

Flour - Bread : Book of Abstracts 9th International Congress Flour - Bread '17 [and] 11th Croatian Congress of Cereal Technologists

Edited book / Urednička knjiga

Publication status / Verzija rada: **Published version / Objavljena verzija rada (izdavačev PDF)**

Publication year / Godina izdavanja: **2017**

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:109:222167>

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Download date / Datum preuzimanja: **2025-02-22**

REPOZITORIJ

PTF

PREHRAMBENO-TEHNOLOŠKI FAKULTET OSIJEK



Repository / Repozitorij:

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ISSN 1848-2554

9th INTERNATIONAL CONGRESS

FLOUR–BREAD '17

11th CROATIAN CONGRESS OF CEREAL TECHNOLOGISTS

BRAŠNO–KRUH '17.

OPATIJA, CROATIA

October 25-27, 2017

BOOK OF ABSTRACTS

ORGANISED BY

JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK
FACULTY OF FOOD TECHNOLOGY OSIJEK - PTFOS

INTERNATIONAL ASSOCIATION FOR CEREAL SCIENCE AND TECHNOLOGY - ICC

CROATIAN FOOD AGENCY - HAH

Published by
JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK
FACULTY OF FOOD TECHNOLOGY OSIJEK

Editors
Antun Jozinović
Sandra Budžaki
Ivica Strelec

Proofreading
Antonija Šarić

Cover page
Grafika d.o.o., Osijek

Printed by
Grafika d.o.o., Osijek

Edition
200 copies

UNDER THE AUSPICES OF:

Ministry of Science and Education of the Republic of Croatia



Ministry of Agriculture of the Republic of Croatia



Ministry of Economy, Entrepreneurship and Crafts of the Republic of Croatia



Josip Juraj Strossmayer University of Osijek



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SCIENTIFIC PROGRAMME

SCIENTIFIC PROGRAMME

Wednesday, 25 October 2017

15:00-19:00 Participant registration

**WORKSHOP:
"HOW TO CALCULATE NUTRIENT CONTENT OF FOODS"**

18:00-18:15 Workshop organizer addressing

(Croatian Chamber of Economy, Croatian Food Agency, Faculty of Food Technology)

18:15-18:45 NUTRITION DECLARATION – MANDATORY FOOD INFORMATION

Sanja Kolarić Kravar, Ministry of Agriculture of the Republic of Croatia, Croatia

Lecture

18:45-19:15 HOW TO CALCULATE NUTRIENT CONTENT OF FOOD:

INTRODUCING A GUIDELINE FOR FOOD BUSINESS OPERATORS

Daniela Čačić Kenjeric, Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Croatia

Lecture

19:15-19:45 SOFTWARE MODEL FOR CALCULATING THE NUTRITIONAL VALUE OF FOOD IN BAKERY

Dubravko Bašić, Intel Informatika Ltd., Croatia

Lecture

19:45-20:00 Discussion, questions and answers

20:00-21:00 Welcome cocktail

Thursday, 26 October 2017

08:00 Participant registration

09:00-10:15 Opening Ceremony

10:15-10:40 Coffee Break, Exhibition and Poster Session

Sponsored by Ru-Ve d.o.o., Croatia

Moderators:

Paola Battilani, Elizabet Janić Hajnal, Ivica Strelec

10:40-11:10 MYCOTOXINS - FROM FIELD TO THE STABLE AND THE TABLE

Elisabeth Streit, Ines Taschl, Gerd Schatzmayr (Austria)

Plenary lecture

11:10-11:30 MYTOOLBOX – SAFE FOOD AND FEED THROUGH AN INTEGRATED TOOLBOX FOR MYCOTOXIN MANAGEMENT

Rudolf Krska, Monique de Nijs, Oonagh McNerney, Michaela Pichler, John Gilbert, Simon Edwards, Michele Suman, Naresh Magan, Vittorio Rossi, Ine van der Fels-Klerx, Ferenc Bagi, Carsten Fahl-Hassek (Austria)

Invited lecture

11:30-11:45 PREVENTING FOOD SAFETY INCIDENTS BY THE DEVELOPMENT OF A GLOBAL ALERT SYSTEM

Vlasta Piližota, Huub Lelieveld, Chin-Kun Wang, Veslemøy Andersen, Helga Medić (Croatia)

Oral presentation

11:45-12:00 INTRODUCING THE NEW ULTIVO TRIPLE QUADRUPOLE MS – TRUE INNOVATION IN MASS SPECTROMETRY

Neven Bubić, Alphachrom d.o.o. (Croatia)

Sponsor advertisement presentation

12:00-12:05 Discussion and conclusion

12:05-14:00 Lunch break

13:00-14:00 GHI General Meeting

Moderators:

Antonio Moretti, Michaela Pichler, Bojan Šarkanj

- 14:00-14:30 CLIMATE CHANGE AND MYCOTOXINS**
Paola Battilani (Italy)
Plenary lecture
- 14:30-14:50 REDUCTION OF TENUAZONIC ACID IN WHEAT DURING PROCESSING**
Elizabet Janić Hajnal, Jasna Mastilović, Dejan Orčić, Ferenc Bagi, Jovana Kos, Dragana Budakov, Aleksandra Torbica (Serbia)
Invited lecture
- 14:50-15:05 EXPOSURE OF CROATIAN ADULTS TO ACETYLATED AND MASKED FORMS OF DEOXYNIVALENOL**
Martina Jurković, Tomislav Klačec, Bojan Šarkanj (Croatia)
Oral presentation
- 15:05-15:20 MYCOTOXINS: THE IMPACT ON HEALTH AND ANALYTICS**
Matjaž Rejec, Labena d.o.o. (Slovenia)
Sponsor advertisement presentation
- 15:20-15:25 Discussion and conclusion**
- 15:25-15:55 Coffee Break, Exhibition and Poster Session**
-

Moderators:

Elisabeth Streit, Jasna Mastilović, Vlasta Piližota

- 15:55-16:25 MYCOKEY SOLUTIONS FOR THE MITIGATION OF TOXIGENIC FUNGI AND RELATED MYCOTOXINS IN THE WHEAT CHAIN**
Antonio Moretti, Antonio Francesco Logrieco (Italy)
Plenary lecture
- 16:25-16:45 UNVEILING THE MASK OF THE UNREGULATED AND MASKED MYCOTOXINS IN CROATIAN CEREALS**
Bojan Šarkanj, Lidija Brodar, Tomislav Klačec (Croatia)
Invited lecture
- 16:45-17:00 AFLATOXIGENIC EFFECT OF ILLUMINATED FULLERENE NANOPARTICLES**
Tihomir Kovač, Bojan Šarkanj, Tomislav Klačec, Ivana Borišev, Marija Kovač, Ante Nevistić, Ivica Strelec (Croatia)
Oral presentation

- 17:00-17:15 IFA - ISEKI FOOD ASSOCIATION**
Nada Knežević (Croatia)
Oral presentation
- 17:15-17:20 Discussion and conclusion**
- 17:20-17:50** Coffee Break, Exhibition and Poster Session
-

Moderators:

Hamit Köksel, Daliborka Koceva Komlenić, Dragan Živančev

- 17:50-18:10 FACING THE FUTURE OF CEREALS/FLOURS: SUSTAINABILITY AND HEALTH CONCERNS**
Cristina Molina Rosell (Spain)
Invited lecture
- 18:10-18:25 ANALYTICAL FEATURES OF THE DIFERENT FLOUR COMPOSITES BASED ON THE WHEAT AND BARLEY MIXTURES**
Ivan Švec, Marie Hrušková, Ivana Kadlčíková (Czech Republic)
Oral presentation
- 18:25-18:40 DETERMINATION OF HIGH MALTING QUALITY OF WINTER BARLEY GENOTYPES FROM TRAKYA REGION IN TURKEY CULTIVATED UNDER RAINFED CONDITIONS**
Safure Güler, Recai Ercan, Taner Akar, Ismail Sayim, Turhan Kahraman, Turgay Şanal, Sinan Aydoğan, Namuk Ergun (Turkey)
Oral presentation
- 18:40-18:55 A NOVEL BREAD IMPROVER FOR THE PROLONGATION OF SHELF LIFE OF WHITE WHEAT FLOUR BREAD**
Amanda Rajakaruna, Chathudina Liyanage, Suren Perera (Sri Lanka)
Oral presentation
- 18:55-19:00 Discussion and conclusion**
-
- 20:00 Congress Dinner**
-

Friday, 27 October 2017

09:30-10:00 Muffin surprise

Practical presentation of muffin preparation

*High Professional School "Braća Radić", Kaštel Štafilić - Nehaj,
Croatia*

Moderators:

Günter Unbehend, Darja Sokolić, Lea Pollak

**10:00-10:20 HEALTH BENEFITS OF WHOLE GRAIN PRODUCTS AND
APPERTAINING MISLEADING CLAIMS**

Hamit Köksel, Buket Çetiner, Turgay Şanal (Turkey)

Invited lecture

10:20-10:40 WHOLEGRAINS: BENEFITS, RISKS AND CHALLENGES

Daniela Čačić Kenjeric (Croatia)

Invited lecture

10:40-10:55 MILLET CAKE IN PRESCHOOL NUTRITION

Marija Rapanić, Petrana Pupić (Croatia)

Oral presentation

**10:55-11:10 QUALITY ASSURANCE OF BREAD AND BAKERY PASTRIES IN
PUBLIC INSTITUTIONS ACCORDING TO THE LAW ON PUBLIC
PROCUREMENT**

Ana Repše, Aleš Krulec (Slovenia)

Oral presentation

11:10-11:15 Discussion and conclusion

11:15-11:35 Coffee Break, Exhibition and Poster Session

Muffin tasting

Moderators:

Ana Repše, Daniela Čačić Kenjeric, Andrea Gross-Bošković

**11:35-11:55 BIOACTIVE COMPONENTS OF CEREALS AND THEIR POSSIBLE
HEALTH BENEFITS - A REVIEW**

Günter Unbehend, Jürgen Zapp (Germany)

Invited lecture

11:55-12:15 GLUTEN-FREE DIET AND ITS PITFALLS

Lea Pollak (Croatia)

Invited lecture

12:15-12:30 ADDITION OF AMARANTH, QUINOA AND BUCKWHEAT FLOUR FOR ENRICHMENT OF GLUTEN-FREE COOKIE

Gholam Hossein Haghvegh (Iran)

Oral presentation

12:30-12:45 TRANS FATTY ACIDS IN CEREAL-BASED FOOD - HAH RESEARCH 2015-2016

Darja Sokolić, Andrea Gross-Bošković, Milica Gačić (Croatia)

Oral presentation

12:45-12:50 Discussion and conclusion

12:50-14:30 Lunch break

Moderators:

Cristina Molina Rosell, Ivan Švec, Daniela Horvat

14:30-14:50 LAB-ON-A-CHIP DEVICE AS A USEFUL TOOL FOR DETERMINATION OF GLUTEN PROTEINS AND THEIR CONNECTION WITH END USE QUALITY OF WHEAT

Dragan Živančev, Aleksandra Torbica, Jasna Mastilović, Daniela Horvat, Daliborka Koceva Komlenić (Serbia)

Invited lecture

14:50-15:10 PEPPER (*Capsicum annum* L.) AND BY-PRODUCTS OF ITS PROCESSING AS SUPPLEMENTS FOR BAKERY PRODUCTS

Jasna Mastilović, Milan Vukić, Marko Ivanović, Jelena Radovanović, Dženita Džinić, Žarko Kevrešan (Serbia)

Invited lecture

15:10-15:25 OPTIMIZATION OF FRENCH BREAD BAKING USING SUPERHEATED STEAM

Alain Sommier, Yannick Anguy, Pradere Christophe (France)

Oral presentation

15:25-15:40 CHANGES FROM DOUGH TO BREAD BY DIGITAL IMAGE ANALYSIS

Raquel Garzon, Cristina Molina Rosell (Spain)

Oral presentation

15:40-15:55 **QUALITY MONITORING OF MILLING AND BAKERY PRODUCTS BY THE CHANGE OF PROCESS PARAMETERS IN LOW CAPACITY MILLS**

Gordan Avdić, Dijana Miličević, Amel Selimović, Šejla Omerović (Bosnia and Herzegovina)

Oral presentation

15:55-16:00 **Discussion and conclusion**

16:00-16:15 Coffee Break, Exhibition and Poster Session

Moderators:

Artur Gryszkin, Jurislav Babić, Dijana Miličević

16:15-16:35 **BIOFORTIFICATION WITH Zn AND Se AS A STRATEGY FOR PREVENTING MICRONUTRIENT MALNUTRITION**

Zdenko Lončarić, Vladimir Ivezić, Brigita Popović, Andrijana Rebekić, Ivna Štolfa Čamagajevac (Croatia)

Invited lecture

16:35-16:50 **TIME-COURSE EXPERIMENT OF FUSARIUM INFESTATION OF WHEAT GENOTYPES WITH THE EMPHASIS ON THE PHYSIOLOGICAL RESPONSE**

Tihana Marček, Marija Viljevac Vuletić, Ivan Bakula, Sara Alivojvodić, Valentina Španić (Croatia)

Oral presentation

16:50-17:05 **IMPROVING PEPTIDE SUBSTRATE FOR THE DETECTION OF SUNN PEST DAMAGE**

Bequm Zeynep Hancerliogullari, Fahriye Ceyda Dudak (Turkey)

Oral presentation

17:05-17:20 **SOCIAL MEDIA IN BAKERY PRODUCT E-PROMOTION**

Sanja Dugandžić, Stojanka Dukić, Branimir Dukić (Croatia)

Oral presentation

17:20-17:25 **Discussion and conclusion**

17:25-17:40 Coffee Break, Exhibition and Poster Session

Moderators:

Mirela Planinić, Zdenko Lončarić, Tihana Marček

- 17:40-18:00 LIGNOCELLULOSIC CEREAL CROP WASTE AS BIOMASS
FEEDSTOCK FOR BIOFUEL PRODUCTION: BASIC CONCEPT AND
LATEST DEVELOPMENTS**
Marina Tišma (Croatia)
Invited lecture
- 18:00-18:15 EVALUATION OF THE INCORPORATION OF GRAPE POMACE
INTO READY-TO-EAT EXTRUDED SNACKS**
Belén Blanco, Gregorio Antolín (Spain)
Oral presentation
- 18:15-18:30 INFLUENCE OF APPLE POMACE ADDITION ON THE COLOUR AND
HARDNESS OF BISCUITS**
*Dijana Miličević, Gordana Avdić, Martina Andrejaš, Marko Jukić,
Đurđica Ačkar, Amel Selimović (Bosnia and Herzegovina)*
Oral presentation
- 18:30-18:45 E – MARKETING FOR THE RECYCLING OF BAKERY PRODUCTS**
Stojanka Dukić, Branimir Dukić, Goranka Majić (Croatia)
Oral presentation
- 18:45-18:50 Discussion and conclusion**
-
- 19:00-19:30 Congress closing
Best poster award**
-
- 19:30 Farewell cocktail**
-

POSTER PRESENTATIONS

POSTER PRESENTATIONS

CEREAL FOOD SAFETY

- P-01** **ERGOT ALKALOIDS PRESENCE IN CEREALS FROM CROATIA**
Leonard Matijević, Jasenka Petrić, Danijela Stražanac, Andrea Gross-Bošković, Brigita Hengl
- P-02** **MICROBIOLOGICAL SAFETY OF PHYLLO PASTRY**
Dražana Plavšić, Đorđe Psodorov, Dragan Psodorov, Ljubiša Šarić, Anamarija Mandić, Ivana Čabarkapa, Ana Varga
- P-03** **MICROBIOLOGICAL QUALITY ANALYSIS OF ORGANICALLY GROWN OILSEED PRODUCTS**
Dijana Podravac, Nina Jager, Lidija Lenart
-

CEREAL PROCESSING TECHNOLOGIES

- P-04** **PRODUCTION AND QUALITY ANALYSIS OF MALT PRODUCED FROM TWO DIFFERENT HULLESS BARLEY LINES GZ-186 AND GZ-189**
Gordana Šimić, Ana Bucić-Kojić, Mirela Planinić, Gordana Šelo, Alojzije Lalić Marina Tišma
- P-05** **OPTIMIZATION OF A MANUFACTURING PROGRAM OF A BAKERY BASED ON CUSTOMER RELATIONSHIP MANAGEMENT**
Branimir Dukić, Stojanka Dukić, Dina Jukić
- P-06** **POSSIBLE APPLICATIONS OF INDUSTRY 4.0 BASED ON CUSTOMER RELATIONSHIP MANAGEMENT IN BAKERY**
Branimir Dukić, Robert Obraz, Stojanka Dukić
- P-07** **DRYING AND GRINDING CHARACTERISTICS OF THE SPROUTED RYE**
Dariusz Dziki, Urszula Gawlik-Dziki
- P-08** **PROPERTIES OF WHEAT AND HULLESS BARLEY FLOURS MODIFIED BY EXTRUSION COOKING**
Antun Jozinović, Jelena Panak Balentić, Marijana Grec, Jurislav Babić, Borislav Miličević, Artur Gryszkin, Gordana Šimić, Drago Šubarić

P-09 ACID HYDROLYSIS OF STARCH CITRATE
Artur Gryszkin, Tomasz Zięba, Joanna Miedzianka, Jurislav Babić, Antun Jozinović

P-10 THE INFLUENCE OF SUGARS AND THE ADDITION OF MODIFIED STARCHES ON THE RETENTION OF AROMA COMPOUNDS IN THE BLACKBERRY PUREE
Anita Pichler, Ivana Ivić, Mirela Kopjar

P-11 A STUDY OF THE EFFECT OF MICROWAVES ON THE PROPERTIES OF BARLEY MALT
Anastasia Rushchitc, Abduvali Toshev, Elena Shcherbakova

P-12 THE CONNECTION OF KERNEL HARDNESS AND DEBRANNING TIME IN WINTER WHEAT
Antal Véha, Balázs P. Szabó

CEREAL WASTE MANAGEMENT

P-13 EFFECT OF INCORPORATION OF BREWERS' SPENT GRAIN INTO EXTRUDED SNACKS
Belén Blanco, Pedro Acebes, Gregorio Antolín

P-14 CEREAL FOOD WASTE
Diána Bánáti, Zoltán Győri

P-15 SENSORY AND TEXTURAL CHARACTERISTICS OF COOKIES ENRICHED WITH EXTRUDED WHEAT GERM
Jovana Petrović, Biljana Pajin, Ivana Lončarević, Aleksandar Fišteš, Antun Jozinović, Đurđica Ačkar, Danica Zarić

P-16 FUTURE PROSPECTS OF OIL CAKES IMPLEMENTATION AS SUPPLEMENTS IN BAKERY PRODUCTS
Sandra Budžaki, Kristina Alilović, Goran Miljić, Ivica Strelec, Marina Tišma

CEREALS AND CEREAL PRODUCT QUALITY

P-17 THE CHANGES OF THE COOKED PASTA TEXTURE DURING STORAGE
Beata Biernacka, Dariusz Dziki, Renata Różyło, Monika Siastała

- P-18** **VOLATILES OF A TRADITIONAL BAKERY PRODUCT "MEDENJAK"**
Emilija Friganović, Mladenka Šarolić, Žana Delić, Tomislav Svalina, Ljiljana Nanjara, Dajana Gašo-Sokač, Zvonimir Marijanović
- P-19** **WHEAT PROTEINS AS *FUSARIUM* TOLERANCE INDICATORS**
Daniela Horvat, Valentina Španić, Marijana Tucak, Georg Drezner, Zvonimir Zdunić
- P-20** **COMPARISON OF FIBER INFLUENCE FROM THE DIFFERENT LINSEED SOURCES ON WHEAT FLOUR AND CERAL PRODUCT CHARACTERISTICS**
Marie Hrušková, Ivan Švec, Lucie Mrvíková
- P-21** **SENSORY ANALYSIS OF BISCUITS FROM EINKORN FLOUR, BARLEY FLOUR, FLAKING EINKORN AND WHITE FLOUR IN DIFFERENT PROPORTIONS AND DIFFERENT SUGARS**
Gjore Nakov, Daliborka Koceva Komlenić, Nastia Ivanova, Tzonka Godjevargova, Stanka Damyanova, Ana Šušak
- P-22** **TEXTURE OF HYDROCOLLOID/SUGAR SYSTEMS**
Anita Pichler, Mirela Kopjar
- P-23** **BAKING AND STEAMING AS PRETREATMENT FOR THE PRODUCTION OF HIGH VALUE SWEET POTATO FLOUR: INFLUENCE ON PHYSICOCHEMICAL PROPERTIES**
Ante Lončarić, Vlasta Piližota
- P-24** **THE INFLUENCE OF THE CHARACTERISTICS OF COMMISSIONED VARIETAL BARLEY GROUPS ON THE DEGREE OF β -GLUCAN DEGRADATION DURING MALTING**
Kristina Mastanjević, Marko Magdić, Ivana Buljeta, Gordana Šimić, Daniela Horvat, Alojzije Lalić, Vinko Krstanović
- P-25** **SHELF-LIFE PREDICTION OF GLUTEN-FREE RICE-BUCKWHEAT COOKIES BY PHYSICOCHEMICAL CHARACTERISTICS**
Mladenka Pestorić, Marijana Sakač, Lato Pezo, Dubravka Škrobot, Nataša Nedeljković, Pavle Jovanov, Olivera Šimurina, Bojana Filipčev
- P-26** **VOJVODINA BREAD, PASTRY AND CAKE OFFER IN THE SPECIFIC TYPES OF RESTAURANTS, INNS AND FARMS**
Đorđe Psodorov, Bojana Kalenjuk, Maja Banjac, Jovanka Popov-Raljić, Dragan Tešanović, Milijanko Portić, Dragan Psodorov

- P-27** **VALIDATION AND SCREENING OF INDIAN WHEAT GERMLASM FOR SEVERAL QUALITY GENES SUITABLE FOR BISCUIT MAKING**
Anjali Raj, Anju Mahendru Singh, Deepak Ganjewala, Arvind Ahlawat, Poornima Sharma, Sumit Kumar Singh
- P-28** **THE EFFECT OF DIFFERENT COMMERCIAL SOURDOUGHS ON THE QUALITY OF GLUTEN FREE BREADS**
Yaiza Benavent-Gil, Carol Yepez-Guerrero, Cristina Molina Rosell
- P-29** **VOLATILE ALDEHYDES AND MALONDIALDEHYDE DETERMINATION IN SHELF-LIFE PREDICTION OF GLUTEN-FREE COOKIES**
Marijana Sakač, Pavle Jovanov, Nataša Nedeljković, Anamarija Mandić, Lato Pezo, Mladenka Pestorić
- P-30** **RHEOLOGICAL AND BREAD MAKING PROPERTIES OF THE DIFFERENT MILLING FRACTIONS OF HULL-LESS BARLEY**
Gordana Šimić, Daniela Horvat, Krešimir Dvojković, Zvonimir Zdunić, Kristina Lutrov, Ivan Abičić, Alojzije Lalić
- P-31** **INVESTIGATION OF LONG TERM QUALITY STABILITY IN TWO WINTER WHEAT VARIETIES (JUBILEJNAJA 50 AND GK ÖTHALOM) IN HUNGARY**
Diána Unqai, Béla Kovács, Zoltán Győri
-

CEREALS AND HEALTH

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PLENARY LECTURES

CLIMATE CHANGE AND MYCOTOXINS

Paola Battilani*

*Department of Sustainable Crop Protection, Università Cattolica del Sacro Cuore,
via Emilia Parmense 84, 29122 Piacenza, Italy*

*corresponding author: paola.battilani@unicatt.it

plenary lecture

Climate change is expected to strongly impact food security and safety, and mycotoxins play a crucial role in this scenario. Fungi (and related toxins), which are of main concern, are expected to change between years and during each year, when a different biogeography of plants is taken into account. Overall an increase in health risks due to climate change can be expected, but the interaction of factors involved leads to an uncertain conclusion. Maize in central-southern Europe, and related mycotoxin producing fungi, are an interesting example for the study of the system's complexity. In this area, maize is commonly contaminated by fumonisins, frequently above the legal limit fixed for human consumption. Aflatoxins are a recent matter of concern in Europe. The first outbreak of severe aflatoxin contamination in southern Europe happened in 2003, followed by other cases of high contamination in the following years and further serious events in 2012, 2015, 2016 and 2017. On the contrary, 2014 showed high deoxynivalenol contamination, and 2011 was a safe year, with very low detection of all mycotoxins. Then, during the last 14-year period, extremely different mycotoxin problems were faced. In this context of uncertainty, the modelling approach becomes essential. Predictive models allow to generate weather data, so as to draw mycotoxin risk scenarios in the near or far future. Only few examples have been published till now, only one with the focus on *Aspergillus flavus* in maize at European level. Aflatoxins, produced by this fungus, are expected to become a more serious problem in Europe, in the most reliable climate change scenario called "+2 °C". *Fusarium* spp will be apparently less affected in future scenarios. In any case, a wide variability between geographic areas and years is confirmed. The obtained predictions using actual meteorological data as input are crucial in this uncertain situation, in order to highlight risk areas and risk levels, and therefore, to support farmers, extension services and stakeholders to rationalize pre- and post- harvest crops and products management. Furthermore, predictions can be very helpful for risk managers, policy makers, institutions and researchers to define emerging risks and to try to answer the open question of future trends in mycotoxin contamination and their impact on human and animal health.

Keywords: climate change, maize, mycotoxins

MYCOKEY SOLUTIONS FOR THE MITIGATION OF TOXIGENIC FUNGI AND RELATED MYCOTOXINS IN THE WHEAT CHAIN

Antonio Moretti* , Antonio Francesco Logrieco

Institute of Sciences of Food Production (ISPA), Research National Council (CNR), Via Amendola 122/O, 70126, Bari, Italy

*corresponding author: antonio.moretti@ispa.cnr.it

plenary lecture

Among the emerging issues in food safety, the increase of plant diseases associated with the occurrence of mycotoxigenic fungal species, is of major importance. As a result of their secondary metabolism, these fungi can produce mycotoxins, which are low-molecular-weight toxic compounds, having a broad range of biological activities. The consumption of mycotoxin-contaminated food can have multiple consequences on both human and animal health worldwide. Mycotoxins occur naturally and are the most prevalent source of food-related health risks in field crops, especially cereals. Among cereals, wheat can be contaminated by a devastating world-spread disease, the Fusarium Head Blight, which is caused by a complex of *Fusarium* species producing a wide range of mycotoxins. Management of good agricultural practices in the pre-harvest is a key issue for minimizing the risk of a mycotoxin accumulation in wheat crops before the harvest. Such practices can involve crop rotation, tillage, proper fertilization and distribution of fungicides, or biological control agents, variety selection, timely planting and harvests. On the other hand, the reduction of mycotoxins in the agro-food chains is also highly dependent on a correct post-harvest management, such as separation of the infected crop products from the healthy material. The Horizon 2020 European Union project "Integrated and Innovative Key actions for mycotoxin management in the food and feed chain" Mycokey is developing an integrated management of pre- and postharvest practices for reducing the risk of contamination in wheat. An update of the scientific activities carried out in the Project will be provided.

Keywords: *Fusarium graminearum*, trichothecenes, deoxynivalenol

MYCOTOXINS - FROM FIELD TO THE STABLE AND THE TABLE

Elisabeth Streit^{1*}, Ines Taschl², Gerd Schatzmayr¹

¹*Biomin Research Center, Technopark 1, 3430 Tulln, Austria*

²*Biomin Holding GmbH, Erber Campus 1, 3131 Getzersdorf, Austria*

*corresponding author: elisabeth.streit@biomin.net

plenary lecture

Mycotoxins are secondary fungal metabolites that are ubiquitously present in agricultural commodities like cereals and oil seeds. Ingested in sufficiently high concentrations, they elicit severe toxic effects in humans and animals. In order to assess the extent of mycotoxin contamination in feed and feed raw materials, a survey program was launched in 2004. Since then more than 57 000 samples have been analysed and more than 200 000 individual analyses have been conducted. The results clearly show that high mycotoxin contamination is often linked to unusual weather during the growing season. Overall, 81% of the samples contained detectable amounts of aflatoxins, fumonisins, deoxynivalenol, zearalenone or ochratoxin A, and in 48% of the samples a co-contamination with two or more mycotoxins was detected. In most of the samples the concentrations were low enough to ensure compliance with EU guidance values or maximum levels. However, compliant samples containing several mycotoxins might still exert adverse effects due to synergistic interactions of the mycotoxins. Emerging mycotoxins and masked mycotoxins may also contribute to the overall toxicity of the feed and their presence is frequently detected with multi-mycotoxin LC-MS/MS. Regarding food, the situation is quite similar: low level contamination is frequently observed in official controls, but maximum levels are rarely exceeded in developed countries. Removing mycotoxins from contaminated commodities is very difficult. Hence preventing their accumulation in agricultural commodities is the most effective strategy to combat the problem. Nevertheless, excessive mycotoxin levels may occur despite all efforts. Therefore, continuous monitoring is essential, and efficient detoxification strategies are needed to deal with such outbreaks.

Keywords: mycotoxin co-occurrence, interaction, prevention, detoxification

CEREAL FOOD SAFETY

REDUCTION OF TENUAZONIC ACID IN WHEAT DURING PROCESSING

Elizabet Janić Hajnal^{1*}, Jasna Mastilović¹, Dejan Orčić², Ferenc Bagi³, Jovana Kos¹,
Dragana Budakov³, Aleksandra Torbica¹

¹University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, 21000
Novi Sad, Serbia

²University of Novi Sad, Faculty of Sciences, Department of Chemistry, Trg Dositeja
Obradovića 3, 21000 Novi Sad, Serbia

³University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000
Novi Sad, Serbia

*corresponding author: elizabet.janich@fins.uns.ac.rs

invited lecture

Alternaria toxins are mycotoxins produced by various *Alternaria* species that, beside the *Fusarium* species, represent the principal cereal contaminants worldwide. Taking their possible harmful effects on human and animal health into consideration and the fact that scarce information is available worldwide about the behaviour of *Alternaria* toxins in food and feed during the processing, the aim of this study was to investigate the possibilities of the reduction of tenuazonic acid (TeA) content as the most common *Alternaria* toxin detected in wheat from Serbia during harvest (using laboratory thresher), by using the wheat cleaning procedure (laboratory aspirator), and dry milling process (laboratory mill, Bühler MLU 202). The content of TeA in the samples of wheat chaff, in the kernels without chaff, in the uncleaned wheat samples, in the cleaned grain, in the impurities and in the milling fractions was analysed by high performance liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS). The detected levels of TeA were about three times higher in chaff compared to the kernels without chaff. The cleaning of wheat grain led to the reduction of TeA by 40 - 65%, while in the removed impurities an increase in TeA content by 2 - 10 times was obtained in comparison to the initial TeA concentrations in the unprocessed wheat samples. After dry milling process, in white flours, the level of TeA was reduced by 57% to 87.5% of the initial concentration in wheat before cleaning, while in dark flours and milling by-products (bran and shorts), TeA was present in 2 to 4 times higher concentrations.

Keywords: tenuazonic acid, wheat, harvesting, cleaning, dry milling

MYTOOLBOX – SAFE FOOD AND FEED THROUGH AN INTEGRATED TOOLBOX FOR MYCOTOXIN MANAGEMENT

Rudolf Krska¹, Monique de Nijs², Oonagh McNerney³, Michaela Pichler^{4*}, John Gilbert⁵, Simon Edwards⁶, Michele Suman⁷, Naresh Magan⁸, Vittorio Rossi⁹, Ine van der Fels-Klerx², Ferenc Bagi¹⁰, Carsten Fauhl-Hassek¹¹

¹*Center for Analytical Chemistry, Department of Agrobiotechnology (IFA-Tulln), University of Natural Resources and Life Sciences, Vienna, Austria*

²*Contaminants and Toxins, Stichting Dienst Landbouwkundig Onderzoek RIKILT (DLO-RIKILT), Wageningen, Netherlands*

³*Innovacio i Recerca Industrial i Sostenible SL (IRIS), Castelldefels, Spain*

⁴*International Association for Cereal Science and Technology (ICC), Wien, Austria*

⁵*FoodLife International Ltd (FLI), Ankara, Turkey*

⁶*Department of Crop and Environment Science, Harper Adams University (HAU), Newport, United Kingdom*

⁷*Food Chemistry and Safety Research, Barilla Research Labs, BARILLA S.p.A. (BARILLA), Parma, Italy*

⁸*Applied Mycology, Soil and Agrifood Institute, Cranfield University (CRANFIELD), Cranfield-Bedfordshire, United Kingdom*

⁹*HORTA SRL (HORTA), Piacenza, Italy and Faculty of Agriculture, Università Cattolica del Sacro Cuore, Milan, Italy*

¹⁰*Faculty of Agriculture, University of Novi Sad (PFNS), Serbia*

¹¹*Produktidentität und Rückverfolgbarkeit, Sicherheit in der Nahrungskette, Bundesministerium für Risikobewertung (BFR), Berlin, Germany*

*corresponding author: michaela.pichler@icc.or.at

invited lecture

The MyToolBox consortium led by Rudolf Krska (BOKU/IFA-Tulln) will not only pursue a field-to-fork approach along the food and feed chain, but will also consider the safe use options of mycotoxin contaminated batches, such as microbial energy conversion, to efficiently produce biogas and bioethanol, assisted by novel enzymes. The intervention technologies considered within MyToolBox include the investigation of genetic resistance to fungal infection, cultural control, the use of novel biopesticides, competitive biocontrol treatment, and the development of new forecasting approaches to predict mycotoxin contamination. Research into post-harvest measures includes real-time monitoring during storage, e.g. in China, innovative sorting of crops using vision-technology, and novel downstream processing approaches such as innovative (pre-) milling technology. Research into the effects of baking on mycotoxin levels will provide a better understanding of the process factors used in mycotoxin risk assessment. The mycotoxin commodity combinations that will be addressed include the most

prevalent Fusarium mycotoxins (DON, T-2/HT-2 toxins, ZEN, and fumonisins) in wheat, oats, maize, and animal feed chains, ochratoxin A in wheat and aflatoxins in maize, peanuts, and dried fruit (figs). The developed measures will be combined with existing knowledge and will become accessible via a dynamic web-based MyToolBox e-platform. MyToolBox mobilises a comprehensive multi-actor approach, with 23 partners with > 40% industry participation, including 5 end users from the farming community, agronomists, and professionals working in agriculture and food manufacturing.

Keywords: MyToolBox, mycotoxin, safe food and feed, safe use options of mycotoxin contaminated batches

UNVEILING THE MASK OF THE UNREGULATED AND MASKED MYCOTOXINS IN CROATIAN CEREALS

Bojan Šarkanj, Lidija Brodar, Tomislav Klapac

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: bsarkanj@ptfos.hr

invited lecture

There is not enough data on the occurrence of unregulated and/or masked mycotoxins in Croatia, and one of the aims of the CroMycoScreen project was to properly screen their presence. In the 200 samples of cereals from all Croatian counties, there were 128 different mycotoxins, bacterial toxins, and plant metabolites detected, and so far only few of them are regulated. The European Food Safety Authority (EFSA) has also requested that the member states screen the cereals for the following mycotoxins: enniatins, beauvericin, sterigmatocystein, moniliformin, diacetoxyscirpenol, nivalenol, 3- and 15- acetyldeoxynivalenol, deoxynivalenol-3-glucoside, ergot alkaloids, and *Alternaria* toxins. Out of all the items on the EFSA's list, only sterigmatocystein was not detected, while all other mycotoxins were present. The monitoring partially continued with fewer samples, and the presence of the unregulated and/or masked mycotoxins was confirmed in Croatian cereals in the harvesting years from 2013 to 2016. The data was used to prepare heat maps and network graphs for easy visual detection of the problematic areas and cereals. Continued monitoring could generate enough data for prediction models, which could be used to increase cereal based food and feed safety.

Keywords: Croatia, cereals, masked mycotoxins, unregulated mycotoxins

EXPOSURE OF CROATIAN ADULTS TO ACETYLATED AND MASKED FORMS OF DEOXYNIVALENOL

Martina Jurković^{1*}, Tomislav Klačec², Bojan Šarkanj²

¹Croatian Food Agency, I. Gundulića 36b, Osijek, Croatia

²Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia

*corresponding author: mjurkovic@hah.hr

oral presentation

Deoxynivalenol (DON) is a frequent contaminant of grains and cereal products, thus representing a serious threat to food safety. Since the group provisional maximum tolerable daily intake (PMTDI) was set only for DON and acetylated forms, and not for deoxynivalenol-3-glucoside (DON-3-Glc), the exposure estimation was calculated for the two scenarios: the first scenario without DON-3-Glc, and second scenario where DON-3-Glc was included. The results showed that the average exposure of the population was 0.21 µg/kg bw per day for both scenarios. From the total number of consumers, 0.57% in the first scenario and 0.62% in the second scenario were exposed to concentrations of DON higher than the established PMTDI. The exposure was also determined for several subcategories of population and the results were similar for both scenarios. There was an equal number of men and women, but the average male exposure was higher. Likewise, the number of younger and older consumers was also the same, but the former were more exposed to DON. Regarding body mass index (BMI), exposure decreased with the increase in the body weight, so it was the highest in underweight, and the lowest in obese people. The average exposure was similar for urban and rural participants, although the percentage of participants with an intake exceeding PMTDI was two times greater for rural participants. The calculation of the average exposure in terms of eating habits showed that exposure was highest in vegans, followed by omnivores, and then lacto-ovovegetarians, regardless of the fact that the majority of people who exceeded PMTDI were omnivores.

Keywords: mycotoxin, DON, intake, exposure, Croatia

AFLATOXIGENIC EFFECT OF ILLUMINATED FULLERENE NANOPARTICLES

Tihomir Kovač^{1*}, Bojan Šarkanj¹, Tomislav Klapac¹, Ivana Borišev², Marija Kovač³,
Ante Nevistić³, Ivica Strelec¹

¹Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia

²Faculty of Sciences, University of Novi Sad, Department of Chemistry, Biochemistry
and Environmental Protection, Novi Sad, Serbia

³Inspecto Ltd., Đakovo, Croatia

*corresponding author: tihomir.kovac@ptfos.hr

oral presentation

This study examined the effect of environmentally plausible fullerene C₆₀ nanoparticle (nC₆₀) concentrations on the aflatoxigenic fungi *Aspergillus flavus* NRRL 3251. Fungi were grown in YES medium for 168 h at 29 °C in the presence of 0, 10, 50 and 100 ng mL⁻¹ of nC₆₀ under VIS illumination (LED bulb, 50 W, 2250 Lux, Stella) in the 12 h light/12 h dark regime. Dry mycelial weight measurement was used for the antifungal activity estimation, while an effect of nC₆₀ on aflatoxin production in YES media was assessed using a dilute and shoot LC-MS/MS method. Additionally, the main oxidative status markers of *A. flavus* cell (TBARS, GSH/GSSG ratio, Cu, Zn-SOD, Mn-SOD, and CAT) were determined by standard biochemical assays. Fullerene C₆₀ nanoparticles caused a slight increase in the mycelial growth, but significantly boosted aflatoxin B1 production up to 8 times the control values at 10 ng mL⁻¹ of nC₆₀. Oxidative status markers indicated that aflatoxigenic effect of the illuminated C₆₀ nanoparticles could be attributed to their strong prooxidant action on *A. flavus*. These results imply negative consequences of the increased release and environmental occurrence of fullerene C₆₀.

Keywords: fullerene C₆₀ nanoparticles, VIS illumination, *Aspergillus flavus* NRRL 3251, aflatoxin B1, oxidative stress

**PREVENTING FOOD SAFETY INCIDENTS BY THE DEVELOPMENT OF A GLOBAL
ALERT SYSTEM**

**Vlasta Pilizota^{1*}, Huub Lelieveld², Chin-Kun Wang³, Veslemøy Andersen⁴, Helga
Medić⁵**

¹*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

²*Global Harmonization Initiative (GHI), Ensahlaan 11, 3723 HT Bilthoven,
Netherlands*

³*School of Medicine, Chung Shan Medical University, 110, Section 1, Jianguo North
Rd., Taichung, Taiwan*

⁴*Global Harmonization Initiative (GHI), Muthgasse 18, 1190 Vienna, Austria*

⁵*University of Zagreb, Faculty of Food Technology and Biotechnology, Pierottijeva 6,
10000 Zagreb, Croatia*

*corresponding author: vlasta.pilizota@ptfos.hr

oral presentation

It is generally assumed that food is safe for its intended use for human consumption. However, food could be accidentally (unintentionally) or deliberately (intentionally) contaminated by chemical, physical or microbial hazards. Regrettably, companies and sometimes, even governments attempt to hide incidents of food contamination to protect their image. The consequences can be severe, leading to illnesses and even deaths. Employees or others who are aware of such incidents often do not dare to report them because of the potential personal consequences. Cereal products are no exception, although the incidents associated with these products occur rarely. Globalization has increased the possibility of these incidents. Since an incident could happen, there are concerns about actual or suspected threats to the safety or quality of food that require intervention to protect consumers. All hazards have to be measured and controlled. For that reason it is of utmost importance to manage food safety in all steps, among which the (anonymus) global alert system (an essential element of an effective food safety system) is the most important one across the global supply chain in terms of ensuring regulatory compliance.

Keywords: global alert system, food safety management, food safety regulations

INTRODUCING THE NEW ULTIVO TRIPLE QUADRUPOLE MS – A TRUE INNOVATION IN MASS SPECTROMETRY

Neven Public^{1*}, Shaun Bilsborough²

¹AlphaChrom d.o.o., Karlovačka cesta 24, 10000 Zagreb, Croatia

²Agilent Technologies UK Ltd, Lakeside 5500, Cheadle Royal, United Kingdom

*corresponding author: neven.public@alphachrom.hr

sponsor advertisement presentation

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Keywords: Triple Quadrupole LC/MS, food and environmental applications, Ultivo, Agilent

MYCOTOXINS: THE IMPACT ON HEALTH AND ANALYTICS

Matjaž Rejec*

Labena d.o.o., Verovškova 64, 1000 Ljubljana, Slovenia

*corresponding author: matjaz.rejec@labena.si

sponsor advertisement presentation

The effects of mycotoxins on health and economic welfare became widely recognised after the plague of turkeys in the 60s, for which aflatoxin was responsible. This event has prompted researchers to discover other mycotoxins and their impact on human health. Since then, many mycotoxins have been identified. Eating foods that have higher amounts of mycotoxins causes reduced appetite, nausea, vomiting, diarrhoea. Chronic exposure to lower concentrations of certain mycotoxins can reduce the immune function, enhance cancer development and can cause embryo and hormonal disorders.

The content of mycotoxins in the samples can be determined by the accredited analytical methods (chromatography). Hence, for analysis prior to purchasing and before processing of the cereal into the finished product, most food companies use nowadays faster routine methods, such as immuno-enzyme (ELISA) and immunochromatographic (LATERAL FLOW TECHNOLOGY). The practical advantage of the appropriate routine methods is in speed, simplicity and low cost, with a simultaneous high reliability level.

Charm Sciences Inc. is the leading manufacturer of immunochromatographic tests and equipment for the rapid detection of mycotoxins in cereals. Predominantly in the technology of extraction of mycotoxins with water, the reliability of these tests is confirmed by a number of approval by USDA GIPSA. In a comparative study by the Belgian national reference laboratory for mycotoxins CODA-CERVA, Charm tests for the determination of DON mycotoxin achieved the best estimate of accuracy, repeatability, detection limits and other criteria. Experience with regional samples from Slovenia and Croatia confirms international results.

Keywords: mycotoxins, health, ELISA, immunochromatographic tests

ERGOT ALKALOIDS PRESENCE IN CEREALS FROM CROATIA

Leonard Matijević, Jasenka Petrić*, Danijela Stražanac, Andrea Gross-Bošković,
Brigita Hengl

Croatian Food Agency, I. Gundulića 36b, Osijek, Croatia

*corresponding author: jpetric@hah.hr

poster presentation

Ergot alkaloids are mycotoxins produced by pathogens that contaminate grains, mainly *Claviceps purpurea*. Rye and triticale are especially susceptible to fungal contamination, but wheat, oats and barley are also potential fungal hosts. Ingestion of contaminated cereals may cause adverse health effects in humans and animals, and it is therefore important to monitor their presence in food and feed, as prescribed by the Commission Recommendation (2012/154/EU).

A three-year monitoring of ergot alkaloids and ergot sclerotia on different types of cereals and cereal products from Croatia has included 80 samples in total. Samples were analysed for six main ergot alkaloids and their corresponding – *inine* epimers. Besides, 28 samples were analysed visually on ergot sclerotia (only rye samples). Ergot sclerotia was found in 36% of the samples with an average content of 0.0242 g/kg, and with a highest value of 0.25 g/kg, which means that all the samples were below the recommended levels of 0.5 g/kg, according to the Regulation 2015/1940. At least one of ergot alkaloids was quantified in 62% of the samples and the mean concentration was 136 mg/kg, with the highest recorded concentration of 1816 mg/kg in a rye sample. Correlation analyses between the incidence of ergot sclerotia in a sample and the concentration of ergot alkaloids, were not sufficient to establish a cause – effect relationship between presence of ergot sclerotia and ergot alkaloid contamination.

Keywords: ergot alkaloids, ergot sclerotia, cereals

MICROBIOLOGICAL SAFETY OF PHYLLO PASTRY

Dragana Plavšić^{1*}, Đorđe Psodorov¹, Dragan Psodorov², Ljubiša Šarić¹, Anamarija Mandić¹, Ivana Čabarkapa¹, Ana Varga¹

¹University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

²College of Management and Business Communications, Mitropolita Stratimirovića 110, 21205 Sremski Karlovci, Serbia

*corresponding author: dragana.plavsic@fins.uns.ac.rs

poster presentation

Pasta related products based on wheat grains represent foodstuffs that are characterized by the optimal ratio of basic nutrients. Pasta related products have almost a daily presence in nutrition. On the other hand, pasta related products, since they are dried very briefly, have a higher a_w value and thus are more susceptible to proliferation of microorganisms.

The aim of this study was to investigate the microbiological safety of pasta related products – phyllo pastry, produced from wheat flour and with the addition of whole grain wheat flour. The study examined the microbiological safety and sustainability of phyllo pastry. Phyllo pastry was analyzed on the production date and after 5, 7, 14, and 21 days of storage, at the temperature of 8 °C. Samples were tested based on the following parameters: total number of microorganisms and total number of yeasts and moulds.

The total number of microorganisms after 21 days of storage was in the range of 1.0×10^5 cfu/g (wheat flour phyllo) to 9.5×10^5 cfu/g (phyllo pastry with the addition of whole grain wheat flour). The total number of yeasts and moulds after 21 days of storage was in the range of 5.4×10^4 cfu/g (wheat flour phyllo) to 7.3×10^5 cfu/g (phyllo pastry with the addition of whole grain flour). The most frequently isolated species of moulds from phyllo pastry belongs to the following genera: *Penicillium* sp and *Mucor* sp.

Keywords: microbiological safety, moulds, phyllo pastry

MICROBIOLOGICAL QUALITY ANALYSIS OF ORGANICALLY GROWN OILSEED PRODUCTS

Dijana Podravac*, Nina Jager, Lidija Lenart

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: dijana.podravac@ptfos.hr

poster presentation

In recent years, seed bread has become one of the favourite breads for consumers, due to its better taste, nutritional value, and positive health effects. This paper illustrates the process of the microbiological quality analysis of organically grown oilseeds, from which many different products can be obtained by cold pressing, including seeds and semi-products made from them that can be added to the bread. Since these products are not thermally treated in any way, their microbiological safety is questionable. Therefore, the goal of this paper was to implement microbiological control of those products and to compare the obtained parameters with the norms prescribed by the Food Hygiene and Food Microbiological Laws (NN 81/2013). The conducted microbiological methods conform to the requirements prescribed in the Croatian norms which are based on the ISO-9001 quality standards. A total of 40 samples, including 6 samples of cold pressed oils, 9 organic butters, 6 organic protein flours, 8 kinds of seeds and nuts, and 11 mixtures of oilseeds and edible nuts for bread and crackers, were collected and analysed on a number of aerobic mesophilic bacteria, bacteria of the *Enterobacteriaceae* family, moulds and yeasts. The samples were also screened for the presence of pathogenic *Salmonella* and *Listeria monocytogenes* species, and sulphite-reducing clostridia, dependent upon the norms prescribed by the Law. It was shown that the measured values did not exceed the prescribed normative values in all samples.

Keywords: seed bread, oilseeds, edible nuts, organic protein flour, butter

CEREAL PROCESSING TECHNOLOGIES

**PEPPER (*Capsicum annum* L.) AND BY-PRODUCTS OF ITS PROCESSING AS
SUPPLEMENTS FOR BAKERY PRODUCTS**

**Jasna Mastilović^{1*}, Milan Vukić², Marko Ivanović², Jelena Radovanović², Dženita
Džinić², Žarko Kevrešan¹**

¹*University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, Novi
Sad, Serbia*

²*University of East Sarajevo, Faculty of Technology, Karakaj bb, Zvornik, Bosnia and
Herzegovina*

*corresponding author: jasna.mastilovic@fins.uns.ac.rs

invited lecture

Additive-free products, as well as fortified products, are among the current development trends in the baking industry. Pepper (*Capsicum annum* L.) is one of the fruits with the highest content of ascorbic acid, which is the inevitable improver of wheat dough properties. However, probably due to the specific colour and aroma, pepper powder was seldom considered as the constituent of bakery products. Additionally, about 25% of pepper fruit is discarded during pepper processing and it represents waste consisting of pepper fruit flesh pieces, calix and seeds. In the present research we investigated possibilities for the production of a natural improver for wheat dough properties and for the enhancement of the nutritional value of bakery products using pepper fruit and pepper processing by-products.

The addition of 0.5 - 1.5% of powdered pepper fruit flesh dried at mild conditions to the wheat dough resulted in the increase of water absorption of the dough, with the preservation or improvement of other dough properties, similarly to the addition of recommended quantities of ascorbic acid. The effects on the improvement of the rising of the dough and on retarding bread crumb firming were also registered.

The addition of 1 - 3% of powdered pepper calix dried at mild conditions had an even more expressed influence on the increase of water absorption of the dough, while the pepper seed powder contributed to a more expressed improvement of dough rising properties. The addition of higher shares (10%) of pepper calix or pepper seed powder, that contributes to the significant increase of soluble dietary fibre content in bakery products, significantly decreased the farinograph quality number and extensograph energy but did not affect significant decrease of the bread quality parameters.

Keywords: *Capsicum annum* L., bakery products, application, powder, by-products

QUALITY MONITORING OF MILLING AND BAKERY PRODUCTS BY THE CHANGE OF PROCESS PARAMETERS IN LOW CAPACITY MILLS

Gordan Avdić^{1*}, Dijana Miličević¹, Amel Selimović¹, Šejla Omerović²

¹Faculty of Technology University in Tuzla, Univerzitetska 8, 75000 Tuzla, Bosnia
and Herzegovina

²Žitoposavina d.o.o. Pelagićevo, Bosnia and Herzegovina

*corresponding author: gordan.avdic@untz.ba

oral presentation

Milling and bakery products are a very important segment of the food industry and include a large number of different products. Mill products, such as different types of flour, are still used as raw material in the manufacture of a wide range of various products, such as bread, biscuits, pasta, cookies, cakes, snack manufactures, baby food, etc. It is advisable to monitor the quality of all these products from the beginning.

Basic raw materials in the milling industry are grains; wheat is dominated in Bosnia and Herzegovina, although corn, rye and other grains are used. The quality and properties of these raw materials have to be monitored during sowing and growing, especially after harvesting and delivering in the mill.

Most basic bakery products (bread, biscuits), and some other types (leafy pies, pies, cakes) are made of the highest quality wheat flour with high protein content. Floury properties, that affect the properties of a finished product the most, depend on the properties of wheat and the method of grinding. The aim of this paper is to monitor and evaluate quality parameters (impurities, absolute and hectolitre masses, humidity) in small capacity mills that are very interesting for low initial investment. The monitoring of production parameters, whose number is, in most cases, far smaller than in large capacity mills, as well as a description of milling process, is sufficient to obtain the required quality of the product.

Keywords: mill, capacity, process parameters, quality parameters

CHANGES FROM DOUGH TO BREAD BY DIGITAL IMAGE ANALYSIS

Raquel Garzon*, Cristina Molina Rosell

Institute of Agrochemistry and Food Technology (IATA-CSIC), Catedrático Agustín Escardino Benlloch 7, 46980 Paterna, Spain

*corresponding author: r.garzon@iata.csic.es

oral presentation

Breadmaking of gluten free products is much more complex than that of gluten products. It is known that the hydration of ingredients is fundamental for obtaining gluten free breads of acceptable quality. Nevertheless, scarce information is available about the proofing and baking conditions. The aim of this study was to characterize the proofing and baking process for obtaining breads with and without gluten, using image digital techniques for the dough and bread analysis. Wheat, rice and corn flours were used to define the conditions of the breadmaking process (mixing, fermentation, baking). Dough rheological properties, assessed by Mixolab, showed that gluten containing doughs had proper consistency, whereas gluten free doughs resembled batters, with fluid consistency, which increased only during the heating stage. Proofing of wheat doughs was faster and higher volume was reached in comparison to gluten free doughs. The largest expansion of the doughs occurred during fermentation and continued during baking in doughs with gluten, while it decreased in gluten free doughs. The bubble size was modified along the baking process; in general, the number of bubbles was rather low. Crumbs from the gluten free breads were harder than those of the wheat bread. The statistical analysis suggested weak correlations between dough consistency and the number and size of the bubbles present in crumbs. In short, it is important for fixing the crumb structure of gluten free products to avoid volume decrease during baking. Therefore, the optimization of baking conditions would be advisable to improve gluten free bread quality.

Keywords: breadmaking, image analysis, gluten free, bread

**ADDITION OF AMARANTH, QUINOA AND BUCKWHEAT FLOUR FOR ENRICHMENT
OF GLUTEN-FREE COOKIE**

Gholam Hossein Haghayegh*

*University of Zabol, Agriculture faculty, Department of Food Science and
Technology, 98615-538 Zabol, Iran*

*corresponding author: gh2002_haghayegh@yahoo.com

oral presentation

Consumption of food with low nutritional value is the main reason for the malnutrition among Iranian children. Enrichment of this kind of food is one of the main goals for food researchers. In this study, quinoa, amaranth and buckwheat flour in levels of 5, 10 and 15% were used as rice flour replacers in gluten-free cookie with high nutritional value. Nutritional, textural, visual and sensory properties of the samples were evaluated. The results indicated that the addition of semi cereal flour to cookie formulation increased protein, ash, moisture, softness of texture in 2 h, and one week after baking. The results of image processing showed that buckwheat and amaranth flour increased the amount of a* and b* values of the gluten-free cookie surface, respectively. Sensory evaluation showed that the samples containing 10 and 15% quinoa and amaranth were rated the best considering overall acceptance, and these formulations can be supplied to the market as fortified gluten-free products.

Keywords: amaranth, quinoa, buckwheat, flour, cookie

INFLUENCE OF APPLE POMACE ADDITION ON THE COLOUR AND HARDNESS OF BISCUITS

Dijana Miličević^{1*}, Gordan Avdić¹, Martina Andrejaš¹, Marko Jukić², Đurđica Ačkar², Amel Selimović¹

¹*Faculty of Technology University in Tuzla, Univerzitetska 8, 75000 Tuzla, Bosnia and Herzegovina*

²*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: dijana.milicevic@untz.ba

oral presentation

The aim of this paper was to make biscuits from wheat flour of three quality groups, and to replace part of flour with the apple pomace (10 and 20%). Biscuits were made according to the same recipe, and baking time differed depending on the type of flour and the amount of the added apple pomace. In addition to testing (examination) the amount of water, water absorption capacity and the degree of acidity in flour and mixtures, as well as the colour and hardness of the dough and the biscuit were determined after baking.

The results showed that the addition of the apple pomace has an effect on the colour of the biscuit in terms of brightness reduction (L^* value) and the increase in a^* and b^* values. With the addition of the apple pomace and the increase in the added amount, the hardness of the biscuit is reduced.

Keywords: apple pomace, biscuits, colour, hardness

OPTIMIZATION OF FRENCH BREAD BAKING USING SUPERHEATED STEAM

Alain Sommier*, Yannick Anguy, Pradere Christophe

12M-TREFLE UMR CNRS 5295, Esplanade des Arts et Métiers, 33405 Talence Cedex,
France

*corresponding author: alain.sommier@ensam.eu

oral presentation

French bread is very well-known all around the world. We perceive the bread-maker as an artist making so many different products with only a few simple ingredients: flour, salt, water, yeast, and sometimes a few other ingredients (ascorbic acid, bean flour, exogenous enzymes). French bread requires energy, time and a very precise dexterity. In this paper, the link between heat and mass transfer for a French loaf of bread is highlighted, as well as the interaction between the oven and the product. Furthermore, the link between thickness, temperature, mass and internal pressure of the product driven by the temperature and the relative humidity in the oven is addressed. Stress is put on the impact of steam on the porosity and the microstructure (e.g. size of starch grains). Using this knowledge, it becomes evident that the baking process is two-fold: the first phase is the expansion of the dough; the second phase is a drying process and the crust formation. Based on this knowledge, the superheated steam as an energy vector added to the classical ones (radiative and contact) is used. We present a pilot oven and a new baking process using superheated steam at some *key time*. This leads to a time reduction (36%) and to a lower energy consumption (12%). The product was tested by an expert panel and judged as a traditional product of a quality.

Keywords: baking process, heat and mass transfer, microstructure, superheated steam

**PRODUCTION AND QUALITY ANALYSIS OF MALT PRODUCED FROM TWO
DIFFERENT HULLESS BARLEY LINES GZ-186 AND GZ-189**

**Gordana Šimić¹, Ana Bucić-Kojić^{2*}, Mirela Planinić², Gordana Šelo², Alojzije Lalić¹
Marina Tišma²**

¹*Agricultural Institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia*

²*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: abucic@ptfos.hr

poster presentation

In the last few years, the interest for the use of hulless barley in human nutrition and industrial alteration, e.g. in brewing, has been growing. The advantage of the hulless barley refers to its use without the need to remove the husk after the harvest. In this work, micromalting of two hulless barley samples lines (GZ-186 and GZ-189) were performed. Barley and malt quality control parameters, as well as the concentration of total phenolic compounds, total flavanoids and proteins in barley and malt extracts were analyzed.

Both hulless barley samples comprise high protein content (12.3 - 12.9%). Values of extract content from produced malt samples were from 83.92% to 84.46%, fine/coarse extract difference from 7.64% to 8.05%, Kolbach index from 34.1% to 35.2%, viscosity from 1.95 mPas to 2.04 mPas, friability from 33.1 % to 41.56%.

It was shown that tested hulless barley samples present rich source of phenolic compounds (364.19 mg_{GAE}/mL and 316.99 mg_{GAE}/mL GZ-186 and GZ-189, respectively), and poor source of total flavonoids (GZ-186: 1.69 mg_{CE}/mL and GZ-189: 1.25 mg_{CE}/mL). Consequently, malt samples are characterized with higher phenolic concentration (GZ-186: 408.95 mg_{GAE}/mL and GZ-189: 375.540 mg_{GAE}/mL) and lower flavonoids concentration (GZ-186: 1.22 mg_{GAE}/mL and GZ-189: 1.24 mg_{GAE}/mL).

Keywords: hulless barley, malt, quality analysis, phenolic compounds

**OPTIMIZATION OF A MANUFACTURING PROGRAM OF A BAKERY BASED ON
CUSTOMER RELATIONSHIP MANAGEMENT**

Branimir Dukić^{1*}, Stojanka Dukić², Dina Jukić³

¹*University of Josip Juraj Strossmayer in Osijek, Faculty of Economics in Osijek, Gajev trg 7, Osijek, Croatia*

²*duxMission d.o.o. Osijek, Dalmatinska 21, Osijek, Croatia*

³*Faculty of Electrical Engineering, Computer Science and Information Technology Osijek, Kneza Trpimira 28, Osijek, Croatia*

*corresponding author: bdukic@efos.hr

poster presentation

Industrial age had reached its peak in the 20th century. Increase in the volume and in the quality of industrial production, increased the need for more rational behaviour in producing the output, similar to the process of baking. To wit, a necessary condition for the survival of a business entity is efficiency that manifests itself in the successful realization of the product, which requires making products whose prices and/or quality are levelled with, or are better than competitive products. The pressure of the constant rationalization of production and the constant optimal behaviour of manufacturers raised proportionally with the increase of the volume of production. In other words, increase in the competition on the market successively leads to margin drop, i.e. price differences. Extra weight has been put on production rationalization by modern ICT that fastened and broadened the flow and exchange of information about the prices and the quality of products. Furthermore, knowledge contributes to the need for rational behaviour in production. General increase in knowledge, that is, knowledge and awareness of individuals about values and quality of their own lives, leads to changes of meaning of production rationalization. Today's business entities, besides efficiency, give importance to effectiveness, making it a priority to ensure their business is a sustainable development. To secure rational behaviour, business entities keep track of trends and use new approaches for rationalization of management. One of those approaches is customer relationship management (CRM) used to get insight of customers' needs and behaviour, which allows optimization of the manufacturing program. Therefore, a general model based on CRM for optimal manufacturing program for bakers, needs to be developed.

Keywords: bakery, customer relationship management, production optimization, program solution

POSSIBLE APPLICATIONS OF INDUSTRY 4.0 BASED ON CUSTOMER RELATIONSHIP MANAGEMENT IN BAKERY

Branimir Dukić^{1*}, Robert Obraz², Stojanka Dukić³

¹*University of Josip Juraj Strossmayer in Osijek, Faculty of Economics in Osijek, Gajev trg 7, Osijek, Croatia*

²*Klimaoprema d.d. Samobor, Gradna 78A, Samobor, Croatia*

³*duxMission d.o.o. Osijek, Dalmatinska 21, Osijek, Croatia*

*corresponding author: bdukic@efos.hr

poster presentation

Production of bakery products went through a long and gradual transformation from the individual, handicraft to modern industrial production. Today, the production of bakery products has been developed by mass high-automated industrial production. Although we are talking about production plants that find their economic validity mostly on the expenditure side of reduction of production costs and production processes, the modern business requires a change of the income side, where more important role has the development of consumer relations. Recently, the production of bakery products had all the features of mass production. Due to the importance of bakery products in the nutrition of people, especially in developed parts of the world, demand for bakery products could only recently be considered as non-elastic, since the price, quality and range of bakery products were basically irrelevant to the volume of demand for these products. However, at the end of the twentieth century the purchasing power of the population, as well as the level of information, knowledge and self-awareness, significantly influenced the consumption of bakery products. The modern consumer changes the structure of food in the nutrition and he is no longer satisfied with the mass-produced product, but requires a product that is "tailored" according to his needs. The manufacturing capabilities of modern, numerically controlled machines that make industry 4.0, allow the production of "tailored" products according to the needs of individual consumers. Consequently, transformation and transition from mass to individualized bakery product production requires a scientific and systematic approach.

Keywords: bakery, customer relationship marketing, industry 4.0, mass production

DRYING AND GRINDING CHARACTERISTICS OF THE SPROUTED RYE

Dariusz Dziki^{1*}, Urszula Gawlik-Dziki²

¹*Department of Thermal Technology, University of Life Sciences, Doświadczalna Street 44, 20280 Lublin, Poland*

²*Department of Biochemistry and Food Chemistry, University of Life Sciences, Skromna Street 8, 20704 Lublin, Poland*

*corresponding author: dariusz.dziki@up.lublin.pl

poster presentation

The purpose of this paper was to examine the influence of rye germination and preliminary seeds crushing on the drying and grinding characteristics, and antioxidant properties. The seeds of rye (cv. Dańkowskie Żłote) were sprouted for four days at 20 °C. After sprouting, the seedlings were air dried at 40, 50 and 60 °C, until the moisture content of the sample reached 14% (wb). The control and sprouted seeds were ground using a laboratory hammer mill. The particle size distribution, average particle size and the grinding energy indices were determined. The total phenolic content and antioxidant activity of flour were also estimated. The obtained data showed that sprouting had little influence on the drying process and the grinding energy requirements. Preliminary crushing of rye grain significantly reduced the drying time, depending on the drying temperature from 38 to 46%. The specific grinding energy ranged from 27 to 35 kJkg⁻¹. The slightly higher values of this index were obtained for uncrushed seeds. The average particle size of the ground rye changed from 0.55 to 0.80 mm for sprouted and control seeds, respectively. Sprouting significantly increased the mass fraction of particles below 0.2 mm, whereas crushing of seeds before drying had little influence on the particle size distribution. Furthermore, sprouting increased the antioxidant activity of rye (about 28%). The drying temperature had no significant influence, both on total phenolic content and antioxidant activity. The obtained results provide the basis for the development of the sprouted rye processing into the wholemeal flour with the increased antioxidant properties.

Keywords: rye, sprouting, drying, grinding, antioxidant activity

PROPERTIES OF WHEAT AND HULLESS BARLEY FLOURS MODIFIED BY EXTRUSION COOKING

Antun Jozinović¹, Jelena Panak Balentić¹, Marijana Grec^{1*}, Jurislav Babić¹, Borislav Miličević¹, Artur Gryszkin², Gordana Šimić³, Drago Šubarić¹

¹Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia

²Wroclaw University of Environmental and Life Sciences, Faculty of Biotechnology and Food Technology, Chelmonskiego Street 37, 51630 Wroclaw, Poland

³Agricultural Institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia

*corresponding author: mgrec@ptfos.hr

poster presentation

Flours obtained by extrusion cooking and posterior milling of the extruded products can be used in starch-based recipes, allowing for the change of functionality of native flours.

The objective of this research was to determine the effect of extrusion and different barrel temperatures in the die section (90, 100 and 110 °C) on the properties of two cultivars of wheat and hulless barley flours. Samples with 30% moisture content were extruded in the laboratory single screw extruder Brabender 19/20 DN, at the temperature profile of 70/90/90, (100), (110) °C, using a die with a 5 mm diameter and the screw configuration 1:1. The obtained extruded flours were air-dried and milled, and the pharinographic parameters (AACC 54-21.02), falling number (AACC 56-81.03), Zeleny sedimentation value (AACC 56-61.01), and pasting properties (by Micro Visco-Analyser) were determined.

The extrusion resulted in the decrease of peak, hot, and cold viscosity of all samples, which is found to be correlated with higher degradation and gelatinisation of starch during the extrusion process. Further, the extrusion caused a significant reduction of the falling number and sedimentation values, but the increment of the water absorption index. The dough stability for all extruded samples was low, probably due to gluten "dilution" and degradation. The extruded flours had a higher dough development time, resistance, and the farinograph quality number, but lower softening degree. The obtained results showed no statistically significant correlation of differences in barrel temperature and the observed changes, except for water absorption, which increased proportionally with the increase in temperature. The pharinographic values defined that all extruded flours belong in the strong quality group and can be used as bread improvers.

Keywords: extrusion, wheat, hulless barley, flour

ACID HYDROLYSIS OF STARCH CITRATE

Artur Gryszkin^{1*}, Tomasz Zięba¹, Joanna Miedzianka¹, Jurislav Babić², Antun Jozinović²

¹Wroclaw University of Environmental and Life Sciences, Faculty of Biotechnology and Food Technology, Chelmonskiego Street 37, 51630 Wroclaw, Poland

²Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia

*corresponding author: artur.gryszkin@upwr.edu.pl

poster presentation

The objective of this study was to determine the effect of acid hydrolysis of starch citrate, obtained by roasting potato starch at different temperatures with acid citrate on the chosen properties of produced samples.

Citrate acid in aqueous solution was applied on the potato starch (10 g of acid per 100 g of starch), conditioned, dried, and roasted for 3 hours at 90, 100, 110, 120 and 130 °C. After rinsing with distilled water, the obtained citrates were held for 3 days in 7.5% HCl solution at 40 °C. Afterwards, the samples were rinsed with water, dried, and milled. The degree of substitution, water absorption, and solubility in water with a temperature of 80 °C, as well as temperature and heat for gelatinization (heat of phase transition) were determined in starch esters before and after the hydrolysis process.

The acid hydrolysis of starch citrate affected the properties of obtained starch hydrolysates, and the direction and degree of changes were dependent on the temperatures used during esterification. The degree of starch citrate substitution was higher at the higher temperature used during the esterification process. On the other hand, water absorption and water solubility for starch esters were lower when the temperature for obtaining the starch citrate was higher. The increase of the esterification temperature caused the decrease of initial and final temperatures of gelatinization, both for the starch esters and for starch citrate hydrolysates. Furthermore, the heat of the phase transition was lower for esters and hydrolysates when the esterification temperature was higher.

Keywords: esterification, starch citrate, hydrolysis

**THE INFLUENCE OF SUGARS AND THE ADDITION OF MODIFIED STARCHES ON
THE RETENTION OF AROMA COMPOUNDS IN THE BLACKBERRY PUREE**

Anita Pichler*, Ivana Ivić, Mirela Kopjar

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: anita.pichler@ptfos.hr

poster presentation

Aroma compounds are very important for fruit quality. Their stability is of great importance, since it helps to predict the shelf-life of products, and technological processes in order to make more consumer-friendly products. In this study, different sugars (sucrose, fructose and trehalose), and modified starches (tapioca and waxy maize modified starches) were used for the blackberry puree preparation and their influence on the blackberry aroma compounds was investigated.

Samples with the addition of sugars only and with the addition of sugars and modified starches were prepared. By using gas chromatography-mass spectrometry (GC/MS) and SPME sampling technique thirty-six ingredients in the blackberry puree were determined and were divided into eight groups: terpenoids, alcohols, acids, norisoprenoids, lactones, esters, C6 compounds and others.

The addition of sugars in the blackberry puree showed no significant impact on the retention of aroma compounds. The addition of modified starches in samples with sugars increased the content of C6 compounds, terpenoids, norisoprenoids and lactones. Acid content was significantly less in the samples with added sugars and modified starches. When samples with the added modified starches are compared, those with waxy maize modified starch had higher aroma retention in comparison to samples with the tapioca modified starch. However, puree with the addition of sugar, trehalose, in combination with waxy maize modified starch had the highest retention of aroma compounds.

Our results showed that small modifications (addition of different modified starches) of the food matrix composition greatly affected the aroma compounds of the blackberry puree, probably due to the interactions between the food matrix ingredients.

Keywords: aroma compounds, sugars, modified starches, blackberry puree

A STUDY OF THE EFFECT OF MICROWAVES ON THE PROPERTIES OF BARLEY MALT

Anastasia Rushchitc*, Abduvali Toshev, Elena Shcherbakova

South Ural State University (NIU), 454080, Lenin Ave., 78-b, Chelyabinsk, Russia

*corresponding author: asuta80@gmail.com

poster presentation

Microwave radiation is widely used in the production of food products: for cooking and heating food, drying, disinfecting raw materials, and extracting biologically active substances.

It would be of interest to develop a technology that allows the regulation of grain crop properties by treating them with microwave radiation.

In this study barley malt grain processed in a microwave oven with a frequency of 2450 MHz was used. The radiation power was 100 - 500 W, exposition – 30 - 150 s.

In the experiments, the effects of different combinations of power and duration of microwave treatment on the properties of malt enzymes (α - and β - amylases, proteases), protein and carbohydrate content, and acidity were studied.

It has been established that the combination of low power and long treatment (100 - 300 W and 90 - 150 s), and high-power and short-term treatment (500 W and 30 s) leads to the activation of enzymes. The combination of high power and long treatment (400 - 500 W and 90 - 150 s) leads to a decrease of enzymatic activity.

The protein content in the malt during all processing modes was almost constant. Fluctuations amounted to 0.5% and 1.5%.

The greatest impact of microwave processing has been recorded on the carbohydrate fraction of malt. Depending on the processing modes, the content of the starch was reduced, and mono- and disaccharides have increased 2 - 4 times.

Also, when processing in the range of 90 s and a power of 100 - 300 W, malt acidity increases.

The developed technology allows the regulation of the properties of nonconforming raw materials by using different combinations of processing modes.

Keywords: microwave radiation, barley malt, hydrolytic enzymes, acidity, protein content

**THE CONNECTION OF KERNEL HARDNESS AND DEBRANNING TIME IN WINTER
WHEAT**

Antal Véha, Balázs P. Szabó*

Faculty of Engineering, University of Szeged, Moszkvai boulevard 5.-7., Szeged H-6725, Hungary

*corresponding author: szpb@mk.u-szeged.hu

poster presentation

Wheat hardness has an effect on the milling process; it determines the properties, the qualities, and the end use of flours. In recent years, the debranning of kernels before milling has moved to the forefront. Our research examined the debranning process using two different wheat kernels, called GK Fény (with soft kernel hardness) and GK Békés (with hard kernel hardness), in different water-conditions. The aim of our work was to demonstrate and compare the changes in different wheat kernel parameters, such as grinding energy, percentage of broken kernels, peeled bran content, and the Hardness Index, as the function of debranning times. The results demonstrated that longer debranning times caused a decrease in the kernel hardness and the grinding energy in both wheat varieties.

Keywords: PeriTec technology, SATAKE, debranning, wheat kernel hardness

CEREAL WASTE MANAGEMENT

**LIGNOCELLULOSIC CEREAL CROP WASTE AS BIOMASS FEEDSTOCK FOR BIOFUEL
PRODUCTION: BASIC CONCEPT AND LATEST DEVELOPMENTS**

Marina Tišma*

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000, Osijek, Croatia*

*corresponding author: marina.tisma@ptfos.hr

invited lecture

Biofuel production represents one of the most important essentials for sustainable development all over the world. Cereal and oilseed crops are mostly cultivated for their edible seeds, whereas their harvest residues are usually left in the field. However, they represent abundant and cheap, carbon-rich, non-food lignocellulosic biomass with great potential to be used in biofuel production. The latest developments in biodiesel and biogas production using different types of lignocellulosic biomass will be given, followed by the cost-benefit analysis. The current status and possibilities for utilizing lignocellulosic biomass in Croatia will be discussed.

An innovative ecological process design for the possible application of lignocellulosic biomass will be presented: *a)* as a substrate for lipase production and/or as a carrier for lipase immobilization in enzymatic biodiesel production, and *b)* as a substrate or co-substrate in biogas production.

Keywords: biogas, biodiesel, cereal crop waste

E – MARKETING FOR THE RECYCLING OF BAKERY PRODUCTS

Stojanka Dukić^{1*}, Branimir Dukić², Goranka Majić³

¹*duxMission d.o.o. Osijek, Dalmatinska 21, Osijek, Croatia*

²*University of Josip Juraj Strossmayer in Osijek, Faculty of Economics in Osijek,
Gajev trg 7, Osijek, Croatia*

³*Kruna 2011 d.o.o. Zagreb, Zagrebačka avenija 104c, Zagreb, Croatia*

*corresponding author: dux-mission@os.t-com.hr

oral presentation

In the last thirty years, people have become aware of our limited resources and the need for their rational use. As the result of changes in the people's global awareness, new scientific disciplines, that focus on the more effective use of the available resources and on the assurance of sustainable development of the society, have emerged. In the context of these thoughts, the problem of waste recycling is becoming increasingly important. Like most other industrial products, the surplus of bakery products, both from the production and the consumption side, needs to be correctly sorted out and appropriately recycled. To accomplish the successful recycling of bakery products, it is necessary to encourage changes, not only in the industry behaviour, but also in the behaviour of the individual, the consumer. Marketing has the key role in terms of the development of human awareness about the necessity of recycling in general, and also the recycling of bakery products. But, in line with the technological and social changes, marketing is constantly changing. In the last couple of decades its development has been closely connected with the growth of the information – communication technology, so the new activity principles of marketing are associated with the prefix 'electronic' from which the title 'electronic, marketing' or 'e – marketing' has been derived. In the last decade, marketing has, acquired a more significant position in the sphere of non-profitable activities, coming from purely profitable sphere of activity. As the result of this activity, the so called 'social marketing' has emerged. Marketing achieves a socially useful activity in different spheres through different actions. From that perspective, it is interesting to look at the specifics of e-Marketing for the recycling of bakery products and to define the conceptual model of social e-Marketing for the recycling of bakery products, as a starting point for the formation of the collective awareness about the need and the necessity for the recycling of bakery products.

Keywords: bakery products, electronic marketing, sustainable development, recycling, social networks

EFFECT OF INCORPORATION OF BREWERS' SPENT GRAIN INTO EXTRUDED SNACKS

Belén Blanco^{1*}, Pedro Acebes¹, Gregorio Antolín²

¹*Agrifood and Sustainable Processes Division, Cartif Technology Center, Parque Tecnológico de Boecillo, parc. 205, 47151 Boecillo, Valladolid, Spain*

²*Chemical Engineering and Environmental Technology Department, EII, University of Valladolid, Paseo del Cauce, 59, 47011 Valladolid, Spain*

*corresponding author: belbla@cartif.es

poster presentation

Nowadays there is an increasing trend for the consumption of food products which contain natural ingredients, rich in fibre. Brewers' spent grain (BSG) is a by-product of brewing industry, high in fiber and protein, produced in large amounts. BSG addition is a cheap way to improve nutritional value of rice-based extruded snacks. Extrusion is a high-temperature-short time industrial technology, characterized by continuous cooking, mixing and forming to produce direct expanded snacks.

BSG, mainly malt, were converted to flour, and mixed with rice at different ratios to make extruded ready-to-eat snacks using a twin screw extruder.

The study examines, using a twin screw extruder on physical, functional and pasting properties, the impact of incorporation of BSG to rice flour for the production of snacks.

The extrusion process parameters were kept constant, with varying BSG content from 5 to 15%. Expansion index, pasting properties, water absorption index or water solubility index were affected by the BSG level of incorporation.

Keywords: barley, brewers' spent grain, snacks, extrusion

CEREAL FOOD WASTE

Diána Bánáti¹, Zoltán Gyóri^{2*}

¹ILSI Europe & University of Debrecen, Av. E. Mounier 83/ B.6. B-1200 Brussels, Belgium & University of Debrecen, H-4032 Debrecen 1st Egyetem square, Debrecen, Hungary

²University of Debrecen, H-4032 Debrecen 1st Egyetem square, Debrecen, Hungary

*corresponding author: gyori.zoltan@unideb.hu

poster presentation

Cereal is a processed food, manufactured from grain. The most commonly used grains are corn, wheat, oats, rice and barley. Cereals are the most important food source for human consumption. Of the approximately 2.3 billion tonnes of cereals currently produced worldwide, roughly 1 billion tonnes is destined for food use, 750 million tonnes is used as animal feed, and the remaining 500 million tonnes is processed for the industrial use. According to the Food and Agriculture Organization of the United Nations (FAO), food loss is defined as 'the decrease in quantity or quality of food'. Food waste is part of food loss and refers to discarding, or alternative use of food, that is safe and nutritious for human consumption. Approximately 1.3 billion tonnes of food produced in the world for human consumption is wasted annually, with cereals accounting for 30%. The amount of food lost or wasted every year is equivalent to more than half of the world's annual cereals crop. Over the next four decades, the world's population is estimated to increase by 2 billion, and will exceed 9 billion people by 2050. Recent FAO figures indicate that to meet the projected food demand, global agricultural production will have to increase by 60% with regard to the figures from 2005 – 2007. A reduction in food waste would increase the amount of food available for human consumption and enhance global food security to meet the demand of a rapidly increasing global population, which has to cover the whole food supply chain (harvesting, threshing, cleaning and drying, storage, transportation).

Keywords: cereal, food waste, food supply chain

**SENSORY AND TEXTURAL CHARACTERISTICS OF COOKIES ENRICHED WITH
EXTRUDED WHEAT GERM**

**Jovana Petrović^{1*}, Biljana Pajin¹, Ivana Lončarević¹, Aleksandar Fišteš¹, Antun
Jozinović², Đurđica Ačkar², Danica Zarić³**

¹*University of Novi Sad, Faculty of Technology, Bulevar cara Lazara 1, 21000 Novi
Sad, Serbia*

²*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

³*This Techno Experts doo, research development center, 11000 Belgrade, Serbia*

*corresponding author: jovana@tf.uns.ac.rs

poster presentation

The major challenge in the food industry sector is the introduction of agro-food industry by-products rich in bioactive compounds. Wheat germ is a rich and cheap source of bioactive components, produced as a by-product during the milling process of wheat grains. In this paper, the influence of extruded wheat germ particle size (<250 µm, 250 - 1000 µm and 1000 - 2000 µm) on the textural and sensory characteristics of cookies was investigated. Extruded wheat germ particle size affected the cookies' hardness and colour. As the wheat germ particle size decreased, the cookies' hardness increased. The increasing particle size of the extrudate caused lower scores for cookies' sensory characteristics.

Keywords: cookies, by-product, extruded wheat germ, sensory characteristics

FUTURE PROSPECTS OF OIL CAKES IMPLEMENTATION AS SUPPLEMENTS IN BAKERY PRODUCTS

Sandra Budžaki, Kristina Alilović, Goran Miljić, Ivica Strelec, Marina Tišma*

Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000, Osijek, Croatia

*corresponding author: marina.tisma@ptfos.hr

poster presentation

It is well known that the use of oil cakes as protein supplements, as flour, in human nutrition in combination with wheat or other flours, increases the nutritional value and has a positive effect on health, and even reduces the risk of some diseases.

The objective of this study was to determine the chemical composition of three oil cakes: hull-less pumpkin (*Cucurbita pepo* L.), flax (*Linum usitatissimum* L.) and hemp (*Canabis sativa* L.) that remains after the production of cold-pressed oil, before and after the treatment with two microorganisms (*Trametes versicolor* and *Humicola grisea*).

The results showed that after the treatment, the amount of total nitrogen increased (from 247.69 to 500.55 g/kg db), fat content decreased (from 365.53 to 24.40 g/kg db), as well as the amount of soluble sugars (from 26.40 to 7.12 g/kg db) for all three oil cakes. The results confirmed our hypothesis: after biological treatment, nutritional value of oil cakes was improved. The future prospective could be the use of biologically treated oil cakes as supplements in bakery products.

Keywords: hull-less pumpkin (*Cucurbita pepo* L.), flax (*Linum usitatissimum* L.), hemp (*Canabis sativa* L.), biological treatment, bakery products

This work has been fully supported by Croatian Science Foundation under the project IP-2016-06-7993.

CEREALS AND CEREAL PRODUCT QUALITY

FACING THE FUTURE OF CEREALS/FLOURS: SUSTAINABILITY AND HEALTH CONCERNS

Cristina Molina Rosell*

Institute of Agrochemistry and Food Technology (IATA-CSIC), Catedrático Agustín Escardino Benlloch 7, 46980 Paterna, Spain

*corresponding author: crocell@iata.csic.es

invited lecture

Nowadays, sustainability and health are two of the main drivers of the food industry, and cereals and flours stakeholders are facing the same trends. The estimated population increase in the next 30 years prompted the search for new raw materials, especially alternative protein sources, to meet the foreseen needs. Likewise, consumers' health concerns are encouraging the design of cereal and other grains-based products with different technological and nutritional qualities. Those lifestyle changes are forcing the search for new nutritive alternatives to improve the health pattern of bakery products. An overview of the range of raw materials available for making breads and the physical techniques for modulating nutritional properties, like starch and protein digestibility, will be presented. Flours selected from different sources can lead to products with different technological and nutritional properties. Nevertheless, further health improvement could also be obtained through additional processing of the flours using intensive milling, flours fractionation, and germination. Those treatments allow the modification of the glycaemic index and the protein digestibility of the resulting bakery products. In any case, future challenges will require breakthrough innovations, including non-traditional flours, where sustainability and nutrition go hand in hand. In this scenario, preliminary results indicate that insect flours are opening new alternatives for developing bakery products.

Keywords: sustainability, health, cereals

LAB-ON-A-CHIP DEVICE AS A USEFUL TOOL FOR DETERMINATION OF GLUTEN PROTEINS AND THEIR CONNECTION WITH END USE QUALITY OF WHEAT

Dragan Živančev^{1*}, Aleksandra Torbica², Jasna Mastilović², Daniela Horvat³, Daliborka Koceva Komlenić⁴

¹*Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia*

²*University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia*

³*Agricultural Institute Osijek, Južno Predgrađe 17, 31000 Osijek, Croatia*

⁴*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: dragan.zivancev@nsseme.com

invited lecture

Gluten is complex protein compound of wheat endosperm. It's main purpose as all seed storage proteins is to provide nutrients during germination of kernel for seedling growth. Also, due to structural characteristics, it's possess unique viscoelastic features important for rheological properties of wheat dough which are crucial for determining wheat quality. Moreover, gluten consists of numerous different glutenin and gliadin subunits. Until now, different analytical techniques are used for their determination. In the last decade, is developed the microfluidic or Lab-on-a-Chip (LoaC) devices which have found application for determination of gluten proteins. Also, it is possible to use the LoaC platforms for identification and quantification of gliadin and glutenin subunits. Therefore, in this lecture will be presented research results from several different surveys about possibility utilization of LoaC technique for determination of glutenin and gliadin subunits and their influence at technological quality of wheat dough.

Keywords: LoaC, gluten protein, wheat quality, glutenin, gliadin

EVALUATION OF THE INCORPORATION OF GRAPE POMACE INTO READY-TO-EAT EXTRUDED SNACKS

Belén Blanco^{1*}, Gregorio Antolín²

¹*Agrifood and Sustainable Processes Division, Cartif Technology Center, Parque Tecnológico de Boecillo, parc. 205, 47151 Boecillo, Valladolid, Spain*

²*Chemical Engineering and Environmental Technology Department, EII, University of Valladolid, Paseo del Cauce, 59, 47011 Valladolid, Spain*

*corresponding author: belbla@cartif.es

oral presentation

Extrusion cooking is used worldwide for the production of expanded snack food. Incorporation of fibre usually limits expansion or reduces crispness. Nowadays, agri food by-products are considered as alternative, natural sources of fibre.

Ready-to-eat extruded snacks were prepared from cereal and pulse flour blends, with the incorporation of white grape pomace (WGP) and seedless white grape pomace (SWGP), using a twin screw extruder with a combination of parameters, including constant feeding rate of 25 kg/h, process temperature range of 105 - 160 °C, screw speeds 500 - 1000 rpm, and a water rate of 1.2 - 1.8 kg/h. Chemical composition of WGP (skins, stalk and seeds) was investigated and feasibility of developing WGP ready-to-eat expanded snacks in terms of physico-chemical and sensory acceptability was evaluated.

Formulations of snacks were done in order which can support fibre-related health claims. The effect of the incorporation of milled WGP and SWGP at 15% with two different flour formulations (F1: including corn, wheat and oat flour and F2: including rice, wheat and oat flour) on the physicochemical properties like expansion ratio, colour and on consumer sensory acceptability was evaluated.

It was found that the addition of WGP and SWGP significantly affected the expansion index and sensory acceptability.

Keywords: extrusion, grape pomace, fiber, sensory acceptability, quality

SOCIAL MEDIA IN BAKERY PRODUCT E-PROMOTION

Sanja Dugandžić^{1*}, Stojanka Dukić², Branimir Dukić¹

¹University of Josip Juraj Strossmayer in Osijek, Faculty of Economics in Osijek, Gajev trg 7, Osijek, Croatia

²duxMission d.o.o. Osijek, Dalmatinska 21, Osijek, Croatia

*corresponding author: dsanja@efos.hr

oral presentation

Marketing could be seen as a dominant business philosophy today, oriented on satisfying the needs of consumers. A marketing driven business process starts with market research, and a marketing program is defined after that, based on the acquired information about consumer needs, with a task to answer questions about which product to produce, how to determine the price, how to deliver the product to the consumer, and how to inform the consumer about the product. The answer to these questions is provided by the so-called marketing mix, which in the standardized form consists of the product, the price, the place and the promotion. From the time it originated, in the middle of the last century, marketing probably used all available media to inform the consumer, in the part where it interacts with the consumer, especially in the promotion part, so lately, after the Internet was invented, especially the World Wide Web environment, marketing used this media space more and more intensively for promotion purposes, so one can talk about the existence of electronic promotion, i.e. e-Promotion. However, whether it is physical or electronic media, the practical experiences show that the word-of-mouth marketing, i. e. personal contact and sharing of personal experiences from one consumer to another, is the most efficient form of product promotion. Because of this, social networks have an increasingly important role to play in sharing the personal experiences of consumers in a virtual environment, within the e-Promotion environment. However, social networks also offer significantly greater opportunities than personal contact, as they enable the multilateral (network) exchange of information. For this reason, it is important for the bakery industry to investigate and define the model of social networking for the purpose of electronic promotion of bakery products.

Keywords: internet, e-Marketing, e-Promotion, social media, bakery production promotion

DETERMINATION OF HIGH MALTING QUALITY OF WINTER BARLEY GENOTYPES FROM TRAKYA REGION IN TURKEY CULTIVATED UNDER RAINFED CONDITIONS

**Safure Güler^{1*}, Recai Ercan², Taner Akar³, Ismail Sayım⁴, Turhan Kahraman⁵,
Turgay Şanal¹, Sinan Aydoğan⁴, Namuk Ergun⁴**

¹*Department of Quality Assessment and Food, Field Crops Central Research Institute, Araştırma ve Teknoloji Geliştirme Kampüsü İstanbul Yolu 5. Km 06171 Yenimahalle, Ankara, Turkey*

²*Department of Food Engineering, Ankara University, Bahçelievler Mahallesi, 06110 Dışkapı, Gölbaşı, Ankara, Turkey*

³*Faculty of Agriculture, Akdeniz University, Pınarbaşı Mahallesi, 07070 Konyaaltı, Antalya, Turkey*

⁴*Department of Breeding and Genetics, Field Crops Central Research Institute, Araştırma ve Teknoloji Geliştirme Kampüsü İstanbul Yolu 5. Km 06171 Yenimahalle, Ankara, Turkey*

⁵*Trakya Agricultural Research Institute, İstasyon Mahallesi, E-5 Karayolu, 22100 Edirne Merkez, Edirne, Turkey*

*corresponding author: safure.guler@tarim.gov.tr

oral presentation

The aim of this study was to determine high malting quality winter barley genotypes cultivated under rainfed condition of Trakya Region in Turkey. The experiments were conducted at three different locations of the region in two successive years by using 6 cultivars (Aydanhanım, Zeynelaga, Anadolu-98, Cumra, Catalhöyük and Sladoran), and 30 candidate lines selected from different breeding programs under triple lattice design. All genotypes were routinely tested for malting and mashing parameters after grain harvest during two successive seasons over six locations. Candidate Lines 26, 11, 25, and cultivar Burgaz, Bolayır, Sladoran showed a higher level of malting performance compared to all other candidate lines and cultivars and ranked as the first group malting barley genotype in terms of both high malting extract and grain yield. In addition to this, candidate lines 10, 6, 4, 14, and 18 were ranked as second group malting barley genotypes in terms of both high malting extract and grain yield. Moreover, to insure the high malting quality of barley, malting parameters to be monitored in the breeding program under rainfed conditions and suitable locations in Trakya region were determined.

Keywords: malting barley improvement, genotypes, malt extract, locations

IMPROVING PEPTIDE SUBSTRATE FOR THE DETECTION OF SUNN PEST DAMAGE

Begum Zeynep Hancerliogullari, Fahriye Ceyda Dudak*

Hacettepe University, Department of Food Engineering, 06800, Beytepe, Ankara,
Turkey

*corresponding author: ceyda@hacettepe.edu.tr

oral presentation

Sunn Pest (*Eurygaster* spp.) is one of the most common wheat bugs in Turkey, Central Asia and the Middle East, causing substantial losses of crop yield and decrease in technological properties of wheat. During the feeding of Sunn Pest from wheat grain, bug salivates digestive secretions into the grain. Proteolytic enzymes present in secretions cause degradation of the gluten proteins, which result in a decrease of a bread making quality. Therefore, the detection of bug damage in wheat flour samples is of critical importance. The methods widely used in the detection of bug damage have various disadvantages, like long incubation periods and requirement for a specialist. Rapid, easy and in-situ detection of bug damage in wheats are of vital importance. This study is aimed at developing a peptide substrate for sunn pest proteases derived from repeated amino acid sequences of high molecular weight glutenin subunits. For this purpose, sunn pest protease was extracted from flour samples and extraction conditions were optimised for the highest protease activity. Furthermore, the interactions between three different peptides and protease were investigated. Optimum conditions for peptide-Sunn pest protease interaction were determined. As a result of the study, a novel 15-amino acid long peptide sequence was determined as the potential substrate for Sunn pest proteases. The developed peptidic substrate can be used for rapid and easy detection of sunn pest damage in wheat flour samples.

Keywords: Sunn Pest, wheat, protease, peptide substrate

IFA - ISEKI FOOD ASSOCIATION

Nada Knežević*

Podravka d.d., Ante Starčevića 32, Koprivnica, Croatia

*corresponding author: nada.knezevic@podravka.hr

oral presentation

IFA (ISEKI Food Association, <https://www.iseki-food.net/>) is an independent European non-profit organisation, established in 2005. Its members are university institutions, research institutes, companies and associations related to food from 59 countries and 5 continents. This network has existed for more than 20 years and has, among its members, experts available in almost all food-related fields to carry out trainings in different languages, too.

IFA is developing and carrying out activities connected to food, such as: working towards the quality assurance of food studies, tuning and accrediting curricula and certifying training activities on an international level, developing teaching materials and teaching methods, promoting synergies between research, education/teaching, industry and authorities, developing a virtual community of experts in the field of food with communication to the general public, establishing a framework of agreements among partners, fostering the mobility of students and staff, stimulating the development of further related projects, cooperating in the implementation of quality criteria in the food chain. IFA organizes international conferences, tailored workshops, webinars and edits an open e-journal.

In this paper all of the mentioned activities are presented in detail, with a common goal - to assure the best possible competences for all employed in the food sector, and thus contribute to providing the consumer with safe and good food.

Keywords: IFA, ISEKI, food association, food organisation, training

A NOVEL BREAD IMPROVER FOR THE PROLONGATION OF SHELF LIFE OF WHITE WHEAT FLOUR BREAD

Amanda Rajakaruna¹, Chathudina Liyanage^{1*}, Suren Perera²

¹Department of Food Science & Technology, Faculty of Applied Sciences,
Sabaragamuwa University of Sri Lanka, Belihuloya 70140, Sri Lanka

²AB Mauri Lanka (Private) Limited, Templers Road, Mount Lavinia, Sri Lanka

*corresponding author: janitha@appsc.sab.ac.lk

oral presentation

The aim of this study was to develop a novel bread improver for the prolongation of shelf life by the retardation of white wheat bread staling.

The new bread improver formulation consists of soy flour, corn flour, calcium propionate, ascorbic acid, monoglycerides of fatty acids, Diacetyl Tartaric Acid Ester of Monoglycerides (DATEM), xanthan gum, α -amylase, lipase, amyloglucosidase and xylanase. White bread samples with the new improver were produced using a rapid dough method. The effectiveness of the bread improver was determined by moisture content analysis, sensory texture evaluation, texture Profile Analysis (TPA) (according to the AACC International method 74-09.01; Brookfield CT3-1500), and thermal analysis (Differential Scanning Calorimetry-DSC; TA instruments Q200). Yeast and mould counts were determined during storage.

The TPA results (at 40% compression) revealed a significant difference ($p < 0.05$) between the controls (with a commercial improver-MF Doh) and the test samples (with the new improver). Moisture retention and all of the sensory texture attributes (softness, springiness, crumbliness, cohesiveness, and dryness) of the test samples were significantly different ($p < 0.05$) in relation to the controls. The DSC results for the test samples revealed low amylopectin retrogradation enthalpies, indicating a reduction in staling. The test samples can be attributed with an extended shelf life (12 days) compared to the controls (8 days), on the basis of the microbial counts.

It can be concluded that the synergistic effect of the enzymes and the effect of other anti-staling agents in the new improver formulation have a direct impact on reducing the degree of starch retrogradation, as indicated by the reduced hardness of white bread.

Keywords: bread, staling, improver, starch retrogradation, differential scanning calorimetry

**TIME-COURSE EXPERIMENT OF FUSARIUM INFESTATION OF WHEAT GENOTYPES
WITH THE EMPHASIS ON THE PHYSIOLOGICAL RESPONSE**

**Tihana Marček^{1*}, Marija Viljevac Vuletić², Ivan Bakula¹, Sara Alivojvodić¹,
Valentina Španić²**

¹*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

²*Agricultural Institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia*

*corresponding author: tihana.marcek@ptfos.hr

oral presentation

Wheat (*Triticum aestivum* L.) is one of the most significant food cereal in the world. Under natural conditions, biotic and abiotic stress factors can seriously endanger the plant growth and development. Fusarium head blight (FHB), mainly caused by *F. graminearum* and *F. culmorum*, is a disease that has negative effects on economy, namely on the yield and the quality of the grain. In this research, the activities of guaiacol peroxidase (POD), catalase (CAT), ascorbate peroxidase (APX) and polyphenol oxidase (PPO), as well as H₂O₂ concentration and malonaldehyde (MDA) content, were determined in three wheat genotypes of various resistance to FHB ("Super Žitarka" - sensitive; "Lucija" - moderately resistant, and "Apache" - resistant) after the 2nd and the 4th day of infestation. Infected plants of "Lucija" showed higher POD activity compared to control after the 4th day, and increased POD activity compared to the 2nd day of infection. On the 2nd day, "Apache" responded to pathogen by the enhanced APX activity, and higher MDA level, compared to the 4th day of treatment when it started to decrease. Moreover, the treated plants of the same genotype showed the increased MDA level on the 2nd day, unlike the untreated plants. Contrarily, H₂O₂ concentration in "Apache" showed the tendency to increase with the time of Fusarium-exposure. In comparison to the 2nd day of treatment, PPO activity decreased in "Super Žitarka" on the 4th day. In all genotypes at both sampling points, CAT activity did not change significantly under the pathogen attack. Overproduction of H₂O₂ accompanied with the increased APX activity 2 days after infection may lead to the conclusion that FHB tolerance of "Apache" is ensured by the earlier activation of the defence mechanisms.

Keywords: wheat, *Fusarium* spp., MDA, H₂O₂, antioxidative enzymes

This work has been supported in part by Croatian Science Foundation (HRZZ-UIP-2014-9188).

TRANS FATTY ACIDS IN CEREAL-BASED FOOD - HAH RESEARCH 2015-2016

Darja Sokolić^{1*}, Andrea Gross-Bošković¹, Milica Gačić²

¹Croatian Food Agency, I. Gundulića 36b, 31000 Osijek, Croatia

²Food Control Center, Jagićeva 31, 10000 Zagreb, Croatia

*corresponding author: dsokolic@hah.hr

oral presentation

Trans fatty acids (TFA) occur in partly hydrogenated vegetable oils and can also occur in milk and meat of ruminant, where they are formed under the influence of bacteria in their stomach. They have no vital functions in the body. TFA have a harmful influence on health and are closely associated with the development of cardiovascular diseases if consumed in an amount of 5 g/day⁻¹. The European Commission is still looking for a solution to regulate their content in food. The World Health Organisation recommends a maximum of 1% of daily energy intake by TFA, which is a maximum of 2 g/day⁻¹. In the period of 2015-2016, 114 samples, collected from the Croatian market, were analysed in 10 food categories. Results are expressed by the content of TFA per 100 g of fat/oil, and content of TFA per 100 g of product. Only 8 samples, of which 4 were imported, contained more than 2 g per 100 g TFA fats/oil. The highest content of TFA was found in confectionery products with a fatty filling. Cereal-based food, in comparison with all other analysed food, expressed in average TFA per 100 g of fat/oil, contained 0.87%, while other food contained 0.57%. Results expressed in content of TFA per 100 g of product showed a slightly higher content of TFA in other food (0.18%) than in cereal-based food (0.17%).

In conclusion, situation regarding the content of TFA in the food market of Croatia is satisfying.

Keywords: trans fatty acid, cereal based food, Croatia

**ANALYTICAL FEATURES OF THE DIFFERENT FLOUR COMPOSITES BASED ON THE
WHEAT AND BARLEY MIXTURES**

Ivan Švec*, Marie Hrušková, Ivana Kadlčíková

*Department of Carbohydrates and Cereals, University of Chemistry and
Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic*

*corresponding author: ivan.svec@vscht.cz

oral presentation

To elevate dietary fibre content in wheat bread, additions of barley flour were tested (30%) alone, and in combination with 5% or 10% of chestnut and acorn flour. Acorn flour elevated dietary fibre content more effectively than the chestnut flour did (TDF up to 7.80%). Non-gluten nature of proteins in non-traditional raw materials also affected farinograph, extensigraph and amylograph features, used for predicting bakery procedures. Technological parameters (Falling Number, Zeleny sedimentation value) decreased to nearly 30% compared to the wheat flour. Water absorption increased about 2% in total, especially owing to the chestnut presence in the composite flour. All three alternative crops decelerated dough development, but the dough softening degree depended on their combination. Viscoelastic behaviour was worsened (mainly parameter energy), depending on the type and the addition of the non-traditional products in the tested mixtures. Changes of suspension structure were reflected in maximum viscosity, which became lower during the amylograph test. A significant worsening of the buns specific volume and vaulting reflected a partial dilution of the gluten skeleton of the dough. The highest addition of the chestnut flour in the recipe caused a decrease to more than one half compared to the wheat product. By the principal component analysis, some rheological parameters, together with specific bread volume, were identified as principal for sample distinguishing. In terms of wheat flour and bread quality, barley flour addition in the mixtures had a prevailing effect for the tested tri-composites.

Keywords: wheat-barley composite flour, chestnut and acorn flour, bread, PCA

THE CHANGES OF THE COOKED PASTA TEXTURE DURING STORAGE

Beata Biernacka¹, Dariusz Dziki^{1*}, Renata Różyło², Monika Siastała²

¹Department of Thermal Technology, University of Life Sciences, Doświadczalna Street 44, 20280 Lublin, Poland

²Department of Equipment Operation and Maintenance in the Food Industry, University of Life Sciences, Doświadczalna 44, 20280 Lublin, Poland

*corresponding author: dariusz.dziki@up.lublin.pl

poster presentation

The aim of this research was to study the texture changes of cooked pasta after first hour of storage. For testing purposes, 15 samples of commercial spaghetti, produced with semolina and common wheat flour were used. The cooking properties of pasta, such as optimal cooking time, weight increase index and cooking loss were determined. Sensory evaluation of pasta was also performed. These parameters and sensory evaluation were determined after optimum cooking time for each pasta sample. After cooking, the samples of spaghetti were stored in polyethylene bags for 5, 10, 20, 30, 40 50 and 60 minutes. Single samples of cooked spaghetti were cut, and the following texture parameters were determined: cutting force and cutting work, namely pasta hardness and firmness, respectively. All mechanical tests of pasta were performed using a universal strength testing machine Zwick ZN20/TN2S.

The weight increase index, depending on the pasta sample ranged from 2.7 to 3.4, whereas the cooking loss changed from 5.3% to 7.2%. The cutting force and cutting work of cooked pasta during storage decreased in average from 1.0 N to 0.44 N, and from 0.84 mJ 0.43 mJ, respectively. Statistical analysis showed significant correlations between texture parameters of the pasta and storage time. The hardness and firmness were stabilized after 50 minutes of storage of cooked spaghetti. Pasta, which was *al dente* after cooking, decreased hardness and firmness during storage about twice, as a results of the water migration. The sensory evaluation also confirmed the negative influence of storage of cooked pasta on the texture.

Keywords: pasta, mechanical properties, cooking, storage time, quality

VOLATILES OF A TRADITIONAL BAKERY PRODUCT "MEDENJAK"

Emilija Friganović^{1*}, Mladenka Šarolić¹, Žana Delić¹, Tomislav Svalina¹, Ljiljana Nanjara¹, Dajana Gašo-Sokač², Zvonimir Marijanović¹

¹Marko Marulić Polytechnic of Knin, P. Krešimira IV 30, HR-22300 Knin, Croatia

²Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia

*corresponding author: efriganovic@veleknin.hr

poster presentation

"Medenjak" is a traditional, very popular bakery product in Croatia, made with honey, similar to globally known gingerbread, usually prepared for festive occasions in homes, and also produced in artisanal and industry bakeries. In the present study volatile compounds of traditional "medenjak" were studied using headspace solid phase microextraction (HS-SPME) with a PDMS/DVB fibre coat followed with gas chromatography mass-spectrometry (GC-MS). The main ingredients of the tested traditional "medenjak" were wheat flour, honey, animal fat, water, ground spices (cinnamon, vanilla, cloves, nutmeg and cardamom), and baking powder. A total of 21 compounds were identified. The major compounds were cinnamaldehyde (31.8%), eugenol (18.1%), *trans*-anethole (12.7%), *trans*-caryophyllene (7.1%), camphene (5.5%) and benzaldehyde (4.8%). Other identified compounds were 4-terpineol (2.9%), limonene (2.1%), *m*-cymene (1.5%), γ -terpinene (1.3%) and myristicine (1.1%). The identified volatiles, specific for each spice and thus expected, regarding quantity, were in accordance with the amount of spices in the product recipe.

Keywords: "medenjak", honey, volatiles, HS-SPME/GC-MS

The present research has been supported by the Croatian Science Foundation under the project HRZZ-IP-11-2013-8547.

WHEAT PROTEINS AS *FUSARIUM* TOLERANCE INDICATORS

Daniela Horvat*, Valentina Španić, Marijana Tucak, Georg Drezner, Zvonimir Zdunić

Agricultural Institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia

*corresponding author: daniela.horvat@poljinoh.hr

poster presentation

Six wheat genotypes (*Triticum aestivum* L.) resistance (R) and susceptibility (S) to *Fusarium* head blight were studied at the Agricultural Institute Osijek during 2015/2016 vegetation season under control and artificial *Fusarium* infection. The percentage of diseased heads as general *Fusarium* resistance was calculated after assessing a random sample of 30 heads during 26 days after inoculation. The amount of gliadins (GLI), glutenins (GLU) and their components was measured in whole grains by RP-HPLC. GLI and GLU have a very important role in defining dough viscoelastic properties. Golubica, as S cultivar, had the highest percentage of diseased heads (55%) in contrast to Vulkan as R cultivar (8%). S cultivar Golubica had the highest increase of GLI (13.31%), and the highest decrease of GLU (20.60%), and high-molecular-weight glutenin subunits (HWW) (27.4%) in contrast to R cultivar Kraljica whose GLI increase was 5.74%, GLU decrease 16.43%, and HMW decrease 11.28%. S cultivar Sana showed significantly smaller changes in GLI (9.54%), GLU (12.9%) and HMW (7.53%) compared with other S cultivars, while R cultivar Vulkan is the only one with GLI decreasing (15.74%) and GLU and HMW increasing (11.25 and 11.66%, respectively) under artificial infection. In conclusion, a higher level of *Fusarium* infection had a substantial negative effect on GLI/GLU balance in whole wheat grains.

Keywords: wheat, cultivars, *Fusarium*, gluten proteins, HPLC

This study was financially supported by the Croatian Science Foundation (project UIP-2014-09-9188) and Agricultural Institute Osijek.

COMPARISON OF FIBER INFLUENCE FROM THE DIFFERENT LINSEED SOURCES ON WHEAT FLOUR AND CERAL PRODUCT CHARACTERISTICS

Marie Hrušková*, Ivan Švec, Lucie Mrvíková

*Department of Carbohydrates and Cereals, University of Chemistry and
Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic*

*corresponding author: marie.hruskova@vscht.cz

poster presentation

Wheat flour was fortified by 2.5, 5.0 and 10 wt per cent of the linseed fibre, gained from seeds of golden flax varieties Amon and Raciol (granulation 500 - 700 µm, prepared from 2015 flax harvest). Technological quality of the tested flour composites was described by the Falling Number and Zeleny sedimentation test. Both screening methods sustained a little impact on the amylase activity and protein quality, respectively. Rheological tests included the farinograph, the extensigraph and the Rapid Visco Analyser (RVA) proofs. Internal laboratory procedures were used for the bread and cookies preparation. The additions of brown and yellow flax fibre significantly increased farinograph water absorption and shortened dough stability, somewhat stronger by the addition of the brown linseed fibre. Extensigraph features depended on the dough proof resting time. Linseed fibre supported dough extensibility, and energy, represented as the area under the curve, significantly decreased about 7 - 18%. In general, fibre is characterised as hydrophilic material, and pasting profiles of flour composites confirmed this experience. During dough leavening, dough resistance and optimal leavening time of the wheat-linseed fibre dough were shorter than those of the control sample. Regardless of the described modifications in the dough machinability, specific volumes of the bread buns were similar through the whole sample set. A weak worsening of the bread buns vaulting reflected a partial dilution of the gluten skeleton of the dough. Cut-off biscuits were characterised by the gradually lowering spread ratio, corresponding to the elevated dough elasticity. All cereal products were found to have acceptable sensory profiles. The PCA method verified a partial lowering of the protein quality and pointed out the tested sample differentiation according to the linseed addition level.

Keywords: brown and golden linseed fibre, dough rheology, bread, biscuits, PCA

SENSORY ANALYSIS OF BISCUITS FROM EINKORN FLOUR, BARLEY FLOUR, FLAKING EINKORN AND WHITE FLOUR IN DIFFERENT PROPORTIONS AND DIFFERENT SUGARS

Gjore Nakov¹, Daliborka Koceva Komlenić^{2*}, Nastia Ivanova¹, Tzonka Godjevargova³, Stanka Damyanova¹, Ana Šušak²

¹*Department of Biotechnology and Food Technology, University of Ruse "Angel Kanchev", Branch Razgrad, Aprilsko vastanie Blvd. 47, Razgrad 7200, Bulgaria*

²*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia*

³*Department of Biotechnology, University "Prof. Dr. Assen Zlatarov", Prof. Yakimov Street 1, Burgas 8010, Bulgaria*

*corresponding author: dkoceva@ptfos.hr

poster presentation

Sensory assessment has an irreplaceable role when issuing a new product. Whether the product is acceptable for consumption or not is determined with the help of the sensory senses. Biscuits are products which are consumed by different age groups. When producing biscuits, wheat flour is usually used as one of the main raw materials for their production and sucrose is used as sweetener. The aim of this study is to determine the sensory characteristics of new kinds of biscuits produced by using other types of flour (barley flour, einkorn flour, and flaking einkorn) and other sweeteners (glucose syrup).

The sensory assessment was made by implementing the method of scoring. With the help of weighted scores, biscuits are categorized in the certain category of quality. Forty-eight different types of wheat flour biscuits, barley flour, einkorn flour and flaking einkorn in different proportions (30:70, 50:50, 70:30 and 100) were analyzed. Sucrose and glucose syrup were used as sweeteners. The sensory analysis was made by 15 people at the University of Ruse Angle Kanchev, branch Razgrad, Bulgaria. The achieved results were statistically elaborated. The completed sensory analysis showed that major numbers of produced biscuits belong to the category with very good quality (3.5 - 4.5). The statistic elaboration of data showed that different types of flour and different types of sugar had an influence on the sensory characteristics of produced biscuits ($p < 0.05$).

On the basis on the gained results, it can be concluded that using other types of flour (barley flour, einkorn flour, and flaking einkorn) and other sweeteners (glucose syrup) can produce new types of biscuits, which will have good sensory characteristics and satisfying sensory quality.

Keywords: biscuits, barely flour, einkorn flour, flaking einkorn, sensory analysis

TEXTURE OF HYDROCOLLOID/SUGAR SYSTEMS

Anita Pichler, Mirela Kopjar*

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: mkopjar@ptfos.hr

poster presentation

Texture is one of the quality properties dependent on matrix composition and the interactions between food components. Hydrocolloids are often used to modify the texture of fruit products, or the desired texture can be achieved through interactions between hydrocolloids and sugars. In this study, the influence of sugars (sucrose or trehalose) and their amount (30, 40, or 50%) on xanthan, guar gum, starch/xanthan, and starch/guar gum systems was evaluated. The evaluated textural properties were firmness, consistency, cohesiveness, and viscosity index. There was no difference in investigated parameters between xanthan and starch/xanthan systems when 30% of sucrose was added. With the addition of 40% of sucrose, firmness and cohesiveness were the same in xanthan and starch/xanthan systems, while the other two parameters were higher in starch/xanthan model systems. The starch/xanthan system had higher values than the xanthan systems for all the investigated parameters when 50% of sucrose was added. Trehalose addition didn't cause any significant changes in the investigated parameters between xanthan and starch/xanthan systems. The behaviour of guar gum systems had a different tendency. All the investigated parameters were higher in guar gum/starch systems, regardless of the sugar type and the amount. In xanthan systems and starch/xanthan systems with the addition of trehalose, lower values of all the parameters were obtained when comparing to the samples in which sucrose was added, while in guar gum and starch/guar gum systems the reversed effect of the sugars was observed.

Keywords: starch, xanthan, guar gum, sugars, texture

BAKING AND STEAMING AS PRETREATMENT FOR THE PRODUCTION OF HIGH VALUE SWEET POTATO FLOUR: INFLUENCE ON PHYSICOCHEMICAL PROPERTIES

Ante Lončarić*, Vlasta Piližota

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: ante.loncaric@ptfos.hr

poster presentation

The sweet potato [*Ipomoea batatas* (L.) Lam.] is one of the most widely consumed tubers in many cuisines. The estimated production of sweet potato (SP) in Croatia in 2016 was 500 t, of which 350 t were first class products, which are placed on the market in fresh state. The other 150 t can be used as good raw material for processing SP into stable forms, such as chips, flour, or starch. Flour produced from SP has the potential for making a variety of food products, such as baked goods (bread, cakes, cookies, biscuits), doughnuts, breakfast foods (instant porridge, crisp, flake-type products), noodles or pasta-type products, sauces (soy sauce, ketchup), and brewing adjuncts. In this study, we investigated the impact of pretreatment (baking and steaming) on the physicochemical properties of flours produced from two varieties (orange and purple) by freeze drying. The pretreatments caused a decrease in starch, sucrose, glucose, and fructose amounts, but caused an increase in the amount of maltose. The decrease in starch content and the increase in the amount of maltose was also evident in the increment of soluble solids. The results also showed that the pretreatments, baking and steaming, significantly decrease β -carotene content (105.84; 127.72 $\mu\text{g}/\text{mL}$, respectively) in orange, and anthocyanin (0.69; 0.57 $\mu\text{g}/\text{mL}$, respectively) content in purple SP, compared to untreated SP, 284.65 and 0.89 $\mu\text{g}/\text{mL}$, respectively. Baking and steaming decreased the colour intensity of SP. However, flour produced from pretreated SP had a higher content of soluble solids, β -carotene and anthocyanins compared to the flour produced from untreated SP. The highest quality flour was produced from baked purple SP.

Keywords: sweet potato flour, β -carotene, anthocyanins, freeze drying

THE INFLUENCE OF THE CHARACTERISTICS OF COMMISSIONED VARIETAL BARLEY GROUPS ON THE DEGREE OF β -GLUCAN DEGRADATION DURING MALTING

Kristina Mastanjević^{1*}, Marko Magdić¹, Ivana Buljeta¹, Gordana Šimić², Daniela Horvat², Alojzije Lalić², Vinko Krstanović¹

¹*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Franje Kuhača 20, 31000 Osijek, Croatia*

²*Agricultural Institute Osijek, Južno predgrađe 17, 31103 Osijek, Croatia*

*corresponding author: khabschi@ptfos.hr

poster presentation

This paper investigated the influence of different commissioned varietal barley groups (malting, food and feed) on the degree of β -glucan degradation during the process of malting. The samples, obtained from the Agricultural Institute Osijek, included: winter and spring double-row varieties, six-row winter varieties, and naked barley varieties. Malting varieties Tiffany and Vanessa were used as control. β -glucan concentrations were determined in barley, finished malt and wort. The aim of this study was to establish the changes in β -glucan concentrations during malting through the reduction of the starting concentration of β -glucan in the grain's dry matter - before and after malting, and the mass fraction of soluble β -glucan in total β -glucans in malt (measured as the difference between total β -glucans in starting malt and in the obtained wort). In order to establish which varieties can deliver worts with the recommended β -glucans concentrations, the correlation between the starting β -glucans in barley and the final β -glucan concentration in wort was also determined. The obtained results emphasized that the tested varieties displayed a significant difference in β -glucan concentrations, which is in correlation with β -glucans concentrations in malts obtained from the chosen barley varieties. The lowest share of β -glucans was determined in malting varieties.

Keywords: barley, β -glucan, malting process

**SHELF-LIFE PREDICTION OF GLUTEN-FREE RICE-BUCKWHEAT COOKIES BY
PHYSICOCHEMICAL CHARACTERISTICS**

**Mladenka Pestorić^{1*}, Marijana Sakač¹, Lato Pezo², Dubravka Škrobot¹, Nataša
Nedeljković¹, Pavle Jovanov¹, Olivera Šimurina¹, Bojana Filipčev¹**

¹*University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1, 21000
Novi Sad, Serbia*

²*Institute of General and Physical Chemistry, University of Belgrade, Studentski trg
12/V, 11000 Beograd, Serbia*

*corresponding author: mladenka.pestoric@fins.uns.ac.rs

poster presentation

The aim of this study was to explore the effect of different storage conditions on the physicochemical stability assessment of gluten-free rice-buckwheat cookies. In order to explore the effects of storage time (0-6 months) at ambient (23 ± 1 °C) and elevated (40 ± 1 °C) temperature, and the packaging condition (packed and unpacked samples) on the level of the physicochemical characteristics (water activity (a_w), hydroxymethylfurfural content (HMF), firmness (F), and colour parameters), second order polynomial (SOP) models were developed. The physicochemical characteristics of cookies were influenced by temperature, while the colour properties were mostly influenced by the position of the sample surface. The firmness was affected upon by the synergistic effect of temperature and the packaging condition. The purpose of the developed SOP models was to investigate the effect of the storage conditions on the observed parameters, which showed a good fit to the experimental data ($r^2 > 0.8$). The obtained results showed that the developed empirical models provided an appropriate fit to the experimental data and predicted the physicochemical properties at a satisfactory level, and that they could be successfully applied to a cookie stability assessment.

Keywords: gluten-free cookies, physicochemical characteristics, mathematical modelling

VOJVODINA BREAD, PASTRY AND CAKE OFFER IN THE SPECIFIC TYPES OF RESTAURANTS, INNS AND FARMS

Đorđe Psodorov^{1*}, Bojana Kalenjuk¹, Maja Banjac¹, Jovanka Popov-Raljić¹, Dragan Tešanović¹, Milijanko Portić¹, Dragan Psodorov²

¹*Faculty of Science, Department of Geography, Tourism and Hotel Management, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia*

²*Colledge of Management and business communications, Mitropolita Stratimirovića 110, 21205 Sremski Karlovci, Serbia*

*corresponding author: djordje.psodorov@dgt.uns.ac.rs

poster presentation

Bakery and pastry products represent an important part of the total tourism and gastronomic offer of the country, region, city and the individual facilities. Due to a high quality offer, satisfied tourists have long and nice memories of the "flavour" of the countries they have visited. Moreover, they share experiences amongst their friends, wishing to repeat the visit sometimes. Vojvodina regional kitchen could be described by an authentic bakery-pastry products such as strudel, pumpkin pastry, pastry rolls with fat and other specialties which have been preserved by many generations.

Vojvodina is the one of the most interesting and hospitable places in Serbia, in regards to the agricultural diversity. Also, it is the multicultural area populated with many different nationalities. Each of them possess their own culture and tradition, contributing to the colorful picture of this place. This paper provides an analysis of the Vojvodina bread, pastry and cake offer in 10 specific restaurants, namely, fish restaurants and farm type objects. The main objective is to highlight the importance of Vojvodina bread, pastry and cake offer in inns and farms, throughout theoretical and practical analysis. This analysis presents a current offer of Vojvodina bread, pastry and cake, as well as the opportunity to improve the supply, quality and diversity of products.

Keywords: bread, pastry, cake, Vojvodina, restaurants

**VALIDATION AND SCREENING OF INDIAN WHEAT GERMPLASM FOR SEVERAL
QUALITY GENES SUITABLE FOR BISCUIT MAKING**

**Anjali Rai^{1,2*}, Anju Mahendru Singh², Deepak Ganjewala¹, Arvind Ahlawat²,
Poornima Sharma², Sumit Kumar Singh²**

¹*Department of Biotechnology, Amity Institute of Biotechnology, Amity University,
Noida, 201313, India*

²*Department of Genetics, Indian Agricultural Research Institute, New Delhi, 110012,
India*

*corresponding author: anjalirules22@gmail.com

poster presentation

Wheat is one of the first domesticated food crops and for the last about 8000 years it has been a basic staple food of the population across the world. In less developed countries like India, high-yielding varieties were developed by using modified equipment and an increased use of chemical fertilizers at the expense of poor quality wheat. In India, flour is used for making chapattis, bread, biscuits, and several other products. India's biscuits market is valued at 145 billion rupees (2.3 billion US dollars) last year and is expected to reach 279 billion rupees (4.4 billion US dollars) by 2019. The ideal flour for making most biscuits has a lower protein content and soft wheat grain, for which the dough is weak and extensible. This property is mainly governed by the gluten protein. Gluten is divided into two groups - high molecular weight subunits and low molecular weight subunits. Puroindoline genes (*PinA* and *PinB*) regulate the texture of the grain. *PinA* and *PinB* in their wild type allelic state lead to softness. In this study, thirty one Indian wheat varieties were screened for the high and low molecular weight glutenin subunits (HMW-GS, LMW-GS) and *PinA* genes, and several other quality and rheological tests were conducted. None of the varieties were found completely suitable for biscuit making. Therefore, screening the combination of HMW-GS, LMW-GS, and *PINA* gene in Indian genotypes will generally benefit breeding efforts for quality improvement.

Keywords: grain quality, high molecular-weight (HMW) subunits, low-molecular-weight (LMW) subunits, grain texture, biscuit making

THE EFFECT OF DIFFERENT COMMERCIAL SOURDOUGHS ON THE QUALITY OF GLUTEN FREE BREADS

Yaiza Benavent-Gil, Carol Yepez-Guerrero, Cristina Molina Rosell*

*Institute of Agrochemistry and Food Technology (IATA-CSIC), Catedrático Agustín
Escardino Benlloch 7, 46980 Paterna, Spain*

*corresponding author: crosell@iata.csic.es

poster presentation

The search for solutions to alleviate technological and nutritional defects in gluten free (GF) breads is a major research topic in the area of food technology. Up to now, the strategies used only contemplated the design of complex matrices by adding ingredients and additives, raising the cost of these products. Nevertheless, the strategy of exploiting the sourdough benefits has been scarcely explored. The possible influence of sourdough on bread quality might reduce the need for additives. In this study, the impact of different commercial sourdoughs on the structural and quality behaviour of rice wholemeal breads, as well as its impact on the shelf life of these breads, was investigated. Breads obtained did not show significant differences in relation to specific volume, moisture, and water activity. The addition of sourdough resulted in more acidic bread crumbs and the consequent increase in titratable acidity, resulting in harder crumbs and irregular crumb grain of the sourdough breads. On the other hand, there were no significant differences in the nutritional composition of the breads. Significant differences were observed on the staling behaviour of those breads, and their shelf life was dependent on the type of sourdough added. Overall, commercial sourdoughs changed the textural characteristics of the gluten free breads, without affecting the specific volume. In addition, sourdoughs extended the shelf life of the gluten free breads without adding preservatives.

Keywords: gluten free, sourdough, bread, quality, staling

**VOLATILE ALDEHYDES AND MALONDIALDEHYDE DETERMINATION IN SHELF-LIFE
PREDICTION OF GLUTEN-FREE COOKIES**

Marijana Sakač^{1*}, Pavle Jovanov¹, Nataša Nedeljković¹, Anamarija Mandić¹, Lato Pezo², Mladenka Pestorić¹

¹*University of Novi Sad, Institute of Food Technology, Bulevar cara Lazara 1,
Novi Sad, Serbia*

²*Institute of General and Physical Chemistry, University of Belgrade, Studentski trg
12/V, Belgrade, Serbia*

*corresponding author: marijana.sakac@fins.uns.ac.rs

poster presentation

Two analytical methods – the static headspace gas chromatographic method with flame ionisation detection (SHS-GC-FID) for volatile aldehydes (propanal (C3), pentanal (C5), hexanal (C6), heptanal (C7), and octanal (C8)) and the HPLC method for malondialdehyde (MDA) determination were applied in the shelf-life prediction of gluten-free cookies. Both unpacked and packed gluten-free cookies kept at room (23 ± 1 °C) and elevated (40 ± 1 °C) temperatures were tested. The obtained results indicated that the end-points of cookie shelf-life were the same when using investigated methods, e.g. months 3 and 5 for unpacked and packed cookies kept at elevated temperature, respectively, and months 11 and 14 for unpacked and packed cookies kept at ambient temperature, respectively. Two numerical approaches, namely second order polynomial (SOP) and artificial neural network (ANN) models were used in the cookie shelf-life prediction. The aldehydes and MDA content calculations could be predicted with an overall coefficient of determination of 0.722 using the ANN model, compared to 0.312 - 0.773 for SOP models. Sensitivity analysis was applied to discover the effects of observed parameters on the shelf-life prediction. According to the sensitivity analysis, it might be suggested that a relevant parameter for predicting the end-point of cookie shelf-life is MDA rather than C3, C5, C6, C7, and C8 content.

Keywords: shelf-life, cookies, aldehydes, malondialdehyde

RHEOLOGICAL AND BREAD MAKING PROPERTIES OF THE DIFFERENT MILLING FRACTIONS OF HULL-LESS BARLEY

Gordana Šimić*, Daniela Horvat, Krešimir Dvojković, Zvonimir Zdunić, Kristina Lutrov, Ivan Abičić, Alojzije Lalić

Agricultural Institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia

*corresponding author: gordana.simic@poljinoh.hr

poster presentation

Hull-less barley has been recognized as health food due to its content of fibre, particularly β -glucan, and other phytochemicals with potential benefits for human health. Because the outer hull is loosely attached to the grain and usually falls off during harvesting, hull-less barley requires less processing and can be directly used in meal preparation or it can be milled to flour. The scope of this work was to produce different flour fractions from hull-less barley in a commercial roller flour mill plant and to evaluate the rheological properties and bread making performance of these flours. Four flour types (T-550, T-850, T-1100 and wholegrain) were obtained in this study. Doughs and breads were made by using these barley flours in different ratios (20, 30, 40 and 50%) to wheat flour. Wheat flour from the cultivar Kraljica was used as a control. Dough rheological properties of the barley flours and the flour mixtures were evaluated using farinograph and extensograph tests. The baked breads were evaluated for loaf volume and h/d ratio. Hull-less barley flours had higher results for water absorption and the degree of softening than the control wheat flour. Dough extensograph characterization showed lower resistance to extension and elasticity, with the exception of the wholemeal barley flour. The results of baking test showed that the addition of barley flours in breads resulted in a decrease in the loaf volume and height. The reduction in volume and height increased with a higher barley ratio.

Keywords: barley, hull-less, flour, rheological properties, bread

INVESTIGATION OF LONG TERM QUALITY STABILITY IN TWO WINTER WHEAT VARIETIES (JUBILEJNAJA 50 AND GK ÖTHALOM) IN HUNGARY

Diána Ungai^{1*}, Béla Kovács¹, Zoltán Győri²

¹*University of Debrecen, Institute of Food Science, H-4032 Böszörményi str. 138., Debrecen, Hungary*

²*University of Debrecen Institute of Nutrition, H-4032, Egyetem tér 1. Debrecen, Hungary*

*corresponding author: ungai@agr.unideb.hu

poster presentation

The quality of winter wheat means different things; growers generally look at the yield, while millers look at the other quality indicators. And quality stability is a very important parameter for millers.

Therefore, during the qualifying stage, we need varieties to which we can later relate, taking both yields and quality parameters into account. At the same time, it is not insignificant how the quality in each crop year varies.

Our aim was to observe the quality stability of two genotypes of winter wheat (GK Öthalom and Jubilejnaja 50) at different locations, between 1978 and 2009 in Hungary. Nine cultivation years were observed as the basis for this study. For the comparison purposes, the parameters we examined were valorigraphic value, water absorption, gluten content, and falling number, the quality parameters that were available during each year. The following tools were used for the statistical analysis: statistical program SPSS 22.0, histogram, boxplot, and analysis of variance. The statistical analysis has shown a significant effect on the examined quality parameters, which is probably influenced by the weather conditions of the crop year.

Keywords: winter wheat, stability, quality parameters

CEREALS AND HEALTH

WHOLEGRAINS: BENEFITS, RISKS AND CHALLENGES

Daniela Čačić Kenjerić*

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: daniela.kenjeric@ptfos.hr

invited lecture

Wholegrains (WG) are recommended as a part of the daily diet in dietary guidances around the globe. This recommendation is based on the results of scientific studies, which confirmed positive association of their intake with the reduced risk of the widespread chronic noncommunicable diseases (obesity, cardiovascular disease, colon cancer, type 2 diabetes). Due to this fact, consumers are advised to shape their choices. Yet, as any other food, wholegrains are not beneficial for everyone. Digestion-improving compounds contained in whole grains may result in elevated exposure to poor digestion, toxic, allergic and other disruptive agents. As a result, among other problems, nutrient deficiency may develop. The most problematic is elevated WG intake in persons with iron deficiency anemia (IDA), but zinc, magnesium, calcium and vitamin B₁₂ absorption may be impaired as well due to their high phytates concentrations. At the same time, iron and zinc deficiency are major public health threats worldwide. Specific vulnerable population groups, in which benefits and risks should be individually estimated, are pregnant women and elderly persons. IDA is most common in pregnant women, and elderly persons are likely to suffer from IDA too, due to their impaired functionality of the digestive system caused by ageing. As consumers are encouraged to eat more WG products, fortification of these products with vitamins and minerals surfaces as one of the options to overcome risks and enhance benefits of WG products. Germination, which increases palatability and nutritional value of legumes and cereals at the same time reduces anti-nutrients, such as phytate and protease inhibitors, and therefore improves bioavailability of iron and zinc, being another option. The aim of this lecture is to present recent standpoints on benefits and risks associated with WG consumption, as well as available options to overcome the gap between them.

Keywords: wholegrains, benefits, risks, challenges

HEALTH BENEFITS OF WHOLE GRAIN PRODUCTS AND APPERTAINING MISLEADING CLAIMS

Hamit Köksel^{1*}, Buket Çetiner^{1,2}, Turgay Şanal²

¹Hacettepe University Food Engineering Department Ankara, Turkey

²Central Research Institute for Field Crops Ankara, Turkey

*corresponding author: koksel@hacettepe.edu.tr

invited lecture

Whole grain food products consist of the original composition of bran, germ, and endosperm of grain. Most of the healthy components are found in the germ and bran fractions which are reduced during the grain-refining process. Whole grain products are relatively rich in essential minerals, vitamins, dietary fiber and phytochemicals, such as phenolic acids, lignans and phytosterols that have been linked to disease prevention. Increased consumption of whole grains has been associated with the reduced risk of major chronic diseases including cardiovascular disease, type II diabetes, obesity and cancers.

Although the results of various clinical surveys indicated that consumption of whole grain products has various health benefits, there have recently been misleading claims related to consumption of grain products. It was claimed that consumption of wheat causes overweight, obesity, diabetes, increases risk of coronary heart disease, etc. There are also other false claims indicating that glycemic index of whole wheat bread is higher than sugar; gluten causes celiac disease; wheat is genetically modified; number of chromosomes in wheat has been changed; wheat causes addiction; modern wheat consists of more gliadin than wild wheat, and there was no gluten in wild wheat.

The main aim of this presentation is to review recent research on the health benefits of whole grain consumption and provide a scientific assessment of misleading claims related to whole grain products.

Keywords: whole grains, misleading claims, health benefits, wheat, gluten

**BIOFORTIFICATION WITH Zn AND Se AS A STRATEGY FOR PREVENTING
MICRONUTRIENT MALNUTRITION**

**Zdenko Lončarić^{1*}, Vladimir Ivezić¹, Brigita Popović¹, Andrijana Rebekić¹, Ivna
Štolfa Čamagajevac²**

¹*Faculty of Agriculture in Osijek, Vladimira Preloga 1, 31000 Osijek, Croatia*

²*Department of Biology, Josip Juraj Strossmayer University of Osijek, Cara Hadrijana
8/A, 31000 Osijek, Croatia*

*corresponding author: zdenko.loncaric@pfos.hr

invited lecture

Micronutrients are essential for human health and required in small amounts for physical and mental development, the functioning of the immune system, and various metabolic processes. Micronutrient malnutrition affects nearly a half of the global population and the interest for it has increased greatly over last decade because of the potentially huge public health implications, since it is not uniquely the concern of poor countries and can exist in populations even where the food supply is adequate in terms of meeting energy requirements. Micronutrient deficiencies have often been referred to as the "hidden hunger". Iron, vitamin A and iodine deficiencies are the three micronutrient deficiencies of greatest significance for public health in the developing world, but zinc deficiency has also been declared as a global nutrition problem, since selenium deficiencies occur regionally. The strategies for preventing micronutrient malnutrition are supplementation, fortification, including biofortification, and dietary diversification. Supplementation is a short-term measure of directly delivering nutrients by means like pills. Fortification strategies include delivering one or more micronutrients into commonly consumed foods, like fortification of salt with iodine. Biofortification is seen as the best long-term sustainable solution for preventing micronutrient malnutrition and often includes varieties screening as a first step, followed by breeding new genotypes with higher micronutrient density. It is more effective for preventing Zn than Se malnutrition. Agrofortification is a complex short-term solution, including the application of micronutrient-containing fertilizer, considering soil fertility, towards synergistic approaches using the genotype for the accumulation of additional micronutrients in the edible parts of the plants. This strategy is highly effective for Se and moderately effective for Zn. The goal of fortification, 40-60 mg/kg of Zn in cereal grains with decreased content of antinutrients like phytate, is quite achievable using the adequate genotype and fertilizers.

Keywords: zinc, selenium, fertilization, plant breeding, bioavailability

GLUTEN-FREE DIET AND ITS PITFALLS

Lea Pollak*

Croatian Institute of Public Health, Rockefeller str. 7, 10000 Zagreb, Croatia

*corresponding author: lea.pollak@hzjz.hr

invited lecture

Celiac disease is a digestive system disease. It is believed that gluten intolerance is the most common intolerance today. The cause of the disease is the persistent intolerance to the protein gluten, found in wheat, rye, barley and oats. Studies have shown that the sufferers are not sensitive to other cereals, such as rice and corn, as they do not contain toxic prolamine fractions.

Due to small bowel damage, malabsorption is common. The diagnosis of celiac disease is confirmed by serological and genetic tests, as well as small intestine biopsy.

The only therapy for celiac disease, as well as gluten intolerance, is a tough and lifelong gluten-free diet. By adhering to the strict diet, the symptoms can withdraw. Patients can consume permitted naturally gluten-free foodstuffs and special gluten-free foods. In addition to preferred supplementation, substitute cereals are increasingly used in the diet.

Since the labelling of gluten on products is not legally prescribed analyzing the amount of gluten in foods or food groups is of specific help to patients with celiac disease. The indication of the presence of gluten as an allergen is compulsory under Regulation No.1169/2011 on informing consumers about food, but a special form of labelling is prescribed by special regulations.

Primarily, the Commission Regulation (EC) No. 41/2009 on the composition and labelling of foods suitable for gluten-intolerant persons, and the Regulation 828/2014 on the requirements for the provision of information to consumers on the absence or reduced presence of gluten in food, include the labelling terms. The following terms are allowed: "Gluten free" and "Very low gluten content", as well as "Suitable for people intolerant to gluten" or "Suitable for people with celiac diseases", depending on the quantity of gluten in the product. It includes the terms of reference on the food for general consumption and forbidden uses.

Since gluten is increasingly present in various products, it is necessary to look at the problem of the presence of flour, the problem of hidden gluten, as well as contamination.

Adhering to a gluten-free diet does not only involve consumption, but also purchasing, storing, and preparing this particular type of food.

Keywords: gluten, gluten-free diet, labelling of gluten, pitfalls

BIOACTIVE COMPONENTS OF CEREALS AND THEIR POSSIBLE HEALTH BENEFITS - A REVIEW

Günter Unbehend^{1*}, Jürgen Zapp²

¹Max Rubner-Institute, Department of Safety and Quality of Cereals, Schützenberg
12, 32756 Detmold, Germany

²Hochschule Ostwestfalen-Lippe, University of Applied Sciences, Department 4 – Life
Science Technologies Liebigstraße 87, 32657 Lemgo, Germany

*corresponding author: guenter.unbehend@mri.bund.de

invited lecture

In western industrialized countries, as well as in their neighbouring countries, the food situation has been assessed very favourably. Therefore, there are additional requirements for food. The aim of these requirements has been to maintain health and to reduce risks of diseases among the population. Therefore, bioactive ingredients of food are of particular interest. Bioactive substances are substances in food without nutritional value; however, a health promoting effect has been attributed to them. These are mainly secondary plant metabolites, but also dietary fibres, as well as fermentation ingredients in food. While there have been manifold findings on dietary fibre, there is still a need for clarification regarding the occurrence and the actions of secondary plant metabolites and fermentational produced bioactive substances. The protective effects of more than 20 000 chemically different compounds of the secondary plant materials provide an especially wide field of activity for science and research.

Furthermore, the influences of technological processes, for example the fermentation of a sponge or the baking process of bakery goods, on the preservation and the formation of bioactive components in food have not been sufficiently investigated yet. In the past, both the improvement or the attainment of processibility of food components and the taste improvement or the extension of microbial stability of final products have been focused on. Nowadays, substances with additional health promoting effects for humans and animals should be generated by biotechnological processes.

The presentation provides an insight into the current state of knowledge about bioactive ingredients of selected foods, as well as on the evaluation of health claims based on European food law. Can bioactive ingredients of cereal-based foods fulfil the expectations we associate with it?

Keywords: bioactive components, cereal products, health claims, additional health promoting effect

MILLET CAKE IN PRESCHOOL NUTRITION

Marija Rapanić*, Petrana Pupić

*High Professional School "Braća Radić", Put poljoprivrednika bb, 21217 Kaštel
Štafilić - Nehaj, Croatia*

*corresponding author: rapanic.marija@gmail.com

oral presentation

The objective of this study was to introduce underutilized grains to preschool meals in order to promote healthy dietary habits. Proper diet in children is essential for optimal growth and development. Otherwise, an improper one leads to chronic diseases from early age into the adulthood. The frequency and consumption of grain-based baked foods among preschoolers were determined by surveying children and their parents. As expected, wheat flour-based baked goods were the most prevalent. To reverse this behaviour and encourage healthy eating habits, a new tasty and healthy baked product has been developed. This product is specifically aimed at being a part of a healthy breakfast. Instead of wheat flour, it contains millet as the main ingredient. In addition to millet, chia seeds were added to replace jelly icing, apples were added as a source of fibre, dried blueberries as a rich source of antioxidants, and rice syrup as sugar replacement, as well as hazelnuts and extra virgin olive oil as healthy sources of fat. The product formula was developed in accordance with Croatian legislation, where it is classified as fine baked goods or cake. Nutritional and energy values were calculated by the software tool "Program Prehrane 5.0".

Keywords: grains, millet, preschool, nutrition

**QUALITY ASSURANCE OF BREAD AND BAKERY PASTRIES IN PUBLIC INSTITUTIONS
ACCORDING TO THE LAW ON PUBLIC PROCUREMENT**

Ana Repše^{1*}, Aleš Krulec²

¹*Vrtec Pod Gradom, Praprotnikova 2, 1000 Ljubljana, Slovenia*

²*Institut of Public and Environmental Health, Zaloška cesta 155, 1000 Ljubljana,
Slovenia*

*corresponding author: ana.repse@guest.arnes.si

oral presentation

Public institutions, such as kindergartens, are committed to ordering food according to the Slovenian Law on public procurement (ZJN-3), which is compliant with EU legislation. There are many bread manufacturers in the market, therefore contracting authority have the challenging task to provide a diverse and high-quality bread and bakery pastries through the process of public procurement. Each buyer has the option of ordering food through the so-called "short chain", which allows the ordering of locally produced cereals, bread from the organic and integrated production. The Ministry of Health of the Republic of Slovenia issued a "Guide to Quality Standards of Food in Public Ordering for Educational Institutions" which supports the ordering process. In addition to quality requirements, the buyer divides the tender documentation into several groups and subgroups (e.g. Bread, Bakery pastries and Bread of organic production). The bakery industry is aware that in kindergartens a high-quality bread and bakery pastries are required, therefore they already offer products with reduced salt, sugars, fats, products without trans-fatty acids and gluten. Taking into account the appropriate purchasing specifications and good knowledge of legislation, with respect to public procurement law-related orders, children in kindergartens can be provided with a high-quality bread and bakery pastries.

Keywords: high quality bread and bakery pastries, public institutions, public procurement, quality assurance, quality schemes

ANTIDIABETIC ACTIVITY OF WHOLEMEAL WHEAT BREAD ENRICHED WITH GREEN COFFEE BEANS – IN VITRO STUDY

Urszula Gawlik-Dziki^{1*}, Dariusz Dziki², Urszula Złotek¹, Anna Jakubczyk¹

¹Department of Biochemistry and Food Chemistry, University of Life Sciences, Skromna Street 8, 20704 Lublin, Poland

²Department of Thermal Technology, University of Life Sciences, Doświadczalna Street 44, 20280 Lublin, Poland

*corresponding author: urszula.gawlik@up.lublin.pl

poster presentation

Diabetes is characterized by hyperglycemia, altered lipids, carbohydrate and protein metabolism. Chlorogenic and caffeic acids - major phenolic compounds of coffee beans, are known as antiobesity and antidiabetic agents, thus the aim of this study was to determine their antidiabetic activity *in vitro* using glucose diffusion test.

For functional bread preparation, green coffee (*Coffea arabica*) beans (GCB) and wholemeal wheat bread flour were used. Bread flour was replaced with GCB flour at 1 to 5% levels. GCB addition slightly influenced the total reducing sugar content (TRS) in wheat bread. This tendency was observed in the case of potentially mastication-extractable (BE), potentially bioaccessible (GE) and bioavailable (DE) compounds. The highest TRS content was determined after digestion in the simulated human gastrointestinal tract.

The lowest effect on the glucose diffusion was observed in the case of the control bread extracts (without GCB addition). GCB addition significantly increased its activity in the case of BE and DE compounds, whereas in the case of potentially bioaccessible components, the opposite effect was observed. These results may confirm hypothesis about multidirectional pro health activity of GCB components, especially low molecular and hydrophilic compounds, probably chlorogenic and other phenolic acids.

Our results indicate that wheat bread enrichment with GCB is a good way of manufacturing a product that is the compromise between "traditional" and pro-health food.

Keywords: green coffee, wheat bread, antidiabetic activity

The study was financed by the Polish National Science Centre (grant 2013/09/B/NZ9/01801).

INTERACTION BETWEEN SUPEROXIDE DISMUTASE EFFECTORS DERIVED FROM GREEN COFFEE BEANS AND WHOLEMEAL WHEAT FLOUR

Urszula Gawlik-Dziki^{1*}, Urszula Złotek¹, Dariusz Dziki²

¹Department of Biochemistry and Food Chemistry, University of Life Sciences,
Skromna Street 8, 20704 Lublin, Poland

²Department of Thermal Technology, University of Life Sciences, Doświadczalna
Street 44, 20280 Lublin, Poland

*corresponding author: urszula.gawlik@up.lublin.pl

poster presentation

Superoxide dismutases (SOD) are essential enzymes that eliminate the superoxide radical ($O_2^{\cdot-}$), and thus protect cells from oxidative damage. The active $O_2^{\cdot-}$ production and low SOD activity in cancer cells may render the malignant cells, highly dependent on SOD for survival, and sensitive to inhibition of SOD.

Green coffee beans GCB are rich in phenolic acids, especially in chlorogenic acid (CE), whereas the most important antioxidant of the wheat grain (WF) is ferulic acid (FE) – compound with well-documented antioxidant and anticancer activity. Thus, we wanted to estimate the interactions between SOD effectors from GCB and wholemeal wheat flour (type 2000), compared with pure chemical standards. Additionally, activity of buffer extractable (BE), bioaccessible (DE) and bioavailable *in vitro* (AE) compounds from wheat bread enriched with GCB flour (at 1% to 5% levels) was estimated. In the case of pure chemicals, weak inhibition of SOD was estimated (9% for CE and 8% for FE). The isobolographic analysis showed that chlorogenic and ferulic acid act additively. The fact that interactions between the food matrix component play a key role in creating bioactivity was confirmed by the results obtained for BE, DE, and AE extracts from CGB and WF. All extracts contained SOD inhibitors; the highest inhibitory activity was determined for DE and AE samples. In all cases synergistic interaction between SOD inhibitor was found. Fortification of wheat bread with GCB flour improved SOD-inhibitory potential only in the case of DE extracts. Importantly, SOD inhibitors from bread were poorly bioaccessible *in vitro*.

Keywords: green coffee, wheat bread, superoxide dismutase, ferulic acid, chlorogenic acid

The study was financed by the Polish National Science Centre (grant 2013/09/B/NZ9/01801).

POSITIVE EFFECTS OF OATS ON HUMAN HEALTH

Marina Palfi, Nada Knežević*

Podravka d.d., Ante Starčevića 32, Koprivnica, Croatia

*corresponding author: nada.knezevic@podravka.hr

poster presentation

Consumption of fruits, vegetables and cereals is a basic precondition for diverse and nutritionally balanced diet. Whole grains are beneficial for human health and reduce the risk of developing chronic diseases and also contribute to maintaining normal body weight. Oat is a cereal that contains necessary macro- and micro-nutrients, a high proportion of β -glucan, as well as specific polyphenols with strong antioxidant activity. Although world production of oats is steadily falling, there is an increasing demand for oats and oat products. Health benefits of oats to human health have been proven by many researchers, so the EFSA (European Food Safety Authority) has approved four health claims related to oats that can be applied on food products. In addition, oats have been approved by the European Commission as a component of gluten-free foods under certain conditions. The Nordic countries have recognized the benefits of oatmeal diet, and are investing in increasing the share of oats in the diet by developing and promoting healthy Nordic nutrition. Functional foods based on oats are a great challenge and great potential in the food sector, but further efforts are needed in research, marketing and collaboration with health institutions regarding better acceptance of oat products by the consumers.

The paper presents the current situation of world and domestic oat production, scientific research and legislative framework related to positive effect of oat to human health.

Keywords: oats, β -glucans, health claims, functional foods

**PARENTAL ADHERENCE TO THE MEDITERRANEAN DIET IS ASSOCIATED WITH
THEIR ADOLESCENTS' CEREALS INTAKE**

**Greta Krešić^{1,3*}, Gordana Kendel Jovanović², Sandra Pavičić Žeželj², Jelka Pleadin³,
Nikolina Liović¹, Katarina Plepel⁴**

¹*Department of Food and Nutrition, Faculty of Tourism and Hospitality
Management, University of Rijeka, Primorska 42, Opatija, Croatia*

²*Department of Health Ecology, Teaching Institute of Public Health of Primorsko-
Goranska County, Krešimirova 52a, Rijeka, Croatia*

³*Laboratory for Analytical Chemistry, Croatian Veterinary Institute,
Savska Cesta 143, 10000 Zagreb, Croatia*

⁴*Faculty of Health Studies, University of Rijeka, Viktora Cara Emina 5, Rijeka,
Croatia*

*corresponding author: gretak@fthm.hr

poster presentation

The Mediterranean Diet (MD) that prefers wholegrains is known to be one of the healthiest dietary patterns. Given the health benefits of wholegrain cereals as a rich source of nutrients and phytochemicals, this study examined the parental adherence to the MD and its association with their adolescents' cereals intake in 203 parent-adolescent dyads. The adherence to MD was evaluated using the Mediterranean Diet Quality Index for adolescents (13.5 ± 1.2 y) and Short Mediterranean Diet Questionnaire for parents (41.53 ± 5.99 y). Although the level of the parents' adherence to the MD did not significantly influence the adolescents' weekly frequency of the consumption of pasta and rice, the adolescents whose parents had higher adherence to the MD (44.3%) ate cereals or grains for breakfast ($p=0.045$) more often and they ate commercially baked goods or pastries ($p=0.043$) less frequently. The adolescents with parents who had a lower adherence to the MD (55.7%) stated that they would eat more whole grain bakery products ($p=0.049$) and more breakfast cereals ($p=0.039$) if these foods were available at home more often. Adolescents with parents who had higher adherence to the MD stated that they were encouraged by their parents to eat whole grain bakery products ($p=0.030$) more often, compared with their counterparts whose parents had lower adherence to the MD. With this study, we revealed that the food environment and the parental eating behaviour are notable factors that influence the adolescents' dietary intake. Disease prevention health programs should be aimed more at encouraging parents to adopt MD features in their family food environment.

Keywords: adolescents, cereals, home environment, Mediterranean Diet, parents

TOTAL PHENOLICS AND ANTIOXIDANT ACTIVITY OF GERMINATED RYE

Tomaž Požrl*, Andrej Živković, Petra Terpinč

Biotechnical Faculty, Jamnikarjeva 101, Ljubljana, Slovenia

*corresponding author: tomaz.pozrl@bf.uni-lj.si

poster presentation

Rye (*Secale cereale*) grains were subjected to various malting regimes. Each regime was evaluated by determining the water uptake, soaking time, germination percentage, and length of the germ. At higher temperature, the water absorption was faster, but germination rate was slower. Once the most efficient soaking (20 °C) and germination (20 °C) temperatures had been chosen, green rye malt underwent the kilning process at two different temperatures, 60 °C and 100 °C. The obtained malts were analysed for malt quality parameters using the standard congress mash method. The 72 hours after the seedings were sufficient to achieve maximum extract yield, which amounted to 90%, while the kilning of the germinated seeds under severe conditions at 100 °C resulted in a significant decrease, regardless of the germination time. Two solvents of different polarity were used to obtain extracts from green and kilned malts, resulting in great variation in total phenolic content and antioxidant activity. The phenolic content (expressed as ferulic acid equivalent) of green malts started to increase after 48 hours and was almost 4 times higher at the end of the experiment (after 96 hours) when compared to the raw rye grains. Meanwhile, the kilned grains contained as much as 26 mg/g of phenolic compounds on the dry weight basis. The antioxidant activity (expressed as trolox equivalent) of the methanolic extract was higher than that of the ethanolic ones and was found to be significantly more affected by germination time than by the kilning temperature regime. The kilning was found to have a negative impact on the antioxidant activity of rye malt.

Keywords: rye, malting, total phenolics, antioxidant activity

**KNOWLEDGE AND HABITS RELATED TO DIETARY FIBER INTAKE IN ADULTS FROM
THE CITY OF ZAGREB**

**Ivona Hanžić¹, Ivana Rumbak^{1*}, Irena Colić Barić¹, Zvonimir Šatalić¹, Draženka
Komes¹, Raquel Pinho Ferreira Guiné²**

¹*University of Zagreb, Faculty of Food Technology and Biotechnology, Pierottijeva 6
10000 Zagreb, Croatia*

²*Escola Superior Agrária de Viseu, Quinta da Alagoa, Estrada de Nelas, Ranhados
CI&DETS, Polytechnic Institute of Viseu, Av. José Maria Vale de Andrade
3504-510 Viseu, Portugal*

*corresponding author: ivana.rumbak@pbf.hr

poster presentation

Numerous studies have confirmed that increased consumption of dietary fibre lowers the risk for cardiovascular diseases, diabetes type 2, constipation, obesity and certain malignant diseases. The aim of this study was to evaluate eating habits related to dietary fibre intake in subjects from the city of Zagreb. Furthermore, the aim was to determine the level of knowledge, sources of information and food label reading habits related to dietary fibre. The study included 734 adults (18 – 61 years old) who completed a questionnaire of self-report response on dietary fibre developed by CI&DETS Research Centre. The intake of foods which are rich in dietary fibre among the inhabitants of Zagreb was relatively low and inadequate. Most of the participants (83.1%) recognized the importance of dietary fibre in terms of prevention and/or treatment of various diseases. However, general knowledge about dietary fibre was insufficient. The internet was the most common source of information on dietary fibre. The subjects, on average, only sometimes (M=3.36; scale 1 – 6) consult the food label, but they rarely read the amount of dietary fibre (M=2.06). There is a need to educate the general population about the benefits of dietary fibre with the purpose of adopting a desirable eating habits which will increase their intake.

Keywords: dietary fibre, eating habits, sources of fibre, knowledge about fibre, food labeling

GLUTEN-FREE DIET – KNOWLEDGE AND FREQUENCY OF CONSUMPTION

Ivana Rumora Samarin*, Ana Oguić, Josipa Matanić, Martina Bituh, Ines Panjkota Krbavčić

University of Zagreb, Faculty of Food Technology and Biotechnology, Pierottijeva 6
10000 Zagreb, Croatia

*corresponding author: irumora@pbf.hr

poster presentation

Gluten-free diet gained lately considerable popularity among world population. Possible reason for that is the opinion among general population that gluten-free diet is a more healthful option. Recent researches suggested that there is no evidence to support consumption of gluten-free products among individuals who do not have celiac disease, wheat allergy or nonceliac gluten sensitivity. Our aim was to determine frequency of consumption of the gluten-free diet among Croatian population. For this purpose, a specially designed questionnaire was used to determine general knowledge of the population about gluten and gluten-free products, frequency and main reasons for consumption of the gluten-free diet. The questionnaire was conducted on 200 respondents. Only 4% of all interviewed subjects stated they are not familiar with the terms "gluten" and "gluten-free diet". Furthermore, when all the answers obtained from the questionnaire are taken into consideration, this number was much higher (around 30%). The results showed that around 13% of the interviewed subjects stated to have nonceliac gluten sensitivity or celiac disease. Among remaining, apparently healthy subjects, 40% declared to consume gluten-free diet every day. Just 5% of respondents who consume gluten-free products have the opinion that gluten-free diet is a healthful option. Further investigation with a greater number of respondents and a more detailed questionnaire is needed to obtain more accurate information about the general population opinion regarding the gluten-free diet.

Keywords: gluten, gluten-free, diet

***WORKSHOP:
"HOW TO CALCULATE NUTRIENT CONTENT OF FOODS"***

SOFTWARE MODEL FOR CALCULATING THE NUTRITIONAL VALUE OF FOOD IN BAKERY

Dubravko Bašić*

Metrokom info d.o.o., Cekovići 27, 10040 Zagreb, Croatia

*corresponding author: dubravko@metrokom.hr

lecture

Informational maturity focuses on the use of modern information technology in all aspects of human activity. Nutritional declarations have become mandatory. Since laboratory analysis is expensive and long-lasting, one usually opts for the software model for calculating the nutritional value of food (Recipe Recipe). The experimental results showed that the differences between chemical analysis and computer programs for the calculation of nutrient content in prepared food are generally not significant (EuroFIR). The purpose of this presentation is to present one such Cloud model of the "NutraCalc" information system, which uses nutrient bases with more than 1000 nutrients and more than 100 parameters for each nutrient. Using the example of a typical bakery product, nutritional value, as the basis for producing a nutritive declaration, will be determined. Likewise, a hierarchical model of editing and using the central nutritional value database will be shown. For food manufacturers who do not have enough nutrition knowledge, a model with the introduction of a mediator will be shown as a link between the "NutraCalc" program and the end user. This conceptual program can be applied in education, research, and in all areas where nutrition planning and the determination of optimal nutritional needs is required.

Keywords: bread, nutrient, food, cloud, nutritional needs, nutritional value basis

HOW TO CALCULATE THE NUTRIENT CONTENT OF FOOD: INTRODUCING A GUIDELINE FOR FOOD BUSINESS OPERATORS

Daniela Čačić Kenjerić*

*Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek,
Franje Kuhača 20, 31000 Osijek, Croatia*

*corresponding author: dkenjeri@ptfos.hr

lecture

The adequate choice of food can promote health, prevent diseases, help in recovery, and minimise problems caused by disease. To enable general population to make healthy choices, producers are obligated and encouraged by the Regulation (EU) No 1169/2011 to provide food information to consumers in a simple and understandable way. A nutrition declaration, including energy value, the amounts of fat, saturates, carbohydrate, sugars, protein and salt, is one of the mandatory pieces of information for food. Aside from the traditionally accepted values obtained by the manufacturer's food analysis, average values based on a calculation from the known or actual average values of ingredients used and/or a calculation from generally established and accepted data are options for the nutrition declaration. To help food producers in the implementation of the calculation options, EuroFIR FoodComp Working Group published a step-by-step Guideline for calculating nutrient content for the nutrition declaration as indicated in the above mentioned Regulation. The aim of this presentation is to introduce these guidelines on a few selected cereal products.

Keywords: nutrition declaration, calculation by recipe, Regulation (EU) No 1169/2011, step-by-step guidelines

NUTRITION DECLARATION - MANDATORY FOOD INFORMATION

Sanja Kolarić Kravar*

Ministry of Agriculture, Department for Food and Phytosanitary Policy, Ulica grada
Vukovara 78, 10000 Zagreb, Croatia

*corresponding author: sanja.k-kolaric@mps.hr

lecture

White Paper from the European Commission named A Strategy for Europe on Nutrition, Overweight and Obesity-related health issues noted that nutrition labelling is an important method of informing consumers about the composition of foods, and of helping them to make an informed choice. Therefore, according to Regulation (EU) No 1169/2011 on the provisions of food information to consumers, the nutrition declaration from 13 December 2016 is mandatory for most prepackaged food. There are a number of foods which are exempt from the mandatory requirement to provide nutrition information and these are listed in Annex V of the Regulation, except when a nutrition or a health claim is made. The mandatory nutrition declaration shall include the following: energy value and the amounts of fat, saturates, carbohydrate, sugars, protein and salt. The content of the mandatory nutrition declaration may be supplemented with an indication of the amounts of one or more of the following: mono-unsaturates, polyunsaturates, polyols, starch, fibre and any of the vitamins or minerals present in significant amounts. If space permits, the declaration shall be presented in the form of a table, with numbers aligned. A linear format may be used if space does not allow for the provision of the information in a tabular format. The amounts of nutrients shall be expressed in grams (g) per 100 g or per 100 mL, and the energy value in kilojoules (kJ), and in kilocalories (kcal) per 100 g or per 100 mL of the food. The energy value and the amounts of nutrients shall be those of the food as sold. Where appropriate, the information may relate to the food after preparation, provided that sufficiently detailed preparation instructions are given, and the information relates to the food as prepared for consumption. The declared values shall, according to the individual case, be average values based on the manufacturer's analysis of the food, a calculation from the known or actual average values of the ingredients used, or a calculation from the generally established and accepted data.

Keywords: nutrition declaration, food, consumers

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