

14th
INTERNATIONAL
SYMPOSIUM

MODERN
TRENDS
IN LIVESTOCK
PRODUCTION



P R O C E E D I N G S

4 - 6 October 2023, Belgrade, Serbia

Institute for Animal Husbandry
Belgrade - Zemun, SERBIA

**14th
INTERNATIONAL
SYMPOSIUM**

**MODERN
TRENDS
IN LIVESTOCK
PRODUCTION**



4 - 6 October 2023, Belgrade, Serbia

PATRONS

Ministry of Science, Technological Development
and Innovation of the Republic of Serbia

Ministry of Agriculture, Forestry and Water Management
of the Republic of Serbia

ORGANIZER

Institute for Animal Husbandry

Autoput 16, P. Box. 23,

11080, Belgrade-Zemun, Serbia

Tel: +381 11 2691 611; +381 11 2670 121; +381 11 2670 541;

Fax: + 381 11 2670 164;

PUBLISHER

Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Editor

Zdenka Škrbić, PhD, Principal Research Fellow

Institute for Animal Husbandry, Belgrade-Zemun

The Proceedings is printed by the Institute for Animal Husbandry,
Belgrade, 2023



biotechnology.izs@gmail.com

www.istocar.bg.ac.rs

Circulation 100 copies.

ISBN 978-86-82431-80-0

INTERNATIONAL SCIENTIFIC COMMITTEE

CHAIRMAN

Prof. Dr. **Giacomo Biagi**,
Department of Veterinary Medical Sciences,
University of Bologna, Italy

SECRETARY

Dr. **Nikola Delić**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

MEMBERS

Dr. **Dragana Ružić-Muslić**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Vlada Pantelić**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Aleksandar Stanojković**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Miloš Lukić**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Zdenka Škrbić**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Čedomir Radović**,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Prof. Dr. **Marjeta Čandek-Potokar**,
Agricultural Institute of Slovenia, Ljubljana, Slovenia

Dr. **Giuseppe Bee**,
Agroscope Posieux, Posieux, Switzerland

Prof. Dr. **Zoran Stanimirović**,
University of Belgrade, Faculty of Veterinary Medicine, Serbia

Prof. Dr. **Stayka Laleva**,
Agricultural Institute, Stara Zagora, Bulgaria

Prof. Dr. **Maya Ignatova**,
Institute of Animal Science, Kostinbrod, Bulgaria



INTERNATIONAL SCIENTIFIC COMMITTEE

- Dr. Ivan Bošnjak,**
Ministry of Human and Minority Rights and Social Dialogue, Serbia
- Dr. Veselin Petričević,**
Institute for Animal Husbandry, Belgrade-Zemun, Serbia
- Dr. Dušica Ostojić Andrić,**
Institute for Animal Husbandry, Belgrade-Zemun, Serbia
- Prof. Dr. Galia Zamaratskaia,**
Department of Molecular Sciences, BioCenter,
Swedish University of Agricultural Sciences, Uppsala, Sweden
- Dr. Dragan Nikšić,**
Institute for Animal Husbandry, Belgrade-Zemun, Serbia
- Dr. Ljiljana Samolovac,**
Institute for Animal Husbandry, Belgrade-Zemun, Serbia
- Prof. Dr. Lidiya Perić,**
University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia
- Prof. Dr. Wladyslav Migdal,**
Department of Animal Product Technology,
University of Agriculture in Kraków, Poland
- Dr. Dobrila Jakić-Dimić,**
Scientific Veterinary Institute of Serbia, Serbia
- Prof. Dr. Yalçın Bozkurt,**
Isparta University of Applied Science,
Department of Animal Science, Isparta, Türkiye
- Dr. Snežana Mladenović Drinić,**
Maize Research Institute „Zemun Polje“, Belgrade, Serbia
- Dr. Jelena Aleksić,**
Institute of Molecular Genetics and Genetic Engineering, Serbia
- Dr. Nikola Stanišić,**
Institute for Animal Husbandry, Belgrade - Zemun, Serbia
- Dr. Jack Bergsma,**
Royal Avebe, The Netherlands



INTERNATIONAL SCIENTIFIC COMMITTEE

Dr. **Sam Millet**,

ILVO, Flanders Research Institute for Agriculture, Fisheries and Food, Belgium

Prof. Dr. **Antonella Dalle Zotte**,

Department of Animal Medicine, University of Padova, Italy

Prof. Dr. **Snežana Trivunović**,

University of Novi Sad, Faculty of Agriculture, Serbia

Prof. Dr. **Predrag Perišić**,

University of Belgrade, Faculty of Agriculture, Serbia

Prof. Dr. **Martin Škrlep**,

Agricultural Institute of Slovenia, Slovenia

Dr. **Violeta Caro Petrović**,

Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. **Nevena Maksimović**,

Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Prof. Dr. **Vesna Gantner**,

Josip Juraj Strossmayer University of Osijek,

Faculty of Agrobiotechnical Sciences, Osijek, Croatia

Dr. **Maria Munoz**,

Departamento Mejora Genética Animal,

INIA, Spain

Dr. **Violeta Mandić**,

Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Prof. Dr. **Pero Mijić**,

Josip Juraj Strossmayer University of Osijek,

Faculty of Agrobiotechnical Sciences, Osijek, Croatia

Prof. Dr. **Zoran Luković**,

University of Zagreb, Faculty of Agriculture,

Department of Animal Science and Technology, Croatia

Prof. Dr. **Dubravko Škorput**,

University of Zagreb, Faculty of Agriculture,

Department of Animal Science and Technology, Croatia

Prof. Dr. **Aleksandar Simić**,

University of Belgrade, Faculty of Agriculture, Serbia

Prof. Dr. **Simeon Rakonjac**,

University of Kragujevac, Faculty of Agronomy, Serbia



INTERNATIONAL SCIENTIFIC COMMITTEE

Dr. Jasna Prodanov-Radulović,
Scientific Veterinary Institute “Novi Sad”, Serbia

Prof. Dr. Rosa Nieto,
Departament of Physiology and Biochemistry of Animal
Nutrition Estacion Experimental del Zaidín, CSIC Armilla,
Granada, Spain

Dr. Jordan Marković,
Institute for Forage Crops, Kruševac, Serbia

Dr. Juan M. García Casco,
Departamento Mejora Genética Animal,
INIA, Madrid, Spain

Dr. Slavica Stanković,
Maize Research Institute „Zemun Polje“, Belgrade, Serbia

Dr. Vesna S. Krnjaja,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia



ORGANIZING COMMITTEE

CHAIRMAN

Dr. Nikola Delić,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

SECRETARY

Dr. Maja Petričević,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

MEMBERS

Dr. Marina Lazarević,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. Marija Gogić,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. Vladimir Živković,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. Nenad Mičić,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Dr. Vesna Dragičević,
Maize Research Institute „Zemun Polje“, Belgrade, Serbia

Prof. Dr. **Tanja Vasić,**
Faculty of Agriculture, University of Niš, Serbia

Prof. Dr. **Tanja Petrović,**
Faculty of Agriculture, University of Belgrade, Serbia

Dr. Nataša Tolimir,
Institute for Science Application in Agriculture, Serbia



SYMPOSIUM SECRETARIAT

CHAIRMAN

Dr. Maja Petričević,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

MEMBERS

Slavko Maletić, grad. econ.
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Olga Devečerski, grad. prof.
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Bogdan Cekić, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Miloš Marinković, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Nenad Stojiljković, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Ivan Ćosić, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Tamara Stameniċ, MPharmSc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Tanja Keškić, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Danijel Milenković, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Nemanja Lečić, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia

Aleksandra Petrović, Msc,
Institute for Animal Husbandry, Belgrade-Zemun, Serbia





Address:

Institute for Animal Husbandry,
Autoput 16, P. Box 23,
11080, Belgrade-Zemun, Serbia

Tel:

+381 11 2691 611

+381 11 2670 121

+381 11 2670 541

Fax:

+381 11 2670 164

E-mail: biotechnology.izs@gmail.com

www.istocar.bg.ac.rs

CONTENT

Martin Wähner

THE SCIENTIFIC CONFERENCES OF THE ZEMUN INSTITUTE - A
REVIEW AND OUTLOOK (Germany)..... 1-7

Vesna Gantner, Maja Gregić, Čedomir Radović

SUSTAINABILITY OF A PLANT-BASED DIET(Croatia, Serbia).... 8-23

*Federica Sportelli, Benedetta Delfini, Costanza Delsante, Carla Giuditta
Vecchiato, Carlo Pinna, Giacomo Biagi*

THE INFLUENCE OF NUTRITION ON CANINE BEHAVIOR AND
THE ROLE OF THE GUT-BRAIN AXIS: A COMPREHENSIVE
REVIEW (Italy)..... 24-39

Giuseppe Bee, Steve Jacot, George Guex, Claudine Biolley

EFFECT OF THE FATTY ACID COMPOSITION OF THE
MATERNAL DIETS OF SWISS LARGE WHITE SOWS ON THE
FATTY ACID COMPOSITION OF THE BACKFAT OF THE
PROGENY (Switzerland)..... 40-60

Sam Millet, Sophie Goethals

BALANCING AMINO ACID LEVELS IN PIGLET DIETS (Belgium) 61-72

*Zaira Pardo, Ignacio Fernández-Fígares, Manuel Lachica, Isabel
Seiquer, Luis Lara, Consolación García-Contreras, Fernando Sánchez-
Esquiliche, Rosa Nieto*

HEAT STRESS EFFECTS ON IBERIAN PIG GROWTH AND
PRODUCTIVITY (Spain)..... 73-82

*Vladimir Živković, Wladyslaw Migdal, Lukasz Migdal, Marija Gogić,
Nenad Stojiljković, Aleksandra Petrović, Čedomir Radović*

ENHANCING PIGLET GROWTH WITH LIVE YEAST: A
NUTRITIONAL SUPPLEMENT STUDY (Serbia, Poland)..... 83-92

*Bojana Savić, Martin Škrlep, Klavdija Poklukar, Nina Batorek Lukač,
Marjeta Čandek-Potokar*

VARIATION IN CARCASS, MEAT AND FAT QUALITY OF
AUTOCHTHONOUS BREED IN CONVENTIONAL AND ORGANIC
PRODUCTION SYSTEM (Slovenia)..... 93-103

<i>Galia Zamaratskaia, Ayaz Mammadov, Javid Ojaghi, Simon Tobias Höxter, Oksana Kravchenko, Nataliia Hryshchenko, Mykhailo Matvieiev, Elina Åsbjer, Birgitta Staaf Larsson, Svitlana Usenko, Anders H. Karlsson, Hallvard Wie, Iveta Kocina, Liene Ansone, Vytautas Ribikauskas, David Richard Arney, Ragnar Leming, Francesca Carnovale, Andriy Getya</i> ATTITUDES OF CONSUMERS TOWARDS ANIMAL WELFARE IN UKRAINE AND AZERBAIJAN (Sweden, Ukraine, Azerbaijan, Latvia, Lithuania, Estonia).....	104-113
<i>Ljiljana Samolovac, Dragan Nikšić, Dušica Ostojić Andrić, Vladimir Živković, Dragan Stanojević, Vlada Pantelić, Nenad Mičić</i> ORGANIZATION OF CATTLE PRODUCTION IN CONDITIONS OF CLIMATE CHANGE (Serbia).....	114-128
<i>Nevena Maksimović, Dragana Ružić-Muslić, Violeta Caro Petrović, Bogdan Cekić, Ivan Čosić, Nemanja Lečić, Nikola Stanišić</i> GOATS AND CLIMATE RESILIENCE (Serbia).....	129-143
<i>Fatmagül Tolun, Ergün Demir</i> CARBON CAPTURE TECHNOLOGIES FOR LIVESTOCK FARMS (Türkiye).....	144-156
<i>Slavča Hristov, Marko Cincović, Branislav Stanković, Radojica Đoković, Dušica Ostojić Andrić, Ljiljana Samolovac, Dimitar Nakov</i> DETERMINATION OF NEW WELFARE AND STRESS INDICATORS OF THE ANIMALS ON CATTLE AND PIG FARMS BASED ON DIFFERENT PUBLICATIONS (Serbia, North Macedonia)	157-167
<i>Branislav Stanković, Slavča Hristov, Marko Cincović, Radojica Đoković, Dušica Ostojić Andrić, Ivana Milošević-Stanković, Dimitar Nakov</i> DETERMINATION OF NEW BIOSECURITY INDICATORS ON CATTLE AND PIG FARMS BASED ON DIFFERENT PUBLICATIONS (Serbia, North Macedonia).....	168-181
<i>Simeon Rakonjac, Snežana Bogosavljević-Bošković, Zdenka Škrbić, Miloš Lukić, Vladimir Dosković, Veselin Petričević, Milun D. Petrović</i> ORGANIC POULTRY PRODUCTION: GENOTYPE CHOICE AND WELFARE (Serbia).....	182-192
<i>Marko Pajić, Slobodan Knežević, Jelena Maletić, Sava Spiridonović, Biljana Đurđević, Dalibor Todorović, Dušica Ostojić Andrić</i> ASSESSMENT OF THE CURRENT STATE OF BIOSECURITY MEASURES ON BROILER CHICKEN FARMS WITH DIFFERENT CAPACITIES IN VOJVODINA (Serbia).....	193-205

<i>Maria Muñoz, Ángel M. Martínez-Móntes, Almudena Fernández, Josep Maria Folch, Ana I. Fernández</i> EXPLORING PORCINE GROWTH AND FATNESS THROUGH LIVER TRANSCRIPTOME ANALYSES IN DIFFERENT IBERIAN GENETIC BACKGROUNDS (Spain).....	206-213
<i>Martin Škrlep Nina Batorek Lukač</i> ADVANTAGES AND DRAWBACKS OF REARING OF ENTIRE MALE AND IMMUNOCASTRATED PIGS (Slovenia).....	214-231
<i>Dubravko Škorput, Danijel Karolyi, Ana Kaić, Zoran Luković</i> OPTIMUM CONTRIBUTION SELECTION: PRACTICAL IMPLEMENTATION IN BLACK SLAVONIAN AND BANIIJA SPOTTED PIG (Croatia).....	232-240
<i>Fernando Sánchez-Esquiliche, Patricia Palma-Granados, Luisa Ramírez Hidalgo, Alberto Márquez, María Muñoz, Juan M. García Casco</i> IMPROVING THE REPRODUCTIVE CHARACTERISTICS OF THE PUREBRED IBERIAN PIG: A CHALLENGING ENDEAVOR (Spain)	241-250
<i>Aleksandar Stanojković, Nikola Stanišić, Nikola Delić, Ivan Bošnjak, Violeta Mandić, Aleksandra Stanojković-Sebić, Jakov Nišavić</i> STREPTOCOCCUS SUIS, TWO-FACED GAME CHANGER (Serbia)	251-266
<i>Jasna Prodanov-Radulović, Jelena Petrović, Siniša Grubač, Milijana Nešković, Slavča Hristov, Jovan Bojkovski</i> RELEVANT BIOSECURITY MEASURES TO PREVENT THE SPREAD OF AFRICAN SWINE FEVER IN THE DOMESTIC PIG PRODUCTION SECTOR IN SERBIA (Serbia).....	267-275
<i>Igor M. Stojanov, Doroteja A. Maričić, Radomir D. Ratajac, Jasna Z. Prodanov Radulović, Stevan G. Rodić, Jelena B. Apić, Ivan M. Pušić</i> SIGNIFICANCE OF LISTERIA ISOLATES IN ABORTED MATERIALS FROM COWS (Serbia).....	276-285
<i>Ivan Pavlović, Stanko Minić, Violeta Caro Petrović, Milan P. Petrović, Ivan Dobrosavljević, Nemanja Zdravković, Jovan Bojkovski, Ana Vasić, Marija Pavlović, Aleksandra Tasić</i> COENUROSIS OF SHEEP IN SERBIA - CASE REPORT (Serbia).....	286-296
<i>Yunus Emre Ata, Kemal Çelik</i> INVESTIGATION OF THE USE OF PROPOLIS IN BROILER FEEDS AND ITS EFFECTS ON HEALTH AND PERFORMANCE PARAMETERS (Türkiye).....	297-310

<i>Muhittin Zengin, Ergün Demir, Abdulkadir Keskin</i> CURRENT APPROACHES TO THE RELATIONSHIP OF ZEARALENONE AND FERTILITY IN LIVESTOCK (Türkiye).....	311-324
<i>Jack Bergsma</i> THE USE OF STARCH IN THE MEAT PROCESSING INDUSTRY (The Netherlands).....	325-334
<i>Nikola Stanišić, Nikola Delić, Slaviša Stajić, Maja Petričević, Slobodan Lilić, Tamara Stamenić, Aleksandar Stanojković</i> EFFECT OF FAT LEVEL ON QUALITY CHARACTERISTICS OF TRADITIONAL SUCUK SAUSAGES. PART 1: PHYSICO- CHEMICAL CHANGES DURING PRODUCTION (Serbia).....	335-345
<i>Nikola Delić, Nikola Stanišić, Aleksandar Stanojković, Maja Petričević, Tamara Stamenić, Nevena Maksimović, Tanja Keškić</i> EFFECT OF FAT LEVEL ON QUALITY CHARACTERISTICS OF TRADITIONAL SUCUK SAUSAGES. PART 2: TEXTURE, COLOUR AND SENSORY QUALITY (Serbia).....	346-354
<i>Władysław Migdał, Ćedomir Radović, Vladimir Živković, Maria Walczycka, Anna Migdał, Lukasz Migdał</i> MEAT OF NATIVE PIGS BREEDS AS A RAW MATERIAL FOR TRADITIONAL PRODUCTS OBTAINED IN SERBIA AND POLAND (Poland, Serbia).....	355-374
<i>Ana Kaić, Dubravko Škorput, Danijel Karolyi, Zoran Luković</i> ASSESSMENT OF WATER-HOLDING CAPACITY IN DIFFERENT MEATS USING EZ-DRIPLOSS METHOD: A REVIEW OF KEY METHODOLOGICAL FACTORS (Croatia).....	375-383
<i>Yalcin Bozkurt, Mevlüt Türk, Sabahattin Albayrak</i> PATH COEFFICIENT ANALYSIS BETWEEN BODY WEIGHT AND SOME REAL-TIME BODY MEASUREMENTS OF GRAZING CATTLE ON DIFFERENT ARTIFICIAL PASTURES (Türkiye).....	384-395
<i>Jordan Marković, Vladimir Zornić, Ratibor Štrbanović</i> EFFECT OF CONDENSED TANNINS CONCENTRATIONS ON PROTEIN DEGRADABILITY OF RED CLOVER, ITALIAN RYEGRASS AND THEIR MIXTURES (Serbia).....	396-407
<i>Marina Lazarević, Vlada Pantelić, Dragan Stanojević, Dragan Nikšić, Nevena Maksimović, Miloš Marinković, Ljiljana Samolovac</i> TREND OF MILK YIELD TRAITS OF BULL MOTHERS OF THE HOLSTEIN-FRIESIAN BREED (Serbia).....	408-417

Tina Bobić, Pero Mijić, Vesna Gantner, Mirjana Baban, Maja Gregić
FARMER EXPERIENCE IN TRANSITION FROM CONVENTIONAL
TO ROBOTIC MILKING (Croatia)..... 418-424

Savaş Atasever
BROMOTYMOL BLUE TEST SCORES FOR DETECTING RAW
MILK QUALITY OF BUCKET MILK OF JERSEY COWS (Türkiye) 425-431

*Amila Milišić, Zlatan Sarić, Lejla Biber, Amila Oras, Munevera Begić,
Tarik Dizdarević, Miroljub Barać, Svijetlana Sakić-Dizdarević*
PRODUCTION AND QUALITY ASPECTS OF PROBIOTIC
FERMENTED MILK WITH ADDITION OF HONEY (Bosnia and
Herzegovina, Serbia)..... 432-440

POSTER SECTION

*Milun D. Petrović, Vladan Bogdanović, Snežana Bogosavljević-Bošković,
Simeon Rakonjac, Radojica Đoković, Radica Đedović, Miloš Ži. Petrović*
EFFECT OF SYSTEMATIC FACTORS ON MILK PRODUCTION
PER MILKING, PRODUCTIVE AND LIFETIME DAY IN
SIMMENTAL COWS (Serbia)..... 441-449

*Vesna Gantner, Ivana Jožef, Vera Popović, Maja Gregić, Dragan Solić,
Klemen Potočnik*
THE EFFECT OF MASTITIS PREVALENCE RISK ON THE DAILY
PRODUCTION OF DAIRY COWS CONCERNING THE MILK
RECORDING YEAR (Croatia, Slovenia)..... 450-459

*Dušica Ostojić Andrić, Slavča Hristov, Branislav Stanković, Violeta Caro
Petrović, Marko Pajić, Dragan Nikšić, Ljiljana Samolovac, Miloš
Marinković*
MEDICINAL AND AROMATIC PLANTS IN LIVESTOCK
FARMING: A PROMISING APPROACH FOR BOOSTING HEALTH
AND PERFORMANCE (Serbia)..... 460-475

Dragan Dokić, Vera Popović, Maja Gregić, Vesna Gantner
IMPROVING THE DEVELOPMENT OF THE COMPETITIVENESS
OF PIG AND CATTLE PRODUCTION IN THE REPUBLIC OF
CROATIA BY APPLYING GENERIC STRATEGIES (Croatia)..... 476-483

Maja Gregić, Tina Bobić, Dragan Dokić, Vesna Gantner
THERMOREGULATION OF SPORTS HORSES (Croatia)..... 484-492

<i>Ivan Vlahek, Nevena Maksimović, Aneta Piplica, Maja Maurić Maljković, Nikola Delić, Marina Lazarević, Velimir Sušić</i> POPULATION TRENDS OF GOATS IN SERBIA AND CROATIA FROM 2012 TO 2021 (Croatia, Serbia).....	493-507
<i>Alkan Çağlı, Hasan Coğan, Murat Yilmaz</i> COMPARISON OF BODY WEIGHT, FAMACHA © BCS AND HAIR SCORES IN SAANEN GOATS DURING PREGNANCY AND BIRTH PERIOD (Türkiye).....	508-518
<i>Bogdan Cekić, Dragana Ružić Muslić, Nevena Maksimović, Violeta Caro Petrović, Ivan Čosić, Nemanja Lečić, Zsolt Becskei</i> NEW ASPECTS IN RISK STATUS EVALUATION OF SMALL RUMINANT LOCAL BREEDS IN SERBIA (Serbia).....	519-530
<i>Maria Babetsa, Evangelia D. Apostolidi, Loukia V. Ekateriniadou, Evridiki Boukouvala</i> PRNP GENE POLYMORPHISMS IN HEALTHY GREEK SHEEP FROM 2017 TO 2022 - NATIONAL DATABASE FROM RESISTANT RAMS (Greece).....	531-539
<i>Nikola Metodiev</i> THE EFFECT OF THE APPLICATION OF MELATONIN IMPLANTS IN THE SPRING ON THE MANIFESTATION OF ESTRUS AND FERTILITY IN ILE DE FRANCE SHEEP (Bulgaria).....	540-546
<i>Klavdija Poklukar, Marjeta Čandek-Potokar, Nina Batorek Lukač, Marie-José Mercat, David Picard Druet, Martin Škrlep</i> GENE POLYMORPHISMS FREQUENCIES IN KRŠKOPOLJE PIG BREED (Slovenia, France).....	547-555
<i>Klavdija Poklukar, Marjeta Čandek-Potokar, Nina Batorek Lukač, Marie-José Mercat, David Picard Druet, Martin Škrlep</i> THE EFFECT OF PRKAG3 AND RYR1 GENE ON MEAT QUALITY TRAITS IN THE LOCAL KRŠKOPOLJE PIG BREED (Slovenia, France).....	556-565
<i>Vesna Krnjaja, Violeta Mandić, Slavica Stanković, Ana Obradović, Tanja Petrović, Tanja Vasić, Marina Lazarević</i> FUSARIUM AND DEOXYNIVALENOL CONTAMINATION OF WINTER WHEAT DEPENDING ON GROWING SEASON AND CULTIVAR (Serbia).....	566-576

EFFECT OF FAT LEVEL ON QUALITY CHARACTERISTICS OF TRADITIONAL SUCUK SAUSAGES. PART 1: PHYSICO-CHEMICAL CHANGES DURING PRODUCTION

Nikola Stanišić¹, Nikola Delić¹, Slaviša Stajić², Maja Petričević¹, Slobodan Lilić³, Tamara Stamenić¹, Aleksandar Stanjковиć¹

¹ Institute for Animal Husbandry, Autoput 16, 11080, Belgrade-Zemun, Republic of Serbia

² University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Republic of Serbia

³ Institute of Meat Hygiene and Technology, Kačanskog 13, 11000 Belgrade, Republic of Serbia

Corresponding author: Nikola Stanišić, nikola0135@yahoo.com

Invited paper

Abstract: This trial aimed to investigate changes in pH, proximate composition and fat rancidity parameters during the production of traditional Sucuk sausage (dry fermented sausage) with different fat levels. Three groups of sausages were produced from beef meat and fat: LF (low fat, with 10% added fat), MF (medium fat, with 20% added fat) and HF (high fat, with 30% added fat). The production was carried out in a traditional smoking house, and fermentation and ripening lasted 28 days. Samples were analysed after stuffing (day 0) and on days 7, 14, 21 and 28 of production. The higher fat content of the HF group probably influenced the lowest pH value at the beginning of production (day 0) ($p < 0.05$). The HF group also had the mildest drop in pH ($p < 0.05$), while the MF and LF groups had a similar trend in pH decline. Fat content had a significant effect on the proximate composition of the products, best reflected at the end of the production process, where the HF group had significantly higher fat and lower moisture and protein content ($p < 0.05$). A higher total free fatty acids (FFA) content was obtained in the LF group, showing greater lipolysis than in MF and HF groups. Interestingly, sausages with higher fat content had lower peroxide values during production ($p < 0.05$).

Key words: sucuk sausage, fat level, proximate composition, peroxide value, free fatty acid value

Introduction

Three types of traditional fermented sausages are most popular in Serbia: Sremski kulen, Sremska sausage and sucuk. Sucuk is a Turkish-style sausage, very

popular in several Middle East countries, as well as Europe (*Erkmen, 1997; Stanišić et al., 2012*).

Sucuk and sausages of a similar type are spicy, typically dry fermented sausages made of beef, water buffalo meat or mutton (*Gökalp, 1986*). In Serbia, they are traditionally produced in small plants or village households in autumn and winter when weather conditions (temperature and relative humidity) are favourable. They are made of smaller pieces of beef or sheep meat and tail fat, with meat:fat ratio around 75:25. The mixture is filled into natural beef casings and tied with rope. The product is then smoked and dried for approx—30 days under local weather conditions (*Stajić et al., 2013*).

Due to a high-fat content rich in saturated fatty acids and cholesterol, consumption of meat products is associated with the risk of heart problems, obesity and various blood diseases (*WHO, 2003*). Dry fermented sausages are high-fat and rich in saturated fatty acids. Sucuk usually contains approx-30% fat content in the form of small visible cubes. This high-fat content is essential for proper fermentation and ripening and also plays an important role in the overall sensory quality of the finished product (*Kayaardı and Gök, 2003*). For these reasons, reducing this type of product's fat content to improve nutritional characteristics is very difficult (*Bloukas et al., 1997*).

The scientific knowledge of traditionally produced sucuk sausages with reduced fat content is limited (*Kargozari et al., 2014*). Additionally, due to the natural fermentation and uncontrolled climatic conditions, there is little uniformity in traditionally produced products' recipes and processing conditions, which makes published trials challenging to repeat. In order to improve the nutritional quality of dry fermented sausages, this trial was set to investigate the effect of different fat levels on a change in the quality characteristics of sucuk sausages during production.

Materials and Methods

Sausages were produced in a meat processing plant of the Institute for Animal Husbandry (Belgrade, Serbia) from February to March 2022. For the production of sausages, beef, ham meat and tail fat were used. Three groups of sausages with different fat levels were produced: LF (low fat) group was made of beef meat with the addition of 10% fat, MF (medium fat) group was made of beef meat with the addition of 20% fat and HF (high fat) group was made of beef meat with the addition of 30% fat. In all variants, the same amounts of the following ingredients were added: 1.8 % salt, 0.011% NaNO₂, 0.4% sucrose, 0.3% powdered black pepper, 0.2% garlic and 0.2% powdered red paprika.

The production process was as follows: beef ham meat and tail fat were frozen at -4°C and then minced in a meat grinder (Seydelman 114, Germany) to about 1 cm in diameter. Cutting and mixing with the rest of the dry ingredients was carried out in the cutter (Seydelman K60, Germany) to 3 mm particle size. The mixture was then filled in natural beef casings of 38 mm. Sausages were tied with rope and made into characteristic horseshoe shapes. After stuffing (day 0), the sausages were drained in a cold store ($4 \pm 1^{\circ}\text{C}$) for 12 h for the surface to dry, after which they were hung in a traditional smoking house (without the possibility to control the temperature or humidity), with the parameters varying between $5\text{--}10^{\circ}\text{C}$ and RH 75–90%. They were then occasionally smoked for 28 days.

Sampling of all three variants of sucuk was carried out after filling (day 0) and on production days 7, 14, 21 and 28. Nine sausages were taken from each group to determine pH value and conduct chemical analyses. All samples were analysed after removing the outer casing and grounding in the mixer (Ultra Turrax T18, IKA, Germany).

pH value was measured by pH-meter Hanna, HI 83141 (Hanna Instruments, USA), equipped with a puncture electrode. The pH meter was calibrated using standard phosphate buffers (*ISO 2917, 1999*).

The proximate composition of sausages was determined in the following manner: moisture content by drying samples at 105°C (*ISO 1442, 1997*); protein content by Kjeldahl method and multiplying by factor 6,25 (*ISO 937, 1978*); total fat content by Soxhlet method (*ISO 1443, 1973*), and ash content by mineralisation of samples at $550 \pm 25^{\circ}\text{C}$ (*ISO 936, 1998*).

Peroxide value was determined by the method described in *ISO 3960 (1977)*, and peroxide values were expressed as milliequivalents of active oxygen per kg of fat ($\text{mEq O}_2/\text{kg}$).

Free fatty acid content was expressed as g oleic acid/100 g fat after titration with 0.1N NaOH and determining the total acidity, as described in *ISO 660 (2011)*.

The results of pH value, proximate composition, peroxide and FFA value were processed by single factor analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of the SPSS 20.0 software (IBM SPSS Statistics Version 20, IBM Corp, USA). The differences between individual averages were tested using Tukey's method, and significant differences were considered for $p < 0.05$.

Results and Discussion

Changes in the pH values during the 28 days of production of three groups of sucuk sausages are presented in Fig.1.

During the production of dry sausages, as a product of bacterial fermentation, lactic acid is formed, which results in a pH drop (Lücke, 1994). Multiple factors influence this drop in pH, with the most important being present microflora and the amount and type of added sugars (Hiero et al., 1997). pH values of sausages from the MF and LF groups followed a similar pattern during the entire production process, while the ones from the HF group slightly differed. Initial pH values (day 0) were different between groups, with HF having the lowest values ($p < 0.05$) compared to MF and LF sausages, with no significant difference between the latter. These findings disagree with Gómez and Lorenzo (2013), who reported no significant differences in initial pH values for chorizo sausages produced with different fat levels. However, other authors have observed a similar effect of fat level on the initial pH of various dry fermented sausages (Olivares et al., 2010; Lorenzo et al., 2011; Lorenzo and Franco, 2012).

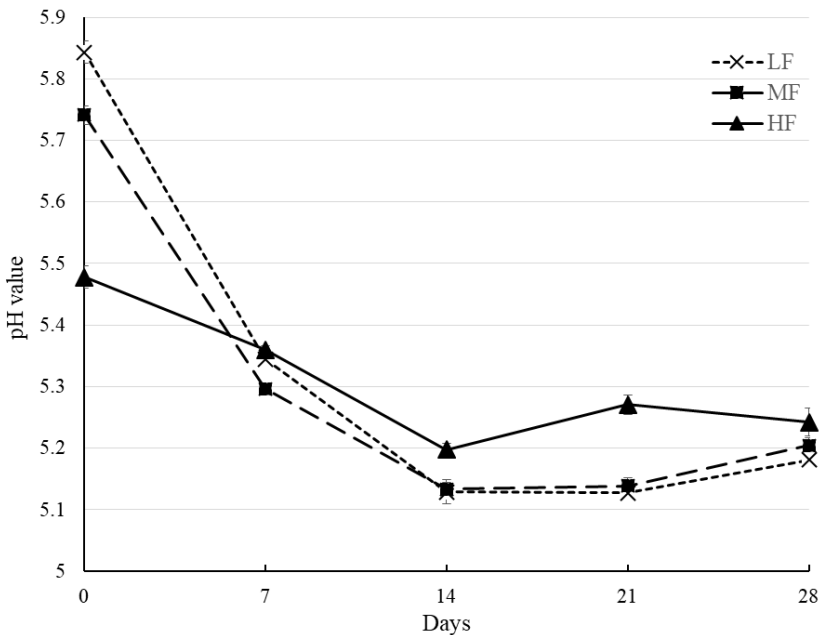


Figure 1. Changes in pH of the three groups of sucuk sausages during the 28 days of production. LF: low fat (10%); MF: medium fat (20%); HF: high fat (30%). Each symbol represents the mean value \pm standard deviation.

The highest pH drop for all three groups of sausages was recorded on days 7 and 14, where all three groups had similar values. Kayaardi and Gök (2003) reported similar dynamics in pH drop for traditionally produced sucuk. The organic

acids production, due to the microflora activity, was probably the reason behind the fast pH decline in the first two weeks of production. Although after day 14, pH values slightly increased, they were similar at the end of ripening (day 28) and did not significantly differ between groups. As stated by *Spaziani et al. (2009)*, the traditional production of fermented sausages is characterised by a slow drop in pH (due to low temperatures and the absence of starter cultures), with the minimal values reached between the 20th and 40th days of production. In this trial, the fat reduction significantly impacted a pH drop, indicating that the medium and low-fat sausages will probably have a different flavour pattern compared to high-fat ones. This is in agreement with *Olivares et al. (2010)* and *Lorenzo and Franco (2012)*, who reported a more significant decrease in pH values in low-fat sausages. However, *Liaros et al. (2009)* did not find a significant difference in pH drop during the production of sausages with different fat levels. Similarly, investigating the quality of Greek sausages, *Papadima and Bloukas (1999)* reported no effects of fat level on final pH.

At the end of the production process, the pH of all three groups of sausages increased slightly and had similar value (around 5.2), which was lower compared to the ones reported by *Comi et al. (2005)* for naturally fermented dry sausages that ranged from 5.2 to 6.4. This increase in pH at the end of production was probably due to ammonia and amine production due to enzymatic activity (*Lücke, 1994*).

The changes in proximate composition during the production process of sucuk are shown in Table 1. As expected, they are characterised by a decline in the moisture content and an increase in fat, protein and ash content during the 28 days of fermentation and ripening in all three groups ($p < 0.05$). As stated by *Živković et al. (2011)*, the changes in the chemical composition of dry fermented sausages during ripening are characterised by a tendency to increase dry matter content.

In all groups of sausages, moisture content was constantly falling during the entire production process ($p < 0.01$) due to temperature and humidity conditions. The initial differences between sausages in moisture content (day 0) were greater than at the end of the production process (day 28), probably due to more rapid water evaporation from sausages with lower fat content. In finished products, moisture content varied from 28.07% (HF) to 33.29% (LF). The moisture content of dry fermented sausages, around 30%, is typical for these products in Hungary, Greece and Croatia (*Kozacinski et al., 2008*).

The fat content of sucuk significantly differ among groups ($p < 0.01$), with mean values of 23.12% in LF, 32.71% in MF and 43.48% in HF sausages at the end of the production process, as expected. Sausages from the HF group had higher fat and lower protein content, followed by MF sausages initially and during the entire production process. Fat content at the end ripening of HF and MF groups was within the range for traditional sucuk (*Yaman et al., 1998*).

Table 1. Changes in the proximate composition (%) of the three variants of sucuk sausage during the 28 days of the production process (means ± standard deviation)

Parameter / Group		Day					Sig.
		0	7	14	21	28	
Water	LF	67.12 ± 1.63 ^{aA}	60.17 ± 1.06 ^{bA}	52.02 ± 0.80 ^{cA}	37.34 ± 1.32 ^{dA}	33.29 ± 2.33 ^{eA}	**
	MF	60.82 ± 1.39 ^{aB}	53.95 ± 1.07 ^{bB}	42.45 ± 0.95 ^{cB}	32.97 ± 0.36 ^{dB}	31.49 ± 2.48 ^{eAB}	**
	HF	54.48 ± 1.36 ^{aC}	43.01 ± 0.87 ^{bC}	39.15 ± 1.14 ^{cC}	32.36 ± 0.62 ^{dB}	28.07 ± 1.05 ^{eB}	**
Sig.		**	**	**	*	*	
Protein	LF	20.69 ± 3.95 ^{dA}	26.14 ± 1.99 ^{cA}	28.97 ± 2.85 ^{bA}	34.30 ± 2.78 ^{aA}	36.90 ± 2.09 ^{aA}	**
	MF	18.09 ± 0.75 ^{dB}	21.82 ± 1.01 ^{cB}	23.12 ± 1.56 ^{cB}	29.51 ± 1.34 ^{bB}	32.48 ± 2.54 ^{aB}	**
	HF	15.20 ± 0.94 ^{cC}	19.77 ± 1.08 ^{bC}	20.24 ± 1.70 ^{bC}	27.76 ± 2.98 ^{aB}	30.94 ± 2.76 ^{aB}	**
Sig.		**	**	**	*	**	
Fat	LF	8.77 ± 0.20 ^{dC}	10.47 ± 0.49 ^{cC}	14.82 ± 0.48 ^{bC}	21.88 ± 1.14 ^{aC}	23.12 ± 0.91 ^{aC}	**
	MF	18.58 ± 0.39 ^{dB}	20.94 ± 1.00 ^{cB}	26.96 ± 0.91 ^{bB}	33.94 ± 1.16 ^{aB}	32.71 ± 1.53 ^{aB}	**
	HF	26.66 ± 1.58 ^{eA}	33.02 ± 0.95 ^{dA}	36.53 ± 1.58 ^{cA}	39.93 ± 1.53 ^{bA}	43.48 ± 1.39 ^{aA}	**
Sig.		**	**	**	**	**	
Ash	LF	3.45 ± 0.04 ^{eA}	4.30 ± 0.04 ^{dA}	4.76 ± 0.04 ^{cA}	5.65 ± 0.02 ^{bA}	6.36 ± 0.08 ^{aA}	**
	MF	3.42 ± 0.02 ^{eA}	3.87 ± 0.03 ^{dB}	4.88 ± 0.04 ^{cA}	5.48 ± 0.04 ^{bAB}	5.62 ± 0.04 ^{aB}	**
	HF	3.37 ± 0.02 ^{eA}	3.89 ± 0.03 ^{dB}	4.80 ± 0.04 ^{cA}	5.19 ± 0.04 ^{aB}	5.10 ± 0.02 ^{aB}	**
Sig.		ns	*	ns	*	*	

LF: low fat (10%); MF: medium fat (20%); HF: high fat (30%)

^{a-c} Different letters within the same row denote significant differences between means

^{A-C} Different letters within the same column denote significant differences between means

^{ns} non-significant (p>0.05); * significant at p<0.05; ** significant at p<0.01

The ash content significantly decreased during ripening in all three groups of sausages (p<0.01). These findings disagree with *Salgado et al. (2005)*, who found no changes in ash content during the fermentation and ripening of Chorizo, a traditional Spanish fermented sausage. At the end of production, ash values were 6.36, 5.62 and 5.10 (for LF, MF and HF sausages, respectively), which is in the range reported by *Coppola et al. (1997)*, *Gimeno et al. (2000)*, *Lorenzo et al. (2000)* and *Franco et al. (2002)* for similar types of sausages.

The changes in fat rancidity indicators during fermentation and ripening of sucuk sausages were evaluated by peroxide and free fatty acid (FFA) values (Fig 2.)

The initial values for both indicators were approximately the same for all sausage groups. However, after seven days of production, the most significant drop in peroxide value was recorded for the HF group (p<0.05), while MF and LF

groups had similar values. After day 7, the LF group had a stip increase in peroxide values, with the biggest differences between groups recorded for days 14 and 21, where the LF group had the highest values and the HF group the lowest, while the MF group was intermediary ($p < 0.05$). At the end of the production process, the MF group had the lowest peroxide value ($p < 0.05$), while HF and LF were similar. In general, peroxide values of sausages in this trial were much lower compared to the ones reported by *Franco et al. (2002)* of 16 and 28 meq O_2/kg and *Salgado et al. (2006)* of 12.85 meq O_2/kg of fat.

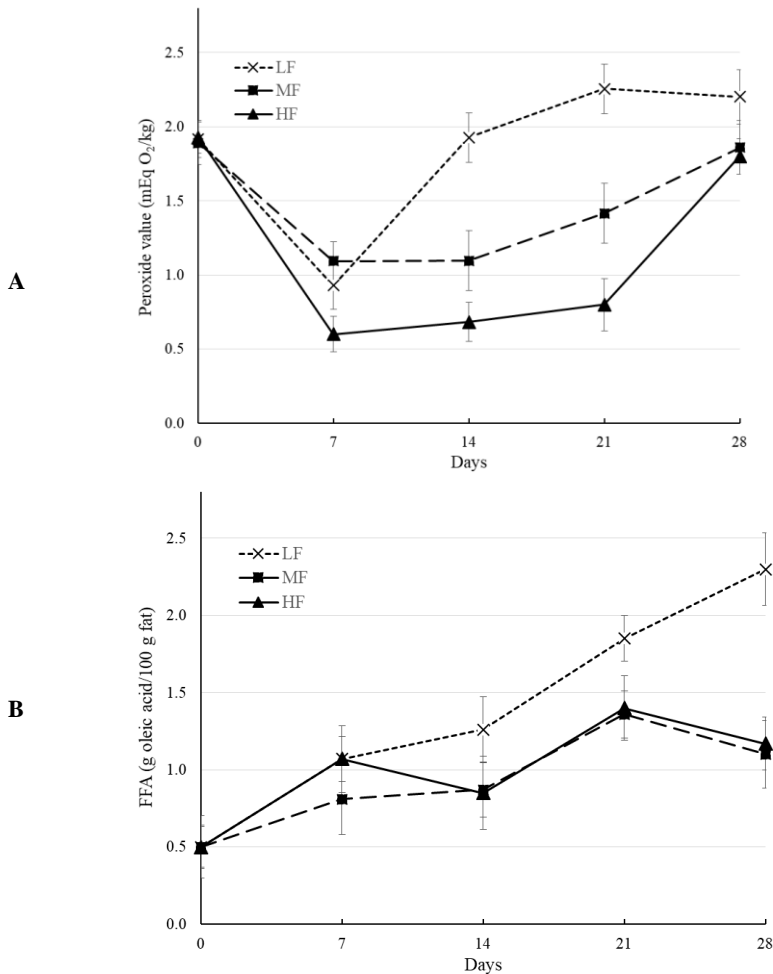


Figure 2. Changes in peroxide (A) and FFA (B) values of the three variants of Sremska sausage during the production process. LF: low fat (10%); MF: medium fat (20%); HF: high fat (30%). Each bar represents the mean value \pm standard deviation.

As a result of lipolysis, free fatty acids are released during the production process of dry-fermented sausages (*Gandemer, 2002*). Although the initial values were similar, the FFA (expressed as g of oleic acid per 100 g of fat) had the highest increase in the LF group of sausages ($p < 0.05$). The increase in the FFA content of MF and HF groups followed a similar pattern and did not differ significantly. These results are in disagreement with the ones reported by *Soyer and Ertas (2007)*, *Liaros et al. (2009)*, *Olivares et al. (2011)* and *Lorenzo and Franco (2012)*, who found higher peroxide and FFA values in sausages with the higher fat content. However, these studies are based on pork subcutaneous fat, which is richer in polyunsaturated fatty acids and more subject to oxidative changes than present beef tail fat (*Marco et al., 2006; Gómez and Lorenzo, 2013*).

Conclusion

Decreasing the fat level in traditionally produced sucuk sausages significantly affected the proximate composition and lipolytic parameters during the 28 days of production. Sausages containing higher fat content had significantly lower water, protein and ash content throughout and at the end of the production process.

Fat content significantly affected peroxide and free fatty acid values. Interestingly, sausages containing higher fat content had lower lipolytic changes during and at the end of production. This can be correlated with a higher degree of saturated fatty acids in beef fat, which are less prone to oxidative changes.

Acknowledgment

This research was funded by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, on the basis of the Agreement on the realization and financing of scientific research work of SRO No. 451-03-47/2023-01/200022.

References

- BLOUKAS J.G., PANERAS E.D., FOURNITZIS G.C. (1997): Effect of replacing pork backfat with olive oil on processing and quality characteristics of fermented sausages. *Meat Science*, 45, 133–144.
- COMI G., URSO R., IACUMIN L., RANTSIOU K., CATTANEO P., CANTONI C., COCOLIN L. (2005): Characterisation of naturally fermented sausages produced in the North East of Italy. *Meat Sci.*, 69, 381-392.

- COPPOLA R., IORIZZO M., SAOTTA R., SORRENTINO E., GRAZIA L. (1997): Characterization of micrococci and staphylococci isolated from soppressata molisana, a southern Italy fermented sausage. *Food Microbiol.*, 14, 47–53.
- ERKMEN O. (1997): Behavior of *Staphylococcus aureus* in refrigerated and frozen ground beef and in Turkish style sausage and broth with and without additives. *Journal of Food Processing and Preservation*, 21, 279-288.
- FRANCO I., PRIETO B., CRUZ J.M., LÓPEZ M., CARBALLO J. (2002): Study of the biochemical changes during the processing of Androlla, a Spanish dry-cured pork sausage. *Food Chem.*, 78, 339-345.
- GANDEMER G. (2002): Lipids in muscles and adipose tissues, changes during processing and sensory properties of meat products. *Meat Science*, 62, 309–321.
- GIMENO O., ANSORENA D., ASTIASARÁN I., BELLO J. (2000): Characterization of chorizo de Pamplona: Instrumental measurements of colour and texture. *Food Chem.*, 69, 195–200.
- GÖKALP H.Y. (1986): Turkish style fermented sausage (soudjouk) manufactured by adding different starter cultures and using different ripening temperatures. *Fleischwirtschaft*, 66, 573–575.
- GÓMEZ M., LORENZO J.M. (2013): Effect of fat level on physicochemical, volatile compounds and sensory characteristics of dry-ripened “chorizo” from Celta pig breed. *Meat Science*, 95, 658–666.
- HIERRO E., DE LA HOZ L., ORDÓÑEZ J.A. (1997): Contribution of microbial and meat endogenous enzymes to the lipolysis of dry fermented sausages. *Journal of Agricultural and Food Chemistry*, 45, 2989-2995.
- ISO 1442 (1997): Meat and meat products – Determination of moisture content. Switzerland: International Organization for Standardization
- ISO 1443 (1973): Meat and meat Products – Determination of total fat content. Switzerland: International Organization for Standardization
- ISO 2917 (1999): Measurement of pH (Reference method). Switzerland: International Organisation for Standardisation
- ISO 3960 (1977): Animal and vegetable fats and oils – Determination of Peroxide Value Switzerland: International Organization for Standardization
- ISO 660 (2011): Animal and vegetable fats and oils – Determination of the acid value of the fat. Switzerland: International Organization for Standardization
- ISO 936 (1998): Meat and meat products – Determination of ash content. Switzerland: International Organization for Standardization
- ISO 937 (1978): Meat and meat products – Determination of nitrogen content. Switzerland: International Organization for Standardization
- KARGOZARI M., MOINI S., BASTI A.A., EMAM-DJOMEH Z., GHASEMLOU M., REVILLA MARTIN I., GANDOMI H., CARBONELL-BARRACHINA Á.A., SZUMNY A. (2014): Development of Turkish dry-fermented sausage (sucuk)

- reformulated with camel meat and hump fat and evaluation of physicochemical, textural, fatty acid and volatile compound profiles during ripening. *LWT - Food Science and Technology*, 59, 2, 849-858.
- KAYAARDI S., GÖK, V. (2003): Effect of replacing beef fat with olive oil on quality characteristics of Turkish soudjouk (sucuk). *Meat Science*, 66, 249–257.
- KOZACINSKI L., DROSINOS E., CAKLOVICA F., COCOLIN L., GASPARIK-REICHARDT J., VESKOVIĆ S. (2008): Investigation of microbial association of traditionally fermented sausages. *Food Technol. Biotech.*, 46, 93-106.
- LIAROS N.G., KATSANIDIS E., BLOUKAS J.G. (2009): Effect of the ripening time under vacuum and packaging film permeability on processing and quality characteristics of low-fat fermented sausages. *Meat Sci.*, 83, 589-598.
- LORENZO J.M., FRANCO D. (2012): Fat effect on physico-chemical, microbial and textural changes through the manufactured of dry-cured foal sausage. Lipolysis, proteolysis and sensory properties. *Meat Sci.*, 92, 704-714.
- LORENZO J.M., MICHINEL M., LÓPEZ M., CARBALLO J. (2000): Biochemical characteristics of two spanish traditional dry-cured sausage varieties: Androlla and Botillo. *J. Food Compos. Anal.*, 13, 809-817.
- LORENZO J.M., PURRIÑOS L., BERMÚDEZ R., TEMPERAN S., FRANCO D. (2011): Effect of fat level on physicochemical and sensory properties of dry-cured duck sausages. *Poultry Science*, 90, 1334–1339.
- LÜCKE F.K. (1994): Fermented meat products. *Food Res. Int.*, 27, 299-307.
- MARCO A., NAVARRO J.L., FLORES M. (2006): The influence of nitrite and nitrate on microbial, chemical and sensory parameters of slow dry fermented sausage. *Meat Science*, 73, 660–673.
- OLIVARES A., NAVARRO J.L., FLORES M. (2011): Effect of fat content on aroma generation during processing of dry fermented sausages. *Meat Science*, 87, 264–273.
- OLIVARES A., NAVARRO J.L., SALVADOR A., FLORES M. (2010): Sensory acceptability of slow fermented sausages based on fat content and ripening time. *Meat Sci.*, 86, 251-257.
- PAPADIMA S.N., BLOUKAS J.G. (1999): Effect of fat level and storage conditions on quality characteristics of traditional Greek sausages. *Meat Science*, 51, 103–113.
- SALGADO A., GARCÍA FONTÁN M.C., FRANCO I., LÓPEZ M., CARBALLO J. (2005): Biochemical changes during the ripening of Chorizo de cebolla, a Spanish traditional sausage. Effect of the system of manufacture (homemade or industrial). *Food Chem.*, 92, 413-424.
- SALGADO A., GARCÍA FONTÁN M.C., FRANCO I., LÓPEZ M., CARBALLO J. (2006): Effect of the type of manufacture (homemade or industrial) on the

biochemical characteristics of Chorizo de cebolla (a Spanish traditional sausage). *Food Control*, 17, 213-221.

SOYER A., ERTAS A.H. (2007): Effects of fat level and storage time on lipid and color stability of naturally fermented Turkish sausages (sucuk). *Journal of Muscle Foods*, 18, 330–340.

SPAZIANI M., TORRE M.D., STECCHINI M.L. (2009): Changes of physicochemical, microbiological, and textural properties during ripening of Italian low-acid sausages. Proteolysis, sensory and volatile profiles. *Meat Science*, 81, 77–85.

STAJIĆ S., PERUNOVIĆ M., STANIŠIĆ N., ŽUJOVIĆ M., ŽIVKOVIĆ D. (2013): Sucuk (Turkish-style dry-fermented sausage) quality as an Influence of recipe formulation and inoculation of starter cultures. *Journal of Food Processing and Preservation*, 37 5, 870-880.

STANIŠIĆ N., LILIĆ S., PETROVIĆ M., ŽIVKOVIĆ D., RADOVIĆ Č., PETRIČEVIĆ M., GOGIĆ M. (2012): Proximate composition and sensory characteristics of Sremska sausage produced in a traditional smoking house. *Proceedings of the 6th Central European Congress on Food*, Novi Sad-Serbia, 1319-1324.

WHO (2003): Diet, nutrition and the prevention of chronic diseases. WHO Technical report Series, 916, (Geneva).

YAMAN A., GÖKALP H.Y., ÇON A.H. (1998): Some characteristics of lactic acid bacteria present in commercial sucuk samples. *Meat Science*, 49, 387-397.

ŽIVKOVIĆ D., TOMOVIĆ V., PERUNOVIĆ M., STAJIĆ S., STANIŠIĆ N., BOGIĆEVIĆ N. (2011): Senzorna prihvatljivost sremske kobasice izrađene od mesa svinja različite starosti. *Tehnologija mesa*, 52, 252-261.

=====
CIP - Каталогизacija у публикацији Народна библиотека Србије,
Београд

636/638(082)(0.034.2)

631/635(082)(0.034.2)

**INTERNATIONAL Symposium Modern Trends in Livestock Production
(14**

; 2023 ; Beograd)

Proceedings [Elektronski izvor] / 14th International Symposium Modern
Trends

in Livestock Production, 4-6 October 2023, Belgrade, Serbia ; [organizer]
Institute

for Animal Husbandry, Belgrade - Zemun ; [editor Zdenka Škrbić]. -
Belgrade :

Institute for Animal Husbandry, 2023 (Belgrade : Institute for Animal
Husbandry).

- 1 USB fleš memorija ; 1 x 3 x 6 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. -
Tiraž 100.

- Bibliografija uz svaki rad.

ISBN 978-86-82431-80-0

a) Сточарство -- Зборници b) Пољопривреда -- Зборници

COBISS.SR-ID 125636361

=====



14th INTERNATIONAL SYMPOSIUM
MODERN TRENDS IN LIVESTOCK PRODUCTION

4 - 6 October 2023 - Belgrade, Serbia

PROCEEDINGS

INSTITUTE FOR ANIMAL HUSBANDRY

Autoput 16, P. Box 23, 11080, Belgrade - Zemun, Serbia

www.izistocar.bg.ac.rs

ISBN 978-86-82431-80-0

