₁ GENERATION
ALPINE CROSSBREDS**

Milevska Elena, Stojanovski M., Blazekovic Dijana., Dimitrovska Gordana

Investigation was carried out on two groups of kids of Domestic White breed and its crosses with Alpine breed of F₁ generation. The average body mass prior to slaughtering of Domestic White breed (n=10) was 10.84 kg and for the alpine (n=12) the average body mass prior to slaughtering was 15.97kg.

The objective of our investigation was to determine body mass of kids prior to slaughtering and physical structure. Carcass yield was higher (51,94%) with pH₁ 6.56 and pH₂ 5.90 in Domestic White kids compared to Alpine kids (57.61%) with pH₁ 6.40 and pH₂ 5.76. Meat participation of body was 49.46% , fat tissue 17.35% and bones 33.19% in domestic kids . Alpine kids have 55.57% meat participation in body, fat tissue 18.19% and bones 26.54% .

Key words: kids, carcass yield, physical structure of body

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

Petrović Ljiljana, Tasić Tatjana, Džinić Natalija, Tomović V.,
Ikonić P., Šakota Tamara

Većina zemalja sa razvijenom proizvodnjom svinjskog mesa ima definisane standarde za predviđene kategorije mesa za preradu u pogledu hemijskog sastava. Radi obezbeđenja potpune standardizacije, optimizacije i ekonomske valorizacije u proizvodnji i preradi svinjskog mesa u našoj zemlji, postavljen je zadatak da se u radu definišu parametri i kriterijumi za standardizaciju svinjskog mesa namenjenog preradi. Rezultati prikazani u ovom radu dobijeni su ispitivanjima na tovnim svinjama u dva ogleđa. 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, otkoštene, a dobijeno meso je klasirano na osnovu vizuelne procene sadržaja masnog i vezivnog tkiva u VI kategorija. Nakon što je utvrđen hemijski sastav klasiranog mesa dobijenog u prvom ogleđu, zaključeno je da vizuelna procena nije bila dovoljno precizna u odnosu na zadati sadržaj masti u pojedinim kategorijama mesa za preradu. U drugom ogleđu 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, s obzirom da se u Pravilniku o kvalitetu i drugim zahtevima za proizvode od mesa iz 2004. godine (Sl. list SCG, br. 33) kvalitet proizvoda od mesa definiše preko sadržaja proteina mesa u proizvodima, ili sadržaja ukupnih proteina.

Ključne reči: svinjsko meso, kategorizacija mesa za preradu, standardizacija

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Napomena: *Istraživanja su finansirana sredstvima MNTR u okviru projekta 20037-TR*

INFLUENCE OF CARCASS HALVES QUALITY ON MEAT YIELD OF CATEGORIES OF MEAT DESIGNATED FOR PROCESSING AND DETERMINATION OF THE CRITERIA FOR STANDARDISATION

Petrovic Ljiljana, Tasic Tatjana, Dzinic Natalija, Tomovic V.,
Ikonic P., Sakota Tamara

Most of the countries with developed production of pork have defined standards provided for the categorisation of pork for processing based on chemical content. For the provision of total standardisation, optimisation and economic evaluation of production and processing of pork in our country, there was a problem to be solved for the definition of parameters and criteria for the standardisation of pork designated for processing. Results which are shown in this paper were obtained after the investigations and two experiments on growing pigs. On the end of slaughterline yield of meat on the carcass halves was determined r.g. grade of the carcass half by the method of two points. After chilling, halves were primarily classified for processing, (mainly U, R i O grades) were cut to the primary anatomical parts, deboned and obtained meat was rated, based on the visual estimation of fat and connective tissue content in 6 grades. After the determination of the chemical content of graded meat in the first experiment, it was concluded that only visual control was not sufficiently accurate in relation to the required parameters for fat content in some grades of meat for processing. In the second experiment meat was rated mainly satisfactory, on the basis of estimated fat content. On the basis of chemical content and analysis of all obtained results, criteria on the standardisation of the meat for processing were suggested, which beside maximal fat content included minimal meat protein content, taking it into account that according to Regulation on quality and other demands for meat products, from the year 2004 ("Sl. list SCG, No, 33") quality of meat products is defined as meat protein content in meat products or on the basis of total proteins.

Key words: pork, meat grade for processing, standardisation

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Note: Investigation supported by Ministry of science and technological development of Republic of Serbia, within the project No. 20037-TR

MRAMORIRANOST MESA SA POLUTKI SVINJA RAZLIČITE MESNATOSTI

Tomović, V., Petrović Ljiljana, Džinić Natalija

U ovom radu utvrđena je mramoriranost, koja se definiše kao pojava manjih ili većih nakupina masnog tkiva (intramuskularno masno tkivo) u rastresitom vezivnom tkivu između snopića mišićnih vlakana, *M. semimembranosus* (SM) i *M. longissimus dorsi* (LD), sa polutki svinja različite mesnatosti. Mramoriranost kod svinjskog mesa, naročito postaje vidljiva kada je sadržaj intramuskularne masti veći od 2 posto, što za potrošače, i pored pozitivnog uticaja veće mramoriranosti, odnosno većeg sadržaja intermuskularne masti na senzorni kvalitet, nije prihvatljivo. Mramoriranost mišića SM i LD, kao i mesnatost polutki utvrđena je 24 sata *post mortem*, odnosno nakon hlađenja. Mramoriranost mišića SM i mišića LD je utvrđena senzorno, sa ocenama od 1 do 5 (1 – bez mramoriranosti do praktično bez mramoriranosti; 2 – tragovi do neznatna; 3 – mala do skromna; 4 – umerena do neznatno obilna; 5 – umereno obilna do velika), uz korišćenje standarda u boji za mramoriranost, dok je mesnatost polutki utvrđena metodom parcijalne disekcije. Prosečna mesnatost polutki bila je 56,3 posto, odnosno mesnatost polutki nalazila se u intervalu od 45,5 do 69,4 posto. Mramoriranost mišića SM nalazila se u intervalu od 3,5 (maksimalna vrednost) do 1 (minimalna vrednost), odnosno prosečno je ocenjena sa ocenom 2,0 i bila je visoko značajno veća ($P < 0.01$), u poređenju sa mramoriranošću mišića LD, čija se mramoriranost nalazila, takođe, u intervalu od 3,5 (maksimalna vrednost) do 1 (minimalna vrednost) i koja je prosečno ocenjena sa ocenom 1,3. Između mramoriranosti mišića SM i mišića LD i procenta mesa u polutkama utvrđena je obrnuta, odnosno negativna, ali neznatna linearna veza, odnosno utvrđeni koeficijenti korelacije su iznosili $-0,38$ i $-0,27$, što ukazuje da se sa povećanjem mesnatosti polutki svinja ne smanjuje mramoriranost mesa i obratno.

Ključne reči: svinjsko meso, mramoriranost, mesnatost

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Napomena: Rad je finansiran sredstvima MNTR RS, nastao kao rezultat rada na projektu broj: 20037.

MARBLING OF CARCASS PORK MEAT OF DIFFERENT PERCENTAGE OF MEAT

Tomovic V., Petrovic Ljiljana, Dzinic Natalija

In this paper marbling which is defined as appearance of smaller or bigger aggregates of fatty tissue (intramuscular fatty tissue) in loosely connective tissue among muscular fibers *M. semimembranosus* (SM) i *M. longissimus dorsi* (LD) from the carcass of the different percentage of meat in carcass halves. Marbling in pork is especially visible when the content of intramuscular fat is above 2 %, and for the consumer, inspite to the positive influence of greater marbling, e.g. higher content of intramuscular fat on sensory quality, is not acceptable. Marbling of muscles SM and LD, as the percentage of meat of carcass was determined 24 hours post mortem, e.g. after chilling. Marbling of the muscle SM and muscle LD was sensory rated by the points 1 to 5 (1 - no marbling, 2-traces to insignificant, 3- small to modest, 4-mild to insignificantly abundant, 5 - mild abundant to great) by using the standards for marbling color, percentage of meat in carcass halves determined with method of partial dissection. Average percentage of meat in carcass halves was 56.3, e.g. percentage of meat in carcass halves was in range between 45.5 to 69.4. Marbling of the SM muscle was in range between 3.5 (maximum value) to 1 (minimum value), namely was evaluated in average by 2.0 points and was of high significant ($P < 0.01$) compared with marbling of LD muscle, whose marbling was in the between 3.5 maximum value) to 1 (minimum value), was evaluated in average by 1.3 points. Between marbling of the SM and LD muscle and percentage of meat in carcass halves, negative or slightly linear relation was found, e.g. determined coefficients of correlation were - 0.38 and -0.27, which points out that with the increase of percentage of meat in carcass halves, marbling of meat does not diminish and vice versa.

Key words: pork, marbling, percentage of meat

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Note: Investigation support by Ministry of Science and Technological Development of Republic of Serbia, project No. 20037.

**ISPITIVANJE ODABRANIH PARAMETARA MESNATOSTI
SVINJA SA JEDNE FARME ZAKLANIH U KLANICI
„KOTEKS“ U SURČINU**

Djokić A., Karabasil N., Baltić Ž. M., Kilibarda Nataša, Jovanović S.

Mesnatost svinja određena je prema Pravilniku o kvalitetu zaklanih svinja i kategorizaciji svinjskog mesa (Sl.list SFRJ br 2/85, 12/85 i 24/86). Podaci o mesnatosti obrađeni su na 82 svinje. Kao parametar mesnatosti trupova uzeti su i podaci dobijeni obradom polutke (tzv. „cepane“ lopatice) do tzv. „francuske“ obrade namenjene maloprodaji.

Količina mesa u trupovima zaklanih svinja sa farme najvećeg dobavljača svinja klanice „Koteks“ u Surčinu, izražena u procentima, bila je od 38,44 posto do 45,53 posto, odnosno, u proseku $43,12 \pm 1,67$ %. Prosečna masa trupa bila je $74,06 \pm 5,80$ kilograma, masa glave $3,90 \pm 0,08$ kilograma, odnosno zastupljenosti u masi trupa 5,26 posto, masa neobrađene slanine $16,20 \pm 0,66$ kilograma (21,83 posto), sala $1,00 \pm 0,03$ kilograma (1,35 posto), nogica $1,33 \pm 0,03$ kilograma (1,75 posto), čvrstog masnog tkiva sa kožom (but, plećka) $1,76 \pm 0,21$ kilograma (2,37 posto), čvrstog masnog tkiva sa kožom $7,42 \pm 0,61$ kilograma (10,02 posto), gronika $1,71 \pm 0,04$ kg (2,31 posto), mesnih obrezaka („ficla“) $1,27 \pm 0,03$ kilograma (1,71 posto), repova $0,30 \pm 0,01$ kilograma (0,04 %) i „francuske“ obrade $39,88 \pm 3,74$ kilograma (53,84 posto).

Kako u mesnatost trupa nije uračunato mišićno tkivo potrubušine za koje se smatra da čini i preko 7 posto od mišića trupa to se može zaključiti da je prosečna količina mesa u trupu ispitivanih svinja izražena u procentima preko 50 posto. Delovi trupa (polutki) dobijeni obradom do „francuske“ obrade se koriste za preradu, a sama „francuska“ obrada se dalje obrađuje po zahtevu kupca i namenjena je maloprodaji ili se raseca i obrađuje za sopstvene potrebe prerade.

Ključne reči: odabrani parametri, mesnatost svinja, klanica

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STUDY OF CHOSEN PARAMETERS OF PIGS' MEATNESS FROM A FARM SLAUGHTERED AT THE "KOTEKS" SLOUGHTERHOUSE IN SURČIN

Djokic A., Karabasil N., Baltić Z. M, Kilibarda Natasa, Jovanović S.

Production of pork meat has a long tradition in Serbia. The overall trend of preferring meat pork, which has started in the early sixties, was followed by Serbia as well, hence the large number of meat pigs present in Serbia nowadays. The relationship between „fattened“ pigs and „meaty“ pigs during 2007 was 1: 1.48 and in 1990 the relationship was 3:1. For meaty pigs are interested not only the producers, but consumers as well. The interest of the producers to grow meaty pigs is not stimulated enough. Sadly, pigs are nowadays paid by the kg and not by the percentage of present carcass meat.

The aim of this work was to study the chosen parameters of meatiness in the carcasses from the pig farm „Koteks“ in Surčin.

The meatiness was defined by the legislation (Sl.list SFRJ br 2/85, 12/85 i 24/86). Data relative to the meatiness of 82 pigs are given. The data relevant are given by the „French“ dressing of carcasses aimed for the retail market.

The quantity of meat present in the halves of slaughtered pigs from the „Koteks“ farm in Surcin, expressed in percentages, was from 38.44% to 45.53%. On average, was $43.12 \pm 1.67\%$. The average mass of the carcass was 74.06 ± 5.80 kg; the mass of the head was 3.90 ± 0.08 kg, thus its relative presence within the carcass was 5.26%. The mass of the bacon was 16.20 ± 0.66 kg (21.83%), lard 1.00 ± 0.03 kg (1.35%), feet $1.33 \text{ kg} \pm 0.03 \text{ kg}$, firm fatty tissue with skin (shoulder and thigh) 1.76 ± 0.21 kg (2,37 %), firm fatty tissue with skin 7.42 ± 0.61 kg (10.02 %), lower neck 1.71 ± 0.04 kg (2,31 %), meaty cut-offs („ficla“) 1.27 ± 0.03 kg (1,71%), tails 0.30 ± 0.01 kg (0.04 %) and „French cut“ 39.88 ± 3.74 kg(53.84 %).

As in the overall carcass meatiness the muscle tissue of the abdominal wall, which is considered to make up over 7% of the carcass muscle mass, it can be concluded that the average quantity of meat in the studied pigs was over 50%. Parts of the trunk (halves) tailored by the “French” method are used for further processing and the half itself is further tailored on request of the customer.

Key words: chosen parameters, meatiness of pigs, slaughterhouse

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UTICAJ RAZLIČITE BRZINE HLAĐENJA POLUTKI SVINJA I RAZLIČITOG VREMENA OTKOŠTAVANJA *POST MORTEM* NA SPOSOBNOST VEZIVANJA VODE *M. SEMIMEMBRANOSUS*

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

U ovom radu ispitan je uticaj brzog vazdušnog hlađenja polutke svinja (BH), na temperaturi od -31°C u prvih 3 časa hlađenja, odnosno do cca 4 časa *post mortem*, a zatim pod konvencionalnim uslovima (do 8 i 24 časa *post mortem*), u poređenju sa konvencionalnim vazdušnim hlađenjem (KH) polutke (na 2 do 4°C do 24 časa *post mortem*), kao i uticaj ranijeg otkošćavanja polutke (8 časova *post mortem*), nakon brzog hlađenja, na sposobnost vezivanja vode (SVV) svinjskog mesa, odnosno *M. semimembranosus* (SM). SVV određena je različitim metodama, i to: „filter paper press“ metodom – metoda kompresije (istisnuti sok, odnosno procenat vezane vode), „bag“ metodom („drip loss“ – gubitak mase ceđenjem), metodom za određivanje kala kuvanja (gubitak mase mesa tokom termičke obrade) i senzorno (vlažnost; skala od 1 do 5). Nezavisno od brzine hlađenja polutke i vremena otkošćavanja *post mortem*, kao i nezavisno od metode određivanja, meso je imalo prosečnu SVV koja odgovara SVV mesa normalnog kvaliteta. Na kraju hlađenja, odnosno na kraju proizvodnje mesa (8 i 24 časa *post mortem*), između različito hlađenih i u različito vreme otkošćenih mišića, nema značajnih razlika u SVV, odnosno u količini istisnutog soka i procentu vezane vode ($P > 0,05$), s tim da je kod BH mišića, u poređenju sa KH mišićima, utvrđena numerički nešto bolja SVV. Nakon 24 sata kondicioniranja, značajno bolja SVV, odnosno značajno manji gubitak mase ceđenjem ($P < 0,05$), utvrđen je kod BH i 8 časova *post mortem* otkošćenih mišića, u poređenju sa KH i 24 sata *post mortem* otkošćenim mišićima, dok je nakon 7 dana kondicioniranja kod BH mišića, u poređenju sa KH mišićima SM, utvrđena, takođe, numerički, ali ne i značajno ($P > 0,05$), nešto bolja SVV. Nezavisno od vremena otkošćavanja *post mortem*, kod BH mišića utvrđen je značajno manji gubitak mase kuvanja ($P < 0,01$), u poređenju sa KH mišićima. Različita brzina hlađenja i različito vreme otkošćavanja nije dovelo do značajne razlike u vlažnosti mišića ($P > 0,05$), ocenjene senzorno, odnosno sve grupe ispitanih mišića su senzorno ocenjene sa neznatnim odstupanjem, odnosno kao neznatno vlažniji, od optimalne vlažnosti.

Ključne reči: svinjsko meso, *M. semimembranosus*, hlađenje, vreme otkošćavanja, sposobnost vezivanja vode

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INFLUENCE OF DIFFERENT CHILLING SPEED OF PIG CARCASSES AND DIFFERENT TIME OF DEBONING POST MOREM ON ABILITY OF *M. SEMIMEMBRANOSUS* TO HOLD WATER

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

The influence of speed carcass air chilling (SAC), on the temperature of -31°C , in first 3 hours of chilling, e.g. approx. 4 hours post mortem, and after that by the conventional conditions (up to 8 and 24 hours post mortem), compared with conventional air chilling (CAC) of halves (on 2 and 4°C up to 24 hours post mortem), as the influence of earlier deboning of halves (8 hours post mortem) after speed chilling, on water holding capacity (WHC) of pork, e.g. *M. semimembranosus* (SM). WHC was determined by the various following methods: "filter paper press" method-compression method (squeezed out juice, percentage of held water), "bag" method ("drip loss" – weight loss by squeezing), cooking method - weight loss after thermal treatment), sensory (moisture; grade from 1 to 5). Independently from the chilling speed of halves and the time of deboning post mortem, and independently of the method for determination, obtained meat (SM muscle), according to the criteria for WHC had average value, which corresponds to the value of normal quality meat. At the end of chilling process e.g. at the end of meat production (8 and 24 hours post mortem) between differently chilled and in various time post mortem deboned SM muscle there were no significant differences in WHC value, e.g. quantity of the squeezed juice and percentage of held water ($P > 0.05$), with the regard that in SAC muscle SM compared to the SAC SM muscle WHC value was little bit better. After 24 hours conditioning there were significantly better WHC value, e.g. less weight loss by squeezing ($P < 0.05$), in SAC and 5 hours post mortem deboned SM muscle, compared with CAC and 24 hours post mortem deboned SM muscle, whereas after 7 days of conditioning in SAC muscle SM compared with CAC SM muscle was found numerically but not significant ($P > 0.05$) better WHC. Independently of the deboning time post mortem in SAC SM muscle was found highly significant lower weight cooking loss ($P < 0.01$), compared to CAC SM muscle. Different chilling speed and the different deboning time did not lead to the significant difference in SM muscle moisture ($P > 0.05$), sensory evaluated, e.g. all groups of examined SM muscles were sensory evaluated with insignificant deviation, e.g. insignificantly higher moisture than optimal.

Key words: pig carcasses, *M. semimembranosus*, chilling, time of deboning, ability to hold water

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OSNOVNI PARAMETRI PROCENE KVALITETA PILEĆEG MESA

Đerić Z., Lilić S., Ilić Tamara, Dimitrijević Sanda, Matekalo-Sverak Vesna

Proizvodnja pilećeg mesa predstavlja 80 posto od ukupne proizvodnje mesa pernate živine i beleži najveći porast u odnosu na meso drugih vrsta životinja. Procenjuje se da će proizvodnja i potrošnja pilećeg mesa i dalje da raste usled niske konverzije hrane, nepostojanja kulturalnih i religioznih aspekata potrošnje, poželjnih senzornih karakteristika i niske cene. Pileće meso je dobar izvor proteina visoke biološke vrednosti (u proseku 23 posto u mesu grudi i 19 posto u mesu bataka i karabataka), zatim vitamina i makroelemenata – vitamini B kompleksa, fosfora, gvožđa i cinka. Prosečno, pileće meso od ukupnih masnih kiselina sadrži 50 posto zasićenih, 40 posto mononezasićenih i 10 posto polinezasićenih masnih kiselina, pri čemu se u belom mesu više deponuju omega 3 masne kiseline. Pileće meso, takođe, predstavlja i pogodnu sirovinu za izradu proizvoda od mesa.

Ključne reči: pileće meso, kvalitet, hemijski sastav, masne kiseline

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MAIN PARAMETERS IN ESTIMATING CHICKEN MEAT QUALITY

Djeric Z., Lilic S., Ilic Tamara, Dimitrijevic Sanda, Matekalo-Sverak Vesna

Chicken meat production represents 80% of the total poultry meat production and has the highest increasing trend compared to meat production of other animal species. It is estimated that the production will have a further increase due to low feed conversion rate, lack of religious or social taboos, desirable sensory features and small cost. Chicken meat is a good source of proteins of high biological value (23% in breast meat and 19% in the drumstick and thigh), vitamins and microelements – B complex vitamins, phosphorus, iron and zinc. On average, chicken meat contains 50% saturated fatty acids (FA), 40% monounsaturated FA and 10% polyunsaturated FA. Breast meat accumulates more omega 3 FA. At the same time, chicken meat is a good raw material for manufacturing meat products.

Key words: chicken meat, quality, chemical composition, fatty acids

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**MOGUĆNOSTI KORIŠĆENJA BUBREGA GOVEDA I SVINJA
U ISHRANI LJUDI**

Janković S., Lilić S., Matekalo-Sverak Vesna, Turubatović L.,
Radičević Tatjana, Stefanović S.

Bubreg goveda i svinja pripada jestivim iznutricama, koje se mogu koristiti u izradi proizvoda od mesa koji se obrađuju toplotom. Bubreg goveda, u 100 g, u proseku, sadrži 17 g proteina, 3 g masti, 411 mg holesterola i energetske vrednost 103 kcal, dok bubreg svinja sadrži 16 g proteina, 3 g masti, 319 mg holesterola i ima energetske vrednost 100 kcal. Konzumiranjem 100 g bubrega goveda zadovoljava se 39 posto dnevnih potreba čoveka u proteinima, a bubrega svinja 33 posto. Pored osnovnog hemijskog sastava, u radu su prikazani i sadržaj toksičnih elemenata, organohlorinih pesticida i veterinarskih lekova u bubregu. Na osnovu hemijskog sastava, može da se zaključi da bubrezi goveda i svinja predstavljaju pogodnu sirovinu za izradu proizvoda od mesa, a mogu da se koriste i u kulinarstvu za pripremanje različitih vrsta jela.

Ključne reči: bubreg, goveda, svinje, nutritivna vrednost, kontaminanti

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Napomena: Rezultati prezentovani u radu su deo istraživačkog projekta: „Održivost lanca masovne proizvodnje hrane“ Ev. br. 20066, koje je finasira Ministarstvo za nauku i tehnološki razvoj Republike Srbije

**POSSIBILITIES OF USE OF CATTLE AND PIG KIDNEYS
IN HUMAN NUTRITION**

Jankovic S., Lilic S., Matekalo-Sverak Vesna, Turubatovic L.,
Radicevic Tatjana, Stefanovic S.

Kidneys of cattle and pigs are considered as edible giblets that can be used in the manufacture of thermally treated meat products. The cattle kidney, on the average, has 17 g proteins, 3 g lipids, 411 mg cholesterol and 103 kcal per 100g, while pig kidney has 16 g proteins, 3 g lipids, 319 mg cholesterol and 100 kcal, respectively. By consuming 100 g of cattle kidney, humans satisfy 39% daily values of proteins and by consumption of pig kidney 33%, respectively. In this paper is presented the basic chemical composition and the content of toxic elements, organochlorine pesticides and veterinary drugs in the kidneys. According to chemical composition it can be concluded that cattle and pig kidneys present a suitable raw material for

the manufacture of meat products, and they can be used in culinary preparation of meals.

Key words: kidney, cattle, pigs, nutritional value, contaminants

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Note: *The results present in this paper are the part of the research project: "Sustainability chain of large production" No. 20066 supported by Ministry of Science and Technological development of the Republic of Serbia*

LIPIDNI SASTAV UZORAKA MLEVENOG JUNEĆEG MESA

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

Kvalitet mesa i proizvoda od mesa zavisi od sadržaja i sastava osnovnih sastojaka mesa, proteina, lipida, mineralnih materija i vode. U ovom radu ispitana je kinetika ekstrakcije lipida na pet uzoraka mlevenog junećeg mesa sa teritorije Leskovca, da bi se odredio sadržaj lipida, sastav acilglicerola kao i masne kiseline u sastavu acilglicerola. Lipidi su dobijeni ekstrakcijom uz refluks sa ugljentetrahloridom kao rastvaračem (1:20 m/v) u trajanju od 30 minuta. Sadržaj lipida u ispitivanim uzorcima kreće se u granicama od 5,1 do 21,1%. Primenom HPLC metode (Agilent 1100 High Performance Liquid Chromatograph, kolona: Zorbax Eclipse XDB-C18; smeša rastvarača: metanol – rastvarač A i 2–propanol/n-heksan–rastvarač B u zapreminskom odnosu 5:4; temperature kolone: 40 °C; detekcija: na 205 nm) određen je sadržaj slobodnih masnih kiselina, mono-, di- i triacilglicerola. Identifikacija komponenata lipida obavljena je upoređivanjem retencionih vremena komponenata sa retencionim vremenima standarda. Sadržaj slobodnih masnih kiselina kreće se u granicama od 8,7 posto do 52,6 posto; sadržaj monoacilglicerola, od 0,4 do 2,6 posto, diacilglicerola, od 0,7 do 3,0 posto, a sadržaj triacilglicerola u granicama od 36,9 posto do 89,6 posto. Za analizu sastava metil-estara lipida korišćen je GC 6890N chromatograf, Agilent Technologies povezan 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°C - 300°C, 7°C/min; temperatura injektora i detektora: 250 i 280°C, respektivno. U ispitivanim uzorcima, kao najzastupljenije masne kiseline, detektovane su oleinska (37,1–41,8 posto), palmitinska (23,5–30,4 posto) i stearinska (15,7–19,0 posto), a prisutne su još i miristinska, pentadekanoična, palmitoleinska, margarinska, linolna i 1,2-benzendikarbonska masna kiselina.

Ključne reči: juneće meso, lipidi, acilgliceroli, masne kiseline

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LIPID COMPOSITION OF MINCED BABY BEEF MEAT SAMPLES

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

Meat and meat products quality depends on content and composition of the main meat components: proteins, lipids, minerals and water. In this paper the kinetics of lipid extraction and lipid composition of five samples of minced baby beef meat from Leskovac territory was investigated. The aim of this paper was to determine and compare the lipid content and composition in the investigated samples.

The lipids were extracted by carbon tetrachloride at 1:10 w/v, by using reflux. The lipid content was in the range 5.1 – 21.1%, 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 in 15 min). The column temperature was held constant at 40 °C. The components were detected at 205 nm. The mono-, di- and tri- acylglycerols were identified by comparison of retention times of the lipid components with those 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 content of free fatty acids was in the range 8.7%-52.6%, monoacylglycerols in the range from 0.4 to 2.6%, diacylglycerols in the range from 0.7 to 3.0%, while the content of triacylglycerols was in the highest range from 36.9% to 89.6%. The methyl ester content of chlorophorm extracts was quantified using a GC 6890N chromatograph, Agilent Technologies gas chromatograph connected to capillary column Agilent 19091s-433 (HP-5MS 5 % Phenyl Methyl Siloxane). A 1.0 µl of the chlorophorm extract was injected into a chromatograph connected to Agilent 19091s-433, capillary column (0.25 mm x 30 m) to determine the methyl ester content. The column temperature was raised from 100 °C to 300 °C at 7°C /min and maintained at this temperature for 2 min. The temperatures of the injector and detector were set at 250 and 280 °C, respectively. The oleic, palmitic and stearic fatty acid had highest content in range 37.1 to 41.8%, 23.5-30,4% and 15.7-19.0%, respectively. Myristic, pentadecanoic, palmitoleic, margaric, linoleic and 1,2 benzendicarboxylic fatty acid in the investigated samples were identified, too.

Key words: beef meat, lipids, acylglycerols, fatty acids

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**PROMENE U SASTAVU FRAKCIJA SARKOPLAZMINOG
RETIKULUMA I MIOFIBRILARNIH PROTEINA SVINJSKOG
MESA TOKOM DUGOTRAJNOG SKLADIŠTENJA PRI
TEMPERATURAMA OKO NULA STEPENI CELZIJUSA
(-1 DO +4°C)**

Irina Chernukha, Usanova Oksana, Grischenko V. M.,

U radu su ispitivane vrste kvantitavnih i kvalitativnih promena u sarkoplazminom retikulumu i frakcijama miofibrilarnih proteina tokom skladištenja tokom 25 dana hlađenog vakuum pakovanog mesa pri temperaturama oko nula stepeni (-1 do +4 °C).

Ispitivana je jednaka količina rastvorljivih proteina u u uzorcima (0.63-0.64 g proteina /100g mesa) posle 12-15 dana skladištenja i postignut je značajan porast rastvorljivosti (do 1.68g proteina/100g mesa) posle 15- 25 dana.

Elektroforegrami ekstrakta pokazali su značajan porast kvantiteta sarkoplazminih i miofibrilarnih frakcija posle skladištenja od 12-25 dana, što je posledica cepanja proteina veće molekularne mase (300-350 kDa). Kvantitativni sastav nisko molekularnih frakcija proteina ekstrahovanih iz mišićnih proteina (molekularna masa < 25 kDa) se pri tom takođe menja.

Ključne reči: sarkoplazmine i miofibrilarne proteinske frakcije, ohlađeno svinjsko meso, dugotrajno skladištenje, elektroforeza

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**CHANGES IN FRACTIONAL COMPOSITION OF
SARCOPLASMIC AND MYOFIBRILLAR PORK
PROTEINS DURING LONG-TERM STORAGE AT
LOW POSITIVE TEMPERATURES
(-1 to +4°C)**

Irina Chernukha, Usanova Oksana, Grischenko V. M.,

The character of quantitative and qualitative determination of changes in sarcoplasmic and myofibrillar protein fractions during a long-term storage (25 days) of chilled vacuum packed meat at low positive temperatures (-1...+4 °C) was investigated.

The equal quantity of soluble protein in samples being investigated (0.63-0.64 g of protein/100g of meat) after 12-15 days of storage and considerable increase in

solubility after 15-25 days (up to 1.68 g of protein/100 g of meat) during refrigerated storage was established.

Electroforegrams of extracts showed considerable increase in the quantity of sarcoplasmic and myofibrillar fractions after 12-25 days of storage, what results from the splitting of protein molecules with a greater molecular mass (300-350 kDa). The quantitative composition of low-molecular protein fractions extracted from the muscular tissue (molecular mass < 25 kDa) changes therewith.

Key words: sarcoplasmic and myofibrillar protein fractions, chilled pork, long-term storage, electroforesis

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SENZORNI I TEHNOLOŠKI KVALITET RAZLIČITIH VRSTA MARINIRANOG MESA

Džinić Natalija, Jelić N., Jokanović Marija, Jocić Lj.

Mariniranje je tradicionalni način pripreme koji se primenjuje da bi se poboljšala aroma i sočnost mesa, produžila održivost i bezbednost, popravio kvalitet tehnološki slabijeg mesa, prikrili nepoželjni polni mirisi mesa, odnosno da bi se gotov proizvod učinio primamljivijim za potrošače. Efekti mariniranja se ogledaju i u omekšavanju mišićnih vlakana, povećanju vezivanja vode, samim tim i smanjenju gustine mase tokom toplotne obrade, zatim ravnomernoj raspodeli soli i začina i ujednačenom kvalitetu gotovog proizvoda. Prednost mariniranih proizvoda od mesa je i u tome što zahtevaju kraće vreme pripreme, tj. samo finalnu toplotnu obradu pre upotrebe.

U ovom radu je analiziran uticaj procesa mariniranja na senzorna i tehnološka svojstva pilećeg i svinjskog mesa. U ispitivanjima su korišćeni komercijalni preparati dva proizvođača, i to suve marinade – marinade za posipanje i tečne marinade – uljane i vodene. Komercijalne marinade su sadržale funkcionalne komponente, začine i začinsko bilje. U zavisnosti od vrste mesa, tj. ako je to bilo potrebno korišćene su i salamure za dodatno omekšavanje i hidriranje komada mesa. Uzorci mesa su stajali u marinadi tokom noći, a zatim su toplotno obrađeni na roštilju.

Na osnovu dobijenih rezultata senzorne ocene toplotno obrađenih uzoraka mariniranog mesa zaključeno je da su ukupne senzorne ocene ispitanih uzoraka bile u intervalu od 71,67 do 92,62 posto maksimalne ocene. Najslabije je ocenjen uzorak pilećeg krilca, a najbolje svinjski vrat mariniran uz dodatak belog luka i peršuna.

Ključne reči: marinade, meso, kvalitet

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SENSORY AND TECHNOLOGICAL QUALITY OF DIFFERENT KINDS OF MARINATED MEAT

Dzinic Natalija, Jelic N., Jokanovic Marija, Jocic Lj.

Marination is a traditional culinary technique that is used to tenderize and to improve flavor and juiciness of meat. Also it is used to extend the shelf-life and to improve the technological quality of meat. It has the potential to mask the off-flavor due to boar taint and altogether to make the product more attractive for consumers.

Marinating also increases water-binding capacity of meats, thus reducing cooking losses and improving meat juiciness. It enables equal distribution of salt and

spices through the meat cut, and uniform quality of the final product. One more advantage of marinated meat is that it needs less time for preparation.

This paper deals with the effects of the marinating processing on sensory and technological properties of chicken and pig meat. In this experiment, commercial marinades (dry marinades – rubs, oil and water marinades) of two producers were used. Marinades included functional ingredients, spices and herbs. Depending of the type of meat cut the prior hydrating and tenderising was applied with brine addition. Meat was marinated over night and than cooked on grill.

According to the results of sensory analyses of grilled marinated meat it was concluded that sensory properties of all samples were evaluated within the interval 71.67 – 92.62% of maximal mark. The least mark was for chicken wings, and the highest mark was for pig neck meat marinated with addition of garlic and parsley.

Key words: marinade, meat, quality

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UTICAJ ODABRANIH ADITIVA NA POBOLJŠANJE KVALITETA I STABILNOSTI BOJE FINO USITNJENIH BARENH KOBASICA OD PILEĆEG MESA

Grujić Slavica, Grujić R., Savanović Danica, Odžaković Božana, Dejanović M.

Kvalitet, bezbednost i stabilnost u toku skladištenja predstavljaju karakteristike proizvoda, značajne za proizvođače i potrošače. U toku ovoga istraživanja ispitan je uticaj dodatka odabranih antioksidansa, stabilizatora i emulgatora na stabilnost i ukupnu prihvatljivost fino usitnjenih kobasica od pilećeg mesa u tipu pariske kobasice. Uzorci su proizvedeni u industrijskim uslovima, u skladu sa specifikacijom proizvođača – kontrolni uzorak (f), ili uz dodatak odabranih aditiva – 5 eksperimentalnih uzoraka: (a) 0,04 posto prirodni ekstrakt ruzmarina (Natural rosemary extract 96 posto; Mono- and diglycerides of fatty acids E471; Acetic acid esters of mono- and diglycerides of fatty acids E472a; Propylene glycol E1520); (b) 0,10 posto mešavine antioksidansa izraženo na sadržaj masti u gotovom proizvodu (10 posto Ascorbyl palmitate E304; 10 posto natural mixed Tocopherols E306 and Lecithin E322; rapeseed oil); (c) 0,3 posto mešavine stabilizatora (Carrageenan E407; Locust bean gum E410); (d) 0,3 posto mešavine stabilizatora (Carob germ flour; Cellulose gum E466), (e) 0,3 posto mešavine emulgatora i stabilizatora (sodium alginate E401; Calcium sulphate E516; Sodium stearate E470a; Tetrasodium diphosphate E450). Za ispitivanje promene boje eksperimentalnih uzoraka kobasica posle 7 dana i posle 35 dana od proizvodnje, korišćene su senzorne i instrumentalne metode analize. Instrumentalna analiza boje zasnovana je na merenju vrednosti parametara boje L^* (svetlina), a^* (intenzitet crvene nijanse boje), b^* (intenzitet žute nijanse boje) u CIE (1978) $L^*a^*b^*$ sistemu boja. Senzornom analizom, ustanovljene razlike nijanse boje uzoraka, potvrđene su i preko apsolutnih vrednosti razlike parametara boje izmerenih instrumentalno. Uzorci kobasica (a) imali su značajno male vrednosti razlika za prosečne vrednosti izmerenih L^* i a^* parametara boje posle 7 dana i posle 35 dana od proizvodnje, ali uzorci kobasica (e) proizvedeni sa 0,3 posto mešavina emulgatora i stabilizatora (E401; E516; E470a; E450) imali su najniže apsolutne vrednosti razlika za prosečne vrednosti izmerenih L^* i b^* parametara boje 7 dana i 35 dana nakon proizvodnje, kao i najveću ukupnu prihvatljivost senzornih svojstava proizvoda u poređenju sa kontrolnim uzorcima (f) fino usitnjenih kobasica od pilećeg mesa u tipu pariske kobasice.

Ključne riječi: kobasice od pilećeg mesa, aditivi, boja, senzorna analiza

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EFFECT OF SELECTED ADDITIVES ON QUALITY IMPROVEMENT AND COLOUR STABILITY OF FINELY COMMUNUTED CHICKEN SAUSAGE

Grujic Slavica, Grujic R., Savanovic Danica, Odzaković Bozana, Dejanovic M.

The quality, safety and storage stability are food product quality characteristics important both for producers and consumers. The influence of added selected antioxidants, stabilisers and emulsifiers on colour change, stability and overall acceptance of finely comminuted chicken sausage „parizer“ type was investigated. Samples were produced in industrial conditions according to the producer's specification, control sample (f) and with selected additives added separately to each of 5 experimental samples: (a) 0.04% Natural rosemary extract (Natural rosemary extract 96%; Mono- and diglycerides of fatty acids E471; Acetic acid esters of mono- and diglycerides of fatty acids E472a; Propylene glycol E1520); (b) 0.10% Antioxidant mixture expressed on fat content in the finished product (10% Ascorbyl palmitate E304; 10% natural mixed Tocopherols E306 and Lecithin E322; rapeseed oil); (c) 0.3% blend of stabilisers (Carrageenan E407; Locust bean gum E410); (d) 0.3% blend of stabilisers (Carob germ flour; Cellulose gum E466), (e) 0.3% blend of emulsifier and stabilisers (sodium alginate E401; Calcium sulphate E516; Sodium stearate E470a; Tetrasodium diphosphate E450). Sensory and instrumental analytical methods were used for the experimental sausages colour change studied 7 and 35 days after production. Instrumental colour analysis was based on measurements of colour parameters L^* (lightness), a^* (redness), b^* (yellowness) values in CIE (1978) $L^*a^*b^*$ colour system. The differences in sensory perceived colour were confirmed by the absolute values of difference instrumentally measured colour parameters. The sausages sample (a) showed significantly low absolute values of difference for means measured L^* and a^* colour parameters 7 and 35 days after production, but sausage sample (e) produced with 0.3% blend of emulsifier and stabilizers (E401; E516; E470a; E450) had the lowest absolute values of difference for means measured L^* and b^* colour parameters 7 and 35 days after production and the highest overall sensory acceptance of product comparing to the control sample (f) of finely comminuted chicken sausage „parizer“ type.

Key words: chicken sausages, additives, colour, sensory analysis

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PRIMENA KARAGENANA U PROIZVODNJI GOTOVIH JELA OD USITNJENOG OBLIKOVANOG MESA

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Hidrokoloidi nude razna inovativna rešenja u proširenju asortimana proizvoda, poboljšanju i racionalizaciji proizvodnje kao i mogućnosti zamene proteina soje (kao potencijalnog alergena) u izradi proizvoda od mesa.

Zadatak ovog rada je da se ispita uticaj dodatih hidrokoloida (karagenana), u količini od 0,5 i 0,7 posto, u pripremi usitnjenog oblikovanog mesa (faširana šnicla) za izradu jela u konzervi (u tipu sterilisana jela od mesa sa povrćem), na nutritivni, tehnološki i senzorni kvalitet gotovih jela.

Analizom dobijenih rezultata ispitivanja kala kuvanjem, osnovnog hemijskog sastava, senzorne analize i utvrđene energetske vrednosti ispitanih proizvoda, zaključeno je da je dodatak hidrokoloida pozitivno uticao na kalo toplotne obrade, a da je neznatno umanjio senzorni kvalitet proizvoda.

Ključne reči: usitnjeno meso, karagenan, kvalitet gotog jela

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USAGE OF CARRAGEENANE IN PRODUCTION OF READY-MEAL WITH RESTRUCTURED MINCED MEAT

Dzinic Natalija, Jokanovic Marija, Vasic Natasa, Markus K.,
Savatic Snezana, Sojic B.

Hydrocolloids with their unique characteristics are of great interest in processed meat due to their ability to bind water and form gels. Hydrocolloids play significant role in expanding variety of meat products, and in improvement and rationalization of production. Also, hydrocolloids can be an alternative for functional properties of soy protein - as potential allergens.

In this paper, attention is drawn to the influence of carrageen addition (0.5 and 0.7%) in the production of ground meat (hamburger steak) for canned ready-meal (meat with vegetables) on nutritive, technology and sensory quality of the ready-meal.

According to the results of cooking loss, chemical composition of meat, sensory analyses and determined energy value of analysed samples it can be concluded that carrageen addition had positive effects on cooking loss, but sensory quality was

characterised with slightly lower marks for the experimental groups, compared with the control group.

Key words: ground meat, carrageen, ready-meal quality

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SADRŽAJ NATRIJUM-HLORIDA I NATRIJUMA U NEKIM PROIZVODIMA OD MESA

Vranić Danijela, Saičić Snežana, Lilić S., Trbović Dejana

U radu je prikazan sadržaj natrijum-hlorida i natrijuma u proizvodima od mesa, uzorkovanim na našem tržištu. Ispitani su proizvodi: barene kobasice, suve fermentisane kobasice, konzerve od mesa, dimljeni i suvomesnati proizvodi. Sadržaj natrijum-hlorida određen je volumetrijski, a sadržaj natrijuma preračunavanjem iz odnosa natrijuma i hlora, na osnovu utvrđenog sadržaja natrijum-hlorida. Dobijeni rezultati pokazuju visok sadržaj natrijum-hlorida i natrijuma u proizvodima od mesa, naročito u suvomesnatim proizvodima. Posebna pažnja pridaje se preporučenom dnevnom unosu i uticaju prekomernog unošenja natrijuma na zdravlje ljudi.

Ključne reči: natrijum hlorid, proizvodi od mesa, natrijum

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CONTENT OF SODIUM CHLORIDE AND SODIUM CONTAINED IN SOME MEAT PRODUCTS

Vranic Danijela, Saicic Snezana, Lilic S., Trbovic Dejana

In this paper is presented the content of sodium chloride and sodium originating from meat products sampled in our market. The following products were examined: boiled sausages, dry fermented sausages, meat cans, smoked and dry meats. Sodium chloride content was determined volumetrically, and sodium content by calculating the relation of sodium and chlorine in the determined sodium chloride. The obtained results show high sodium chloride and sodium content in meat products, especially in dry meats. Particular attention is paid to recommended daily intake and influence of excessive intake of sodium on human health.

Key words: sodium chloride, meat products, sodium

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HIGIJENSKI USLOVI PROIZVODNJE I KVALITET PROIZVODA OD MESA PROIZVEDENIH U MALOPRODAJNIM OBJEKTIMA NA TERITORIJI BEOGRADA

Rašeta M., Milijašević M., Vesković-Moračanin Slavica, Borović Branka, Babić Jelena, Trbović Dejana, Vranić Danijela

U supermarketima, jedan deo asortimana proizvoda od mesa čine proizvodi koji se u ovim objektima proizvode i predstavljaju grupu proizvoda od mesa koji se termički ne obrađuju, već se to prepušta potrošaču. U ovu grupu proizvoda se ubrajaju usitnjeno oblikovano meso (pljeskavice i ćevapčići), mleveno meso i sveže kobasice. Rok održivosti ovih proizvoda je kratak, a njihova zadržavstvena ispravnost zavisi od mnogobrojnih činilaca, a pre svega od higijenskog stanja mesa, odnosno od primene dobre proizvođačke i higijenske prakse pri proizvodnji, transportovanju, skladištenju, obradi i preradi mesa, kao i od veterinarsko-sanitarnih uslova u maloprodajnim objektima.

U trideset i tri maloprodajna objekta na teritoriji Beograda, uzimani su brisevi sa ruku radnika, radnih površina, alata i opreme tokom proizvodnje i nakon obavljene sanitacije. Određivano je prisustvo patogenih mikroorganizama: *Salmonella vrste*, *sulfitoredukujuće klostridije*, *koagulaza pozitivne stafilokoke*, *E. coli* kao i *fekalnih streptokoka*. Ispitivanja su obavljana jednom mesečno, u periodu od decembra 2007. do decembra 2008. godine.

Ispitano je ukupno 1022 brisa. Od toga je bio higijenski neispravan 321 bris (31,4%). *Fekalne streptokoke* dokayane su u 79,4% uzorka, *E. coli* u 18,7%, a *koagulaza pozitivne stafilokoke* u 1,7% uzoraka. Nakon sanitacije (radnih površina, alata i opreme) i pranja ruku uzeto je 158 briseva. Higijenski neispravnih je bilo 48 briseva (30,4 posto).

U istim objektima uzorkovano je 560 proizvoda od mesa koji su mikrobiološki ispitani. Na osnovu dobijenih rezultata ustanovljeno je da je neispravno bilo 11 (1,96 posto) uzoraka (1,25 posto *E. coli* i 0,7 posto *koagulaza pozitivnih stafilokoka*).

Hemijskim ispitivanjem polovine od ukupnog broja uzoraka (280 uzoraka), utvrđeno je da 23 (8,21 posto) nije u skladu sa Pravilnikom o kvalitetu i drugim zahtevima za proizvode od mesa (Sl. list SCG br. 33/2004), zbog povećanog sadržaja proteina vezivnog tkiva u ukupnim proteinima u proizvodu.

Organoleptički je takođe ispitano 280 uzoraka i utvrđeno je da je bilo neispravnih 11 (3,92 posto) zbog izmenjenih organoleptičkih svojstava (kiseo miris i ukus).

Rezultati ovih ispitivanja ukazuju da u određenom broju maloprodajnih objekata nisu u potpunosti primenjeni principi dobre higijenske i proizvođačke prakse, pa postojeći uslovi i način rada nisu garancija za izradu zdravstveno ispravnih proizvoda od mesa.

Ključne reči: supermarketi, brisevi, usitnjeno oblikovano meso, sveže kobasice, kvalitet, zdravstvena ispravnost

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HYGIENIC PRODUCTION CONDITIONS AND QUALITY OF MEAT PRODUCTS PRODUCED IN RETAIL SHOPS IN THE BELGRADE AREA

Raseta M., Milijasevic M., Veskovic-Moracanin Slavica, Borovic Branka, Babic Jelena, Trbovic Dejana, Vranic Danijela

In supermarkets one part of the assortment of meat products are produced on the premises. These products are not thermally treated as cooking is left to the consumer. Within this group of products are minced shaped products (burgers and meat balls), minced meat and fresh sausages. The shelf life of these products is very short and their hygienic value depends on the good hygienic and good producers practice within the production, transport, storage and manufacture, as well as from the veterinary - sanitary conditions in the retail shop.

In 33 retail shops on the territory of Belgrade city swabs are taken from the hands of the workers, working surfaces, equipment and utensils during production and after sanitation. The presence of pathogens such as *Salmonella spp*, *sulphoreducing clostridia*, *coagulase positive staphylococci*, *E. coli* and *fecal Streptococci* was determined in the period from December 2007 to December 2008.

A total of 1022 swabs were studied. Out of these 321 were unhygienic (31.4%). Fecal Streptococci were present in 79.4%, *E. coli* in 18.7% and coagulase positive staphylococci in 1.7% samples. After sanitation of working surfaces, equipment and utensils and careful washing of hands 158 swabs were taken. Unhygienic were 48 swabs (30.4%). In the same shops 560 swabs were taken from meat samples and tested for microbes. It was determined that unsafe were 11 (1.96%) of samples (1.25% *E. coli* and 0.7% coagulase positive staphylococci)

Chemical analysis of half of the total samples (280 samples) determined that 23 of them (8.21%) were not in accordance to the Legislation and Rulebook on quality and other requests for meat products (SI list SCG no 33/2004), due to an increased quantity of connective tissue proteins.

Organoleptic studies revealed that 11 (3.92%) were unfit due changed characteristics (rancid smell and taste)

The results of this study indicate that in a number of retail shops the principles of good hygienic and good producers practice are not applied, thus the existing conditions are not a guarantee for a safe meat production.

Key words: supermarkets, swabs, finely chopped and shaped meat, fresh sausages, health safety

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MAKROKONFEKCIJA - UNAPREĐENJE DISTRIBUCIJE MESA U MALOPRODAJNOM LANCU DELTA MAXI GRUPE

Nikolić Jelena, Smiljević Milena, Jauković M.

Ključna razlika u implementaciji HACCP sistema u maloprodajnim lancima u odnosu na prehrambenu industriju vezana je za to da u obradi, pripremi i izlaganju proizvoda u maloprodajnim objektima postoje dodatni postupci manipulacije, pripreme i izlaganja hrane za prodaju krajnjem potrošaču koji se odvijaju na relativno malom prostoru i u kratkom vremenskom periodu. Kao potpora implementaciji HACCP sistema, sistem nabavke svežeg mesa u vidu trupova, polutki i četvrti je zamenjen makrokonfekcioniranim mesom, rasečenim na osnovne delove i upakovanim u ambalažu. Na osnovu dobijenih rezultata realizacije ovog projekta stekao se uvid u potrebu podizanja nivoa bezbednosti proizvoda, poboljšanja sistema sledljivosti proizvoda, ali i uštede vremena i troškova u odnosu na manipulaciju mesom u obliku trupova, polutki i četvrti.

Ključne reči: Makrokonfekcija, sledljivost, bezbednost proizvoda

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MACRO MEAT TRIMMING - IMPROVEMENT OF MEAT DISTRIBUTION IN DELTA „MAXI GROUP” RETAIL CHAIN

Nikolic Jelena, Smiljevic Milena, Jaukovic M.

The main difference between implementation of HACCP system in retail and in food processing industry is in the fact that processing, preparing and exposition of meat implies additional handling before selling the product to the consumer which is performed in a relatively small place and in a short period of time. In order to support HACCP implementation, meat supplied to the chain as carcasses and quarters is replaced with individually wrapped primal cuts. Results of this project provided insight into increasing the safety of the product, improvement in traceability as well as into the time saving and cost benefit in comparison with handling meat carcasses, halves and quarters.

Key words: Macro meat trimming, traceability, product safety

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MIKROBIOLOŠKA ISPRAVNOST USITNJENOG MESA I POLUPRIPREMLJENIH JELA U VELIKIM DISTRIBUTIVNIM OBJEKTIMA

Plavšić Dragana, Popović M., Čabarkapa Ivana, Varga Ana, Šarić Lj.

U ovom radu je ispitana mikrobiološka ispravnost uzoraka usitnjenog mesa i polupripremljenih jela uzorkovanih u velikim distributivnim objektima tokom 2007. i 2008. godine.

S obzirom na zahteve tržišta, evidentno je da je tokom poslednjih godina kategorija usitnjenog mesa postala veoma zastupljena u ishrani potrošača. S druge strane, sa aspekta potrošača, na tržištu su sve više zastupljena polupripremljena jela. Kod pripreme usitnjenog mesa primenjuje se mehanička obrada, dok se tokom obrade polupripremljenih jela postupak mariniranja izvodi manuelnim putem uz dodatak začina i aditiva. Komparacija dobijenih rezultata mikrobioloških ispitivanja ukazuje da postoji mogućnost rizika po bezbednost proizvoda u slučaju manuelne pripreme uzorka u odnosu na mehaničku pripremu.

Cilj ovog rada bio je da se ispita mikrobiološka ispravnost usitnjenog mesa i polupripremljenih jela (marinade) i utvrdi mogućnost njihove kontaminacije tokom pripreme.

Cljučne reči: mikrobiološka ispravnost, usitnjeno meso, marinada

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MICROBIOLOGICAL SAFETY OF MINCED MEAT AND SEMI READY TO EAT MEALS IN LARGE SUPERMARKETS

Plavšić Dragana, Popović M., Čabarkapa Ivana, Varga Ana, Šarić Lj.

In this paper microbiological safety of minced meat samples and semi ready to eat meals from supermarkets during 2007 and 2008 was investigated.

According to market demands the use of minced meat is increasing. On the other hand, from the consumer's point of view semi ready to eat meals are very welcome in the recent days. Minced meat is mechanically processed while semi ready to eat meals are made from meat marinated with added spices and additives. Comparison of obtained results indicate the possibility of risk for food safety issues is higher in marinated than in mechanically processed meat.

The aim of this paper was to investigate the microbiological safety of minced meat and semi ready to eat products and to identify the possibility of their contamination during processing.

Key words: microbiological safety, minced meat, marinade

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ISPITIVANJE PROIZVODA OD MESA NA TRŽIŠTU RUSIJE U TOKU 2008 GODINE

Khvylya S. I., Burlakova Svetlana, Pchelkina Victoria

Tema ovog rada je ispitivanje kvaliteta proizvoda na ruskom tržištu. Predstavljani su rezultati spitivanja sastava sledećih kuvanih kobasica: “Doctorskaya”, “Molochnaya” i Russkaya” koje su proizvedene u različitim regionima i njihova usklađenoost prema standardu GOST, kao i rezultati spitivanja za konzervisane proizvode od mesa “Stewed beef” GOST 5284 – 84 i “Stewed pork” GOST 697-84.

U istraživanju je korišćen histološki metod za identifikaciju sastava mesnih proizvoda. Dobijeni su satatistički podaci o upotrebi biljnih dodataka, ugljenih hidrata i aditiva proteina, dobijenih metodom analize mikrostrukture i utvrđeni su glavni trendovi korišćenja aditiva u proizvodima od mesa.

U radu su dati ilistrovani prikazi strukture korišćenih aditiva u proizvodima od mesa.

Ključne reči: kvalitet, kuvane kobasice, mesne konzerve, histološki metod, identifikacija, aditivi u hrani

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EVALUATION OF THE MARKET FOR MEAT PRODUCTS IN RUSSIA IN 2008

Khvylya S. I., Burlakova Svetlana, Pchelkina Victoria

The problem of adulteration of meat products on the Russian food market is considered. Results of monitoring of the composition of cooked sausages: “Doctorskaya”, “Molochnaya” and Russkaya” manufactured by producers of different regions in compliance with GOST, are presented, together with the study of canned meats “Stewed beef” GOST 5284 – 84 and “Stewed pork” GOST 697 -84.

The investigations were carried out using the histological method of meat products composition identification. Statistical data about the use of plant, carbohydrate and protein additives revealed by the method of microstructure analysis were obtained; main trends of use of food additives in meat products were established.

The illustrations of structural arrangement of the used adulterating additives in meat products are presented.

Key words: adulteration, cooked sausages, canned meats, histological method, identification, food additives

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IV-24

KVALITET PROIZVODA OD MESA PASTRMKI

Đorđević Mirjana, Karan Dragica, Babić Jelena, Parunović N., Milićević D.,
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Pošto je meso pastrmki veoma prihvatljivo i cenjeno zbog svojih organoleptičkih svojstava, cilj ovog rada je bio da se prikažu najvažnije karakteristike mesa i proizvoda od mesa pastrmki, u pogleda kvaliteta i zdravstvene ispravnosti.

Meso pastrmki, zbog svog sastava (visoko vredne belančevine, minerali, vitamini, nizak sadržaj masti), preporučuje se za ishranu svih uzrasta, kao i u dijetetskoj ishrani.

Pored poznatih vrsta pastrmki (kalifornijska pastrmka, jezerska, potočna i drugo) i proizvoda (dimljena pastrmka, pljeskavica od pastrmki), na tržištu se pojavila pastrmka pod nazivom „lososova pastrmka“, čije meso je svetloružičaste do ružičastonarandžaste boje.

Na osnovu podataka iz literature i saznanja iz prakse, utvrđeno je da vrsta pastrmke *Oncorhynchus mykiss*, ranije *Salmo gairdneri* („salmon trout“, „steelhead trout“, ili „coastal rainbow trout“), uzgajana u kontrolisanim uslovima, uz dodavanje karotenoida u ishrani, ima boju mesa, jednaku ili slična mesu lososa.

Ključne reči: pastrmka, proizvodi od pastrmke, kvalitet, „lososova pastrmka“

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QUALITY OF TROUT MEAT PRODUCTS

Djordjevic Mirjana, Karan Dragica, Babic Jelena, Parunovic N., Milicevic D.,
Milijasevic M.

As trout is highly accepted and appreciated for its organoleptic features, the aim of this study was to indicate the most important characteristics of trout meat and products in terms of quality and hygiene acceptability.

Trout is due to its virtues (high value proteins, minerals, vitamins and low fat content) recommended to be consumed by all age groups, as well as in special diets.

Besides the well known trout (Californian, lake, fresh stream etc.) and their products (smoked trout, fish burgers) on the market has recently appeared a new trout known as „salmon trout“ whose flesh has a light pink to pink/orange color.

Based upon literature data and knowledge obtained from praxis it has been established that the flesh of the *Oncorhynchus mykiss*, trout (previously known as

Salmo gairdneri i.e. „salmon trout“, „steelhead trout“, or „coastal rainbow trout“), grown under controlled conditions, when given a diet supplemented with carotinoids achieves a meat color similar to the color of salmon.

Key words: trout, trout products, quality, salmon trout

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IV-25

**SADRŽAJ MASNIH KISELINA I HOLESTEROLA U NEKIM
PROIZVODIMA OD MESA**

Saičić Snežana, Trbović Dejana, Vranić Danijela, Janković S., Stefanović S.,
Petronijević R.

Ispitano je četiri uzorka proizvoda od mesa iz grupe fermentisanih suvih kobasica i četiri uzorka iz grupe suvomesnatih proizvoda od mesa. Ispitan je osnovni hemijski sastav (%), sadržaj masnih kiselina (izražen kao % ukupno identifikovanih masnih kiselina) i holesterola (mg/100g). Od zasićenih masnih kiselina, najzastupljenija je palmitinska kiselina, sa sadržajem od 22,92% (goveđa pršuta) do 26,26% (svinjski vrat u mreži); od mononezasićenih, oleinska, sa sadržajem od 38,64% (svinjski vrat u mreži) do 48,23% (goveđa pršuta). Najzastupljenija polinezasićena masna kiselina je linolna kiselina sa sadržajem od 5,77% (svinjska pečenica) do 10,29% (svinjski vrat u mreži). Najniži odnos polinezasićenih masnih kiselina sa zasićenim masnim kiselinama (P/Z), utvrđen je u uzorku svinjske pečenice (0,20) a najviši u uzorku svinjske pršute (0,36). Utvrđen je niži sadržaj holesterola u fermentisanim suvim kobasicama u poređenju sa suvomesnatim proizvodima od mesa (prosečna vrednost 56,60 mg/100g i 84,11 mg/100g, respektivno).

Ključne reči: Proizvodi od mesa, masne kiseline, holesterol

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**FATTY ACID AND CHOLESTEROL CONTENT OF SOME
MEAT PRODUCTS**

Saicić Snežana, Trbović Dejana, Vranić Danijela, Janković S., Stefanović S.,
Petronijević R.

Four samples from the group of dry fermented sausages and four samples from the group of dry meat products were examined. Analyses of the basic chemical composition (%), fatty acid content (expressed as percent of total identified fatty acids) and cholesterol

content (mg/100g) were performed. Palmitic acid was the major component of the saturated fatty acids. Its content ranged from from 22.92% (dry beef meat) to 26.26% (pig neck in net). Oleic acid was the major component of the monounsaturated fatty acids (from 38.64% (pig neck in net) to 48.23% (dry beef meat)). The most abundant of the polyunsaturated fatty acids was linoleic acid with the content from 5.77% (dry pork shops) to 10.29% (pig neck in net). The lowest ratio

of polyunsaturated to saturated fatty acids was determined in the sample of dry pork meat (0.20) and the highest was determined in the sample of dry pork meat (0.36). Cholesterol content in the examined samples of dry fermented sausages was lower compared with the examined samples of dry meat products (average content 56.60 mg/100g and 84.11 mg/100g, respectively).

Key words: Meat products, fatty acids, cholesterol

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UTICAJ MINERALNIH ADSORBENATA, DODATIH U HRANU, NA RANDMANE TRUPOVA PILIĆA

Radović Vera, Filipović S., Okanović Đ., Ristić M., Kormanjoš Š., Karović D

U ovom radu saopšteni su originalni rezultati primene mineralnog adsorbenta u ishrani pilića u tovu. Cilj istraživanja bio je da se utvrdi: da li mineralni adsorbenti "Minazel" i "Minazel Plus", dodati u hranu za piliće u tovu imaju uticaj na randman trupova pilića.

Istraživanje je obavljeno na 400 pilića za tov, provenijence Cobb 500, podeljenih u 4 grupe, obzirom na nivo dodatog mineralnog adsorbenta: kontrolna grupa K (100 pilića, bez dodatog mineralnog adsorbenta, 0,0%); ogledna grupa O-I (100 pilića, sa 0,5% Minazel-a); ogledna grupa O-II (100 pilića sa 0,2% Minazela Plus) i ogledna grupa O-III (100 pilića, sa 0,3% Minazela Plus). Ogljed ishrane trajao je 42 dana.

Pošto je randman bitan činilac kvaliteta, praćen je uticaj tretmana ishrane na ovu osobinu. Rezultati istraživanja pokazuju da su pilići O-I grupe imali najbolje proizvodne rezultate ohlađenog trupa (%), O-III %, O-II % i najmanje K grupa % (P). Razlike srednjih vrednosti između ispitivanih grupa su i statistički značajne.

Možemo zaključiti da je dodatak mineralnih adsorbenata u hranu za tov pilića rezultirao boljim proizvodnim rezultatima.

Ključne reči: tov pilića, mineralni adsorbenti, randman, trupovi.

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Napomena: *Istraživanje je izvršeno u okviru projekta: TR-20066. „Održivost lanca masovne proizvodnje hrane“ finansiranog od Ministarstva za nauku i tehnološki razvoj RS*

THE EFFECT OF MINERAL ADSORBENTS ADDED INTO DIET, ON DRESSING PERCENTAGE OF CHICKENS

Radovic Vera, Filipovic S., Okanovic Dj., Ristic M., Kormanjos S., Karovic D.

In this work the original results were presented considering the application of the mineral adsorbents in diet of feeding chickens. The aim of these investigations was to determine: if mineral adsorbents, "Minazel" and "Minazel Plus" added into diet for fattening chickens, have influence on dressing percentage of chickens.

The examination was done on 400 fattening of Cobb 500 strain, divided into 4 groups, considering the level of already added mineral adsorbent: control group K

(100 chickens, without added mineral adsorbent – 0,0%), experimental group O-I (100 chickens, with 0,5% of Minazel), experimental group O-II (100 chickens, with 0,2% of Minazel Plus), experimental group O-III (100 chickens, with 0,3% of Minazel Plus). The feeding experiment lasted for 42 days.

Because for the reason that dressing percentage is important determining element of quality, influence of feeding treatment to this trait was observed. Results of examination show that the chickens from O-I group %, had the best production results of cold carcass %, O-III group %, O-II %, and at least K group % (P). The differences of the mean values between examined groups were statistical significant.

Finally we claim that the mineral adsorbents added into the diets for chickens resulted in better production characteristics of the chickens.

Key words: fattening of chickens, mineral adsorbents, dressing percentage, carcass.

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Note: *This investigation was carried out within the project: “Sustainability of the chain of mass food production” funded by Ministry of Science and Technological development RS, TR-20066*

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