



ISSN 2255-9809

Latvia University of Agriculture  
Faculty of Food Technology

9th Baltic Conference on  
Food Science and Technology

“Food for Consumer Well-Being”

**FOODBALT 2014**

Abstract Book

Jelgava  
May 8–9, 2014

# FOODBALT 2014

Abstract Book of 9th Baltic Conference on Food Science and Technology “Food for Consumer Well-Being” FOODBALT 2014 Conference. Jelgava, LLU, 2014, 164 pages  
ISSN 2255-9809

## Conference Organizers

**Conference Chair** **Inga Ciprovica**, Latvia University of Agriculture, LV

## Editorial Board

Dr.sc.ing. **Tatjana Rakcejeva**, Latvia University of Agriculture, LV  
Dr. **Joerg Hampshire**, Fulda University of Applied Sciences, DE  
Dr. **Ase Solvej Hansen**, Copenhagen University, DK  
Dr.sc.ing. **Daina Karklina**, Latvia University of Agriculture, LV  
Dr. **Raija Lantto**, VTT Technical Research Centre of Finland, FIN  
Dr.med.sc. **Aleksandr Shleikin**, Saint-Peterburg National Research University of Information Technologies, Mechanics and Optics, RUS  
Dr.sc.ing. **Evita Straumite**, Latvia University of Agriculture, LV  
Dr. **Thierry Talou**, National Polytechnic Institute of Toulouse, FR  
Dr. **Rimantas Venskutonis**, Kaunas University of Technology, LT  
Dr.biol. **Raivo Vokk**, Tallin Technological Institute, EE  
Dr. **Erkan Yalcin**, Abant Izzet Baysal University, TR

## Organising Committee

**Chair** **Ruta Galoburda**, Latvia University of Agriculture, LV

**Zanda Kruma**, Latvia University of Agriculture, LV

**Dace Klava**, Latvia University of Agriculture, LV

**Irisa Murniece**, Latvia University of Agriculture, LV

Editor-in-chief and responsible

compiler of abstract book – **leader researcher Evita Straumite**

Printed and bound in Riga by „Drukātava”

© LLU, Faculty of Food Technology, 2014

## FOODBALT 2014

Dear participants,

The 9<sup>th</sup> Baltic Conference on Food Science and Technology „Food for consumer well-being” (FoodBalt 2014) will take place from 8<sup>th</sup> to 9<sup>th</sup> May, 2014 in the Latvia University of Agriculture (LLU). The conference is organized by the Faculty of Food Technology. The conference aims are to bring together master and doctoral students from Baltic countries, as well as students, established researchers from other countries, promoting the dissemination of new knowledge and allowing young scientists and students to meet professionals, contributing to the development of food science and technology area. The conference plans to attract more than 120 delegates from 10 countries. The conference programme contains 4 key lectures and 35 oral presentations over 7 sessions. Additionally, a total of 94 posters will be presented. The conference Organising Committee had received around 70 full paper submissions from 7 countries. A peer review process was enforced, with the help of experts who were members of the Conference Scientific Committee and researchers from Latvia University of Agriculture, all of them internationally recognized in one of the main conference topic areas.

On behalf of Organizing Committee I am honoured to welcome you at FoodBalt 2014 conference and to wish new experience, contacts and further cooperation activities in common projects and programmes. It would help you to achieve the excellence and recognition in food science area in Baltic region and in Europe, too.

Dr.sc.ing. **Inga Ciprovica**

The chair of the 9<sup>th</sup> Baltic conference on Food Science and Technology

# FOODBALT 2014

## 9th Baltic Conference on Food Science and Technology

### “Food for Consumer Well-Being”

## FOODBALT 2014

### Programme

#### May 8, 2014

9<sup>00</sup>-10<sup>00</sup> **Registration and Poster installation**

10<sup>00</sup>-10<sup>15</sup> **OPENING** Vice-rector of LLU Peteris Rivža, Dean of the Faculty of Food Technology Inga Ciproviča, Professor Petras Rimantas Venskutonis

#### Session I **Room 263**

**Moderators:** Petras Rimantas Venskutonis, Kaunas University of Technology, Lithuania  
Inga Ciproviča, Latvia University of Agriculture, Latvia

10<sup>15</sup>-10<sup>55</sup> **KEY LECTURE**

*Dace Tirzīte, Latvian Institute of Organic Synthesis, Latvia* **Antioxidants – benefits and risks**

*Reijo O Karjalainen, University of Eastern Finland, Finland* **Anthocyanin – rich berry extracts for brain health**

10<sup>55</sup>-11<sup>10</sup> **O1 – K. Vene, K Kajava** *Determining off-odors in food: case study on pickles*

11<sup>10</sup>-11<sup>25</sup> **O2 – S. Seisonen, E. Kivima, K. Vene** *Characterization of the aroma profile of different honeys and corresponding flowers using SPME-GC/MS and GC-olfactometry*

11<sup>25</sup>-11<sup>40</sup> **O3 – Ö. Özdestan, T. Erol, B. Acar** *Determination of nitrate and nitrite levels of mineral water and drinking water samples sold in Turkey*

11<sup>40</sup>-11<sup>55</sup> **O4 – A. Kovalčuks, M. Dūma** *Solvent extraction of egg yolk oil from liquid egg yolk*

11<sup>55</sup>-12<sup>45</sup> **LUNCH**

#### Session II **Room 263**

**Moderators:** Thierry Talou, National Polytechnic Institute of Toulouse, France  
Zanda Krūma, Latvia University of Agriculture, Latvia

12<sup>45</sup>-13<sup>25</sup> **KEY LECTURE Meinolf G. Lindhauer, Head of Department of Safety and Quality of Cereals, Federal Research Institute for Nutrition and Food, Germany** **Standard methods and criteria to predict bread cereal quality - Do they still meet the demands of modern raw materials and their processing?**

13<sup>25</sup>-13<sup>40</sup> **O5 – G. Starr, W. L. P. Bredie, Å. S. Hansen** *Wheat varieties can be differentiated by their sensory profiles*

## FOODBALT 2014

- 13<sup>40</sup>-13<sup>55</sup> **O6** – Ö. Güvendi, E. Yalçın *Egg pasta (erişte) produced from whole grain oat flour*
- 13<sup>55</sup>-14<sup>10</sup> **O7** – S. Kalniņa, T. Rakčejeva, I. Grāmatiņa, D. Kunkulberga *Investigation of total dietary fiber, vitamin B<sub>1</sub> and B<sub>2</sub> content in dry mixtures for pasta production*
- 14<sup>10</sup>-14<sup>25</sup> **O8** – V. Kitrytė, A. Šaduikis, P. R. Venskutonis *In vitro antioxidant capacity of brewer's spent grain*
- 14<sup>25</sup>-14<sup>40</sup> **O9** – R. P. F. Guiné, C. F. F. Almeida, P. M. R. Correia *Evaluation of conservation conditions on nuts properties*

### 14<sup>40</sup>-15<sup>10</sup> COFFEE BREAK / POSTER SESSION

#### Parallel Session III Room 263

**Moderators:** Erkan Yalçın, Abant İzzet Baysal University, Turkey

Tatjana Rakčejeva, Latvia University of Agriculture, Latvia

- 15<sup>10</sup>-15<sup>25</sup> **O10** – P. M. R. Correia, S. Gonçalves, H. Gil, J. Coelho *The wettability and surface free energy of acorn starch gels isolated by alkaline and enzymatic methods*
- 15<sup>25</sup>-15<sup>40</sup> **O11** – M. J. Barroca, S. A. Sério, R. P. F. Guiné, P. M. R. Correia *Influence of pre drying treatment on physical properties of carrots*
- 15<sup>40</sup>-15<sup>55</sup> **O12** – K. Rūse, T. Rakčejeva *Physically-chemical parameters of Latvian fresh cranberries*
- 15<sup>55</sup>-16<sup>10</sup> **O13** – D. Urbonavičienė, P. Viškelis *Content and isomeric ratio of lycopene in 'Semlo' variety of tomato*
- 16<sup>10</sup>-16<sup>25</sup> **O14** – J. Feldmane, I. Ciproviča, P. Semjonovs, R. Linde *The influence of fermentation temperature on the development of exopolysaccharides in yoghurt production*
- 16<sup>25</sup>-16<sup>40</sup> **O15** – I. Līdums, D. Karkliņa, A. Ķirse *Quality changes of naturally fermented kvass during production stages*

#### Parallel Session IV Room 278

**Moderators:** Åse Solvej Hansen, Copenhagen University, Denmark

Mārtiņš Šabovics, Latvia University of Agriculture, Latvia

- 15<sup>10</sup>-15<sup>25</sup> **O16** – L. Strauta, S. Muižniece-Brasava, I. Alsīņa, T. Rakčejeva *Extruded bean product quality evaluation*
- 15<sup>25</sup>-15<sup>40</sup> **O17** – O. O. Kara, E. Karacabey, E. Küçüköner *Effects of starch concentrations on physicochemical and functional properties of cape gooseberry leather (pestil)*
- 15<sup>40</sup>-15<sup>55</sup> **O18** – V. Radenkovs, D. Kļava, I. Krasnova *Application of enzymatic treatment to improve the concentration of bioactive compounds and antioxidant potential of wheat and rye bran*

# FOODBALT 2014

- 15<sup>55</sup>-16<sup>10</sup> **O19** – R. Bobinaitė, S. Šatkauskas, N. Lamanauskas, P. Viškelis, G. Pataro, G. Ferrari *Effect of pulsed electric field treatment of blueberries on juice yield and quality*
- 16<sup>10</sup>-16<sup>25</sup> **O20** – V. Eisinaite, R. Vinauskiene, I. Jasutiene, D. Leskauskaite *Influence of the lyophilised vegetable additive on the functional properties of meat products*
- 16<sup>25</sup>-16<sup>40</sup> **O21** – S. Zēberga, M. Strēle, A. Vojevodova, I. Mierīna, M. Jure *Oat hulls and sea buckthorn pomace – a potential source of antioxidants for hempseed oil*
- 16<sup>40</sup>-16<sup>55</sup> **O22** – G. Giacinti, V. Simon, C. Raynaud *Gas chromatographic determination of polar and non polar pesticides in apple matrices by using different sample preparation methods*

## 18<sup>00</sup> CONFERENCE DINNER

**May 9, 2014**

### Session V Room 263

**Moderators:** Meinolf G. Lindhauer, Federal Research Institute for Nutrition and Food, Germany

Ruta Galoburda, Latvia University of Agriculture, Latvia

9<sup>00</sup>-9<sup>40</sup> **KEY LECTURE Hely Tuorila**, Professor of Department of Food and Environmental Sciences, University of Helsinki, Finland **Perception and preferences related to salty taste in foods**

9<sup>40</sup>-9<sup>55</sup> **O23** – A. Simoneliene, E. Treciokiene, G. Lukosiunaite, G. Vysniauskas, E. Kasparaviciute *Rheology, technological and sensorial characteristics of fortified drink products with fibers*

9<sup>55</sup>-10<sup>10</sup> **O24** – A. Kırse, D. Kārklīņa *Nutritional evaluation of pulse spreads in comparison to nutrient recommendations*

10<sup>10</sup>-10<sup>25</sup> **O25** – L. Ozola, E. Straumīte, M. Lazdiņš *Determination of gluten in flour*

### 10<sup>25</sup>-11<sup>00</sup> COFFEE BREAK / POSTER SESSION

### Session VI Room 263

**Moderators:** Joerg Hampshire, Fulda University of Applied Sciences, Germany

Dace Klava Latvia University of Agriculture, Latvia

11<sup>00</sup>-11<sup>15</sup> **O26** – S. Beliakova, L. Krasnikova *Biotechnology of dairy products with herbal excipients for nutrition of school-age children*

11<sup>15</sup>-11<sup>30</sup> **O27** – S. C. Andrade, R. P. F. Guiné, L. C. P. Roseiro *Determination of the content of coenzymes Q<sub>9</sub> and Q<sub>10</sub> in pork meat from different breeds*

11<sup>30</sup>-11<sup>45</sup> **O28** – E. Karacabey, F. Çınar, E. Küçüköner *Effects of different extraction techniques on cape gooseberry fruit extracts*

## FOODBALT 2014

11<sup>45</sup>-12<sup>00</sup> **O29** – T. Tokareva, A. Eglīte *Non-price factors that influence consumers' wasted food amounts*

12<sup>00</sup>-12<sup>15</sup> **O30** – F.-K. Lücke, S. Schreiber *High-oxygen modified atmosphere packaging of organic meats?*

12<sup>15</sup>-13<sup>00</sup> **LUNCH**

### Session VII Room 263

**Moderators:** **Aleksei Kaleda** Competence Centre of Food and Fermentation Technologies, Estonia

**Irisa Mūrniece** Latvia University of Agriculture, Latvia

13<sup>00</sup>-13<sup>40</sup> **KEY LECTURE Petras Rimantas Venskutonis**, *Professor of Department of Food Science and Technology Kaunas University of Technology, Lithuania*  
**Biorefinery of agromaterials processing by-products for high added value ingredients**

13<sup>40</sup>-13<sup>55</sup> **O31** – A. Ruzaiķe, S. Muižniece-Brasava, L. Dukaļska *Packaging material and storage-induced quality changes in flexible retort pouch potatoes' produce*

13<sup>55</sup>-14<sup>10</sup> **O32** – V. Kraujalienė, P. R. Venskutonis *Antioxidant activity of *Bergenia crassifolia* L. extracts isolated by pressurized liquid extraction*

14<sup>10</sup>-14<sup>25</sup> **O33** – A. Melngaile, E. Ciekure, O. Valciņa *Microbiological quality of meat, meat preparations and meat products*

14<sup>25</sup>-14<sup>40</sup> **O34** – L. Nuobariene, N. Arneborg, Å. S. Hansen *Phytase active yeasts isolated from bakery sourdoughs*

14<sup>40</sup>-14<sup>55</sup> **O35** – A. Shleikin, I. Shatalov, A. Shatalova *Enzymatic treatment of gelatin films*

14<sup>55</sup>-15<sup>15</sup> **CLOSING OF CONFERENCE**

# FOODBALT 2014

## Poster Programme

May 8–9, 2014

Poster No.	Author, Title of Poster
<b><i>Health-relevant food products and issues</i></b>	
P1.	J. Hampshire, L. Page, A. Kruke, N. Lauber, M. Müller, V. Rosin, A. Seifert, C. Wagner, S. Wagner, L. Winkler <b>Salt reduction of breads by adding spices</b>
P2.	Ö. Özdestan, B. Acar, T. Erol <b>Phytosterols in rice bran and usage of rice bran in food industry</b>
P3.	R. Raudonis, L. Raudonė, V. Janulis, P. Viškelis <b>Preparation of dry extract of sea buckthorn leaves</b>
P4.	P.M. Smolikhina, E.I. Muratova <b>Determination of the optimal ratio of recipe ingredients in the process of designing confectionery products for functional purposes</b>
P5.	M. Dūma, I. Alsīņa, S. Zeipiņa, L. Lepse, L. Dubova <b>Leaf vegetables as source of phytochemicals</b>
P6.	D. Ikauniece, A. Jemeljanovs, V. Sterna, V. Strazdina <b>Evaluation of nutrition value of Roman snail's (<i>Helix pomatia</i>) meat obtained in Latvia</b>
P7.	V. Strazdina, A. Jemeljanovs, V. Sterna, D. Ikauniece <b>Nutritional characteristics of wild boar meat hunted in Latvia</b>
P8.	L. Degola <b>The different protein sources feeding impact on the quality of pork</b>
P9.	A. Kutaceva, S. Kampuse <b>The influence of gelling agent on the quality of non-sugar marmalade candies</b>
P10.	L. Jaundzeikare, I. Beitane <b>Comparison of dietary fibre content in different fibre sources</b>
<b><i>Quality and safety of processed foods</i></b>	
P11.	E. Skabeikyte, E. Lepaskaite, E. Bartkiene, G. Juodeikiene, D. Vidmantiene, A. Maruska, O. Ragazinskiene <b>The influence of fermented with certain lactobacilli <i>Satureja montana</i> and <i>Satureja hortensis</i> on the quality and safety of chicken meat</b>
P12.	I. Siliņš <b>The effects of pH, <math>a_w</math>, and lactic acid bacteria on <i>Listeria monocytogenes</i> in fermented sausages</b>
P13.	I. Augspole, T. Rakcejeva, Z. Kruma, F. Dimins <b>Shredded carrots quality providing by treatment with hydrogen peroxide</b>
P14.	I. Yilmaz, M. Aluc <b>Determination of aflatoxin levels in cashews by HPLC</b>



## FOODBALT 2014

Poster No.	Author, Title of Poster
P15.	I. Yılmaz, H. Garipoğlu <b>Determination of aflatoxin contamination in some dried nuts and spices by ELISA</b>
P16.	K. Juhņeviča-Radenkova, L. Skudra, M. Skrīvele, D. Segliņa, A. Olšteine <b>Impact of the degree of maturity on apple quality during storage</b>
P17.	A. Steponavičienė, I. Kraujutienė, N. Vasiliauskienė <b>Influence of flour characteristics on quality of baking products</b>
P18.	A. Liutkevičius, V. Speičienė, A. Mieželiene, G. Alenčikiene, A. Kaminskas, A. Abaravičius <b>Quality of drink enriched by soy protein isolate and prebiotic dietary fiber and its influence on human health</b>
P19.	I. Mačionienė, D. Jonkuvienė, J. Šalomskienė <b>The antagonistic effect of lactobacilli on pathogenic and spoilage bacteria during meat fermentation</b>
P20.	A. Rokaitytė, G. Zaborskienė <b>The effects of dihydroquercetin, linalool, thymol and lactic acid against spoilage bacteria and physicochemical properties of minced pork meat</b>
P21.	D. Tcoi, L. Krasnikova <b>Efficiency of nisin and its producers in conservation of puddings</b>
P22.	I. Pugajeva, L. Žumbure, A. Melngailė, V. Bartkevičs <b>Determination of acrylamide levels in selected foods in Latvia and assessment of the population intake</b>
P23.	I. Simonavičienė, A. Stimbirys, D. Andriulionyte <b>Antimicrobial resistance of <i>Listeria monocytogenes</i> and <i>Listeria innocua</i> isolated from fish processing plant environment and raw salmon</b>
P24.	K. Antonenko, V. Kreicbergs, A. Liniņa, D. Kunkulberga <b>Influence of different selenium concentration on the protein and starch content in rye malt</b>
P25.	S. S. Turgut, E. Karacabey, E. Küçüköner <b>Potential of image analysis based systems in food quality assessments and classifications</b>
P26.	A. Batu, F. Elyildirim <b>A study on the shelf life of walnut summer halva</b>
P27.	D. Jasinauskienė, N. Kasnauskytė, D. Jonkuvienė, A. Šarkinas <b>The effect of fresh and frozen juices of cherry berries against bacteria and yeast</b>
<b><i>Trends in new food product and technology development</i></b>	
P28.	A. Zungur, M. Koç, B. Yalçın, F. Kaymak-Ertekin, S. Ötleş <b>Storage stability of microencapsulated extra virgin olive oil powder</b>

# FOODBALT 2014

Poster No.	Author, Title of Poster
P29.	I. Beitane, G. Krumina-Zemture, I. Murniece <b>Sensory and structural properties of pancakes with pea and buckwheat flour</b>
P30.	A. Aydogdu, G. Sumnu, S. Sahin <b>Pore size distribution of eggplants dried by different drying methods</b>
P31.	I. D. Mert, O. H. Campanella, G. Sumnu, S. Sahin <b>Production of gluten-free sourdough breads prepared with chestnut and rice flour</b>
P32.	E.I. Muratova, P.M. Smolikhina <b>Technological aspects of the results in rheological studies of candy mass</b>
P33.	J. Slapkauskaite, J. Zaboraitė, D. Sekmokiene <b>Chemical and sensory properties of ricotta cheese</b>
P34.	P. Semjonovs, I. Denina, A. Patetko, D. Upite, R. Linde, L. Auzina, R. Scherbaka <b>Fish and seafood raw materials – promising source for development of value-added food products</b>
P35.	A. Patetko, P. Semjonovs, I. Denina <b>Evaluation of yeast cultures for development of fermented apple-juice based non-alcoholic beverages</b>
P36.	O. Levuškinas, I. Šeputis, V. Liorančas <b>Protein bar manufacturing abilities</b>
P37.	S. Kampuse, A. Jefimovs, T. Rakcejeva <b>The influence of pre-treatment method on the fat content decrease in French fries</b>
P38.	I. Gramatina, L. Silina, L. Skudra, T. Rakcejeva <b>Dried venison physical and microbiological parameter changes during storage</b>
P39.	I. Vidžiūnaitė, I. Jasutienė, M. Keršienė, R. Klimaviciute, R. Rutkaite <b>Preparation and encapsulation properties of propylene oxide and octenyl succinic anhydride modified starches</b>
P40.	T. Talou, T. M. Zhao, Q. H. Nguyen <b>Anthorefinery for food, feed and non food: dream or reality?</b>
P41.	R. Budreckiene, A. Struzeckiene <b>Optimization of manufacturing technology of soft cheese</b>
<b><i>Food chemistry, analysis and quality assessment</i></b>	
P42.	I. Cinkmanis, S. Vucāne, I. Čakste <b>Berry and fruit juices as potential untraditional acidity regulators in beer mashing</b>
P43.	I. Mūrniece, L. Tomsone, I. Skrabule, A. Vaivode <b>Influence of flesh colour on carotenoid and total phenolic content in potato tubers</b>
P44.	A. Linina, A. Ruza, D. Kunkulberga, T. Rakcejeva <b>The influence of meteorological conditions on winter wheat wholemeal protein content and rheological properties</b>

## FOODBALT 2014

Poster No.	Author, Title of Poster
P45.	P. M. R. Correia, T. Santos, D. Lemos, C. Brites, R P. F. Guiné <b>Amylose content of rice marketed in Portugal</b>
P46.	F. Dimiņš, V. Miķelsone, P. Kūka, A. N. Jefremovs <b>Effect of different types of heat treatment on invertase activity in honey</b>
P47.	L. Tomsone, Z. Kruma <b>Influence of freezing and drying on the phenol content in horseradish and lovage</b>
P48.	V. Krungleviciute, E. Bartkiene, G. Juodeikiene, J. Kantautaitė <b>Biogenic amines formation in fermented barley and wheat flour industry by-products</b>
P49.	M. Kūka, I. Čakste, R. Galoburda, M. Šabovics <b>Chemical composition of Latvian wild edible mushroom <i>Cantharellus cibarius</i></b>
P50.	R. Sausserde, K. Kampuss <b>Composition of carotenoids in calendula (<i>Calendula officinalis</i> L.) flowers</b>
P51.	A. Šalaševičienė, L. Vaičiulytė-Funk, I. Koscelkovskienė <b>Impact of low temperature on prolonged time treatment on the porcine muscle quality and safety of the final products</b>
P52.	L. Tomsone, E. Sturmovica <b>Evaluation of rapeseed meal extract efficiency for prevention of unrefined rapeseed oil oxidation</b>
P53.	V. V. Nazarova, V. A. Balubash, V. L. Ivanov <b>Express analysis of determining the amount of gluten in wheat flour</b>
P54.	D. Kunkulberga, I. Gedrovica, V. Ozolina, I. Ciprovica, V. Sterna <b>Acrylamide reduction options in rye bread</b>
P55.	V. Čeksterytė, P. R. Venskutonis, R. Kazernavičiūtė, B. Kurtinaitienė, J. Balžekas <b>Antioxidant activity of different botanical origin honey</b>
P56.	A. Dizgalve, K. Kampuss, R. Sausserde <b>Composition of the essential oil of peppermint (<i>Mentha piperita</i> L.)</b>
P57.	V. Šulniūtė, P. R. Venskutonis, J. R. Carballido, I. J. Moreno <b>Effect of methanol wheat and rye bran extracts on the stability of meat hamburgers</b>
P58.	A. Dandena, L. Žūka, M. Kostova <b>The content of polyphenols and anthocyanins in black chokeberry (<i>Aronia melanocarpa</i>) marc extracts depending on the extraction method</b>
P59.	V. Vaštakaitė, A. Brazaitytė, A. Viršilė, J. Jankauskienė, G. Samuolienė, S. Sakalauskienė, A. Novičkovas, R. Sirtautas, J. Miliauskienė, P. Duchovskis <b>Effect of supplementary short-term red leds light exposure on antioxidant capacity of <i>Beta vulgaris</i> microgreens</b>
P60.	K. Gaivelyte, V. Jakstas, V. Janulis <b>Composition of flavonoids and phenolic acids in leaves of genus <i>Sorbus</i> L.</b>

# FOODBALT 2014

Poster No.	Author, Title of Poster
P61.	M. Liaudanskas, P. Viškelis, D. Kviklys, R. Raudonis, J. Lanauskas, J. Viškelis, V. Janulis <b>Determination of chlorogenic acid and flavonoids of selected apple cultivars grown in Lithuania</b>
P62.	N. Skvortsova, A. Shleikin <b>The content of reduced glutathione in the yeast <i>Saccharomyces cerevisiae</i> under cold storage</b>
P63.	P. Kendirci, T. A. Onogur <b>Comparison of three different techniques for extraction of volatiles from pistachio nuts</b>
P64.	K. Musayeva, A. Sederevičius, D. Beliavska-Aleksiejūnė <b>Investigations of the casein and somatic cells count dependence in cow's milk</b>
P65.	M. Ružauskas, I. Klimienė, R. Šiugždinienė, M. Virgailis, L. Vaškevičiūtė, R. Mockeliūnas, R. Plančiūnienė, A. Pavilionis <b>Antimicrobial resistance of coagulase-negative <i>Staphylococci</i> isolated from bovine milk in Lithuania</b>
P66.	M. Sabovics, E. Straumite, R. Galoburda <b>The influence of baking temperature on the quality of triticale bread</b>
P67.	Z. Kruma, T. Talou, R. Galoburda, L. Smolskaite, L. Tomsone, I. Alsina, R. Paulovica <b>Composition and properties of forgotten aromatic plants and mushrooms grown in Latvia and Midi-Pyrenees</b>
P68.	L. Brunava, I. Alsina, S. Zute, V. Sterna, Z. Vicupe <b>Investigation of yield and quality parameters for oat cultivars</b>
P69.	V. Sterna, S. Zute, L. Brunava, Z. Vicupe <b>Lipid composition of oat grain grown in Latvia</b>
P70.	I. Raudoniūtė, A. Pukalskas, P. R. Venskutonis, V. Fogliano <b>The effect of plant extracts and phytochemical compounds on the formation of Maillard reaction products in model system</b>
P71.	L. Priečina, D. Karklina <b>Determination of major sugars in fresh and dried spices and vegetables using high performance liquid chromatography</b>
P72.	A. Kaleda, L. Taal, K. Laos <b>Extraction of ice structuring proteins from winter rye and winter wheat and assessment of activity</b>
P73.	D. Povilaitis, P. R. Venskutonis <b>Extraction of bioactive compounds from rye bran using different extraction techniques</b>
P74.	R. Paulovica, L. Smolskaite, T. Talou, Z. Kruma <b>TLC bioautography-guided detection of antioxidants from mushroom extracts</b>
P75.	R. Riekstina-Dolge, Z. Kruma, I. Cinkmanis, E. Straumite, M. Sabovics, L. Tomsone <b>Influence of <i>Oenococcus oeni</i> and oak chips on the chemical composition and sensory properties of cider</b>
P76.	M. Ružauskas, L. Vaškevičiūtė, R. Siugždinienė, I. Klimienė, M. Virgailis, R. Planciūnienė, R. Mockeliūnas, A. Pavilionis <b>Prevalence</b>

# FOODBALT 2014

Poster No.	Author, Title of Poster
	<b>and antimicrobial susceptibility of methicillin-resistant <i>Staphylococcus</i> spp. isolated from poultry products</b>
P77.	R. Galoburda, S. Boca, I. Skrupskis, D. Seglina <b>Physical and chemical parameters of strawberry puree</b>
P78.	M. Rubinskienė, P. Viškelis, J. Viškelis, R. Bobinaitė, M. Shalkevich, D. Urbonavičienė <b>Biochemical composition and antioxidant activity of Japanese quince fruits and their syrup and candied fruit slices</b>
	<b><i>Food material / packaging interaction</i></b>
P79.	S. Senhofa, E. Straumite, D. Klava <b>Cereal muesli with seeds quality changes during storage</b>
P80.	L. Dukajska, E. Ungure, S. Muižniece-Brasava <b>Interaction of sugar confectionary sherbet quality parameters during storage time in different packaging materials</b>
P81.	R. P. F. Guiné, C. F. F. Almeida, P. M. R. Correia <b>Properties of hazelnut as influenced by packaging and storage</b>
	<b><i>Sustainable processing and packaging</i></b>
P82.	O. Bundinienė, V. Zalatorius, D. Kavaliauskaitė, R. Starkutė <b>Efficiency of the additional fertilization with nitrogen fertilizers growing carrot of exceptional quality and its influence on production storage</b>
P83.	V. Speičienė, D. Grauzdytė, D. Leskauskaitė <b>Effect of pork backfat substitution with rapeseed oil in water emulsions on the physico chemical properties of model meat systems</b>
P84.	B. Koç, F. Kaymak-Ertekin <b>The effect of spray drying processing conditions on physical properties of spray dried maltodextrin</b>
	<b><i>Consumer behaviour and sensory issues</i></b>
P85.	G. Juodeikiene, L. Basinskiene, D. Vidmantiene, D. Klupsaite, E. Bartkiene <b>The use of face reading technology to predict consumer acceptance of sugar confectionary products</b>
P86.	E. Yilmaz, Y. Orman, G. Unakitan, B. Basaran <b>Current eating patterns and life style on the health of Hamik Kemal university students</b>
P87.	Y. Oraman, E. Yilmaz, G. Unakitan, B. Basaran <b>An analytic study of university students's nutritional habits and attitudes as a part of society in Turkey</b>
P88.	I. Mūrniece, L. Everosne <b>Analysis of nutritional information shown on the labels of bread produced in Latvia</b>
P89.	M. J. Barroca, C. A. C. Martinho, R. P. F. Guiné <b>A Portuguese survey about the knowledge and attitudes of the population regarding</b>

# FOODBALT 2014

---

Poster No.	Author, Title of Poster
	<b>dietary fibres</b>
P90.	A. Vinozzi, N. Divanach, T. Talou <b>Can food/flavor pairing be an usable tool for flavorings formulation?</b>
	<i>Food chain management (raw materials, logistics, economics, information systems, etc.)</i>
P91.	D. Pyanov, A. Delmukhametov, E. Khrustalev <b>Pike-perch farming in recirculating aquaculture systems (RAS) in the Kaliningrad region</b>
P92.	I. Eizenberga, Y. Derman, M. Lindström, H. Korkeala, A. Bērziņš <b>Perevalance of <i>Clostridium botulinum</i> in the gulf of Riga</b>
P93.	V. Liorančas, O. Levuškinas <b>Impact of stunning on carp bream meat quality</b>
P94.	I. Stuogė, V. Ribikauskas, R. Juodka, G. Švirmickas <b>Lithuanian experience on the assessment of poultry welfare in organic and conventional farms</b>

---

**ORAL PRESENTATIONS**

# FOODBALT 2014



## STANDARD METHODS AND CRITERIA TO PREDICT BREAD CEREAL QUALITY – DO THEY STILL MEET THE DEMANDS OF MODERN RAW MATERIALS AND THEIR PROCESSING?

### Meinolf G. Lindhauer

Max Rubner-Institut (MRI) – Federal Research Institute for Nutrition and Food  
Department of Safety and Quality of Cereals, Schuetzenberg 12, D-32756 Detmold, Germany

Reliable prediction of the baking behaviour of bread cereals (wheat, rye) is of utmost importance in the respective production, trade and processing. Consequently, there is great interest in easy to handle, rapid and precise methods. A broad variety of such methods has been established by international standardisation organisations like ICC, AACCI, ISO and CEN, respectively, to assess a wide range of criteria of grain raw material and products thereof.

In wheat because of its gluten functionality in baking performance protein quantity and quality assessment criteria play a decisive role. In addition, starch characteristics maybe of significance.

In this respect, it has become tradition in practical wheat trade and buying decision making to measure raw protein content (by the Kjeldahl or Dumas method, preferably by NIR), protein quality (as sedimentation value), and Falling number, only. Data received are then put into relation to the bread volume tentatively to be expected.

In rye starch and pentosan quantity and quality play the crucial role in baking performance. Thus, the amylogram data gelatinisation maximum and gelatinisation temperature serve as criteria of quality prediction.

The presentation will show that progress in wheat and rye breeding on the one hand and the increased diversity in baked goods on the market have made the prediction reliability of traditional methods questionable, at least in specific cases. Furthermore, the technical procedure of performing individual methods will have to be evaluated to avoid misleading results.

**Keywords:** wheat, rye, baking quality, standard methods.

For further information please contact: [meinolf.lindhauer@mri.bund.de](mailto:meinolf.lindhauer@mri.bund.de)

## PERCEPTIONS AND PREFERENCES RELATED TO SALTY TASTE IN FOODS

### Hely Tuorila

Department of Food and Environmental Sciences, Faculty of Agriculture and Forestry, University of Helsinki, Agnes Sjöberginkatu 2, Helsinki, Finland

Salty taste of sodium chloride is innately pleasant for humans. The tendency to like salty taste, along with easy access to salt and the availability of salt-containing foods has raised the consumption to a level where it is considered a health risk. Food industry and individual consumers should find ways to reduce salt intakes without losses in taste and enjoyment from food. The presentation will review the background and evidence of preference for salty taste and the prospects of modifying individual salt preferences. Examples of the impact of sodium chloride on taste and other sensory qualities of different foods will be shown. Potential strategies in reducing sodium contents of foods, including the substitution by other salts and other ingredients, will be discussed in the light of current research findings.

**Keywords:** taste, sodium, sensory, consumer.

For further information please contact: [hely.tuorila@helsinki.fi](mailto:hely.tuorila@helsinki.fi)

## BIOREFINERY OF AGROMATERIALS PROCESSING BY-PRODUCTS FOR HIGH ADDED VALUE INGREDIENTS

**Petras Rimantas Venskutonis**

Department of Food Science and Technology, Kaunas University of Technology, Radvilėnų road, 19, LT-50254, Kaunas, Lithuania

The term 'biorefinery' is defined as a facility integrating biomass conversion processes and equipment to produce fuels, power, heat, and value-added chemicals. Some plant origin agromaterials result in large amounts of processing by-products; most of them are being used rather inefficiently, mainly due to the absence of tailor-made technologies based on comprehensive research. For instance, biologically valuable polyphenolic compounds such as antioxidants may be isolated from the juice press-cakes, the residues of essential oil distillation and other by-products. Antioxidant activity, the presence of antioxidants and the possibilities of their isolation and application were intensively studied, including such residual sources as potato peel waste, rape of olive, olive mill waster waters, grape seeds, grape pomaces and its peels, apple pomaces, citrus seeds and peels, carrot pulp waste, old tea leaves, cocoa by-products, hulls from peanut, mung beans and buckwheat, wheat and rye bran, coat of tamarind seeds, nonvolatile residues from essential oil production, soybean molasses, spent ground coffee, etc. The wasted by-products can present similar or even higher contents of bioactive compounds, including natural antioxidants, than the final produce does. For instance, remarkably larger fraction of polyphenolics remain in berry juice press-cakes than in the extracted juice. Taking into account that more than 10 000 plant species have been used for food in human nutrition history, a great number of them remain underinvestigated and underexploited. Therefore, there is an obvious need to promote the application of biorefinery concept in the processing of agricultural crops highlighting the possibility of the integral exploitation of by-products rich in bioactive compounds. Valorisation of agricultural and food origin by-products increases business opportunities for stakeholders in the industry. It is also important to note that modern technologies such as sub- and supercritical fluid, microwave and ultrasonic extraction and fractionation, ultrafiltration, chromatographic separation, encapsulation, microbial and enzymatic treatments applied to plant processing materials expand our opportunities to produce and isolate high added value functional ingredients for many applications.

**Keywords:** biorefinery; agromaterials residues; polyphenolics; antioxidants.

For further information please contact: [rimas.venskutonis@ktu.lt](mailto:rimas.venskutonis@ktu.lt)

## DETERMINING OFF-ODORS IN FOOD: CASE STUDY ON PICKLES

**Kristel Vene, Keili Kajava**

Competence Center of Food and Fermentation Technologies, Akadeemia tee 15A, 12618, Tallinn, Estonia

Off-odor in food is the first indication that something is wrong with the product, but how to determine a compound or compounds that are unknown to begin with. The aim of the study was to identify the source of an off-odor in pickles. The producer provided “BAD” samples returned with a customer complaint and “GOOD” samples for comparison. To solve this task, sensory and instrumental analysis including SPME-GC/MS (tof) and GC-Olfactometry utilising three trained assessors was used. A strong plastic-like off-odor detected by all sensory assessors and also by GC-Olfactometry was found to be 2-chloro-6-methylphenol (ret. index 1096, using DB5-MS column). The source of this compound in the pickles is most probably a reaction between two disinfectants used on the production line: one which contained cresols and the other, which contained sodium hypochloride. The contamination with the off-flavor is a result of a bad rinsing.

**Keywords:** off-flavor, 2-chloro-6-methylphenol.

For further information please contact: [kristelvene@tftak.eu](mailto:kristelvene@tftak.eu)

## CHARACTERIZATION OF THE AROMA PROFILE OF DIFFERENT HONEYS AND CORRESPONDING FLOWERS USING SPME-GC/MS AND GC-OLFACTOMETRY

**Sirli Seisonen**<sup>1,2</sup>, **Evelin Kivima**<sup>1,2</sup>, **Kristel Vene**<sup>1,2</sup>

<sup>1</sup> Department of Food Engineering and Product Development, Tallinn University of Technology, Ehitajate tee 5, 12618, Tallinn, Estonia

<sup>2</sup> Competence Center of Food and Fermentation Technologies, Akadeemia tee 15A, 12618, Tallinn, Estonia

The aroma profile of thirteen different honey samples from four botanical origins: heather (*Calluna Vulgaris*), raspberry (*Rubus idaeus*), rape (*Brassica napus*), alder buckthorn (*Frangula alnus*) and blossoms of four corresponding flowers were investigated to find odor-active compounds exclusively representing specific honeys based on odor-active compounds from the blossoms. Gas-chromatography mass-spectrometry (GC/MS) and gas-chromatography-olfactometry (GC-O) were used to determine and identify the odor-active compounds. Data was analyzed using Agglomerative Hierarchical Clustering (AHC) and Correspondence Analysis (CA). 46 odor-active compounds were found using GC-Olfactometry, which had detection frequency more than 33%. Honeys from same botanical origin clustered together, however, no exclusively common compounds were found between honey and the representing blossom. The aroma profiles of different honeys were rather similar. The most commonly used descriptors were floral and honey-like, and also green and grass. Typical non-herbal aromas were leather, mushroom, metallic and urine. Many compounds had also sweet aromas, like candy and vanilla. Heather honey had the most different flavor profile compared to the others. Isophorone and 2-methylbutyric acid were found only in heather honeys. Heather honey can be characterized by having more “sweet” and “candy-like” notes, raspberry honeys had “green” and “apple” notes, alder buckthorn had more “honey” and “floral” notes. No specific aroma notes can be pointed out in rape honeys.

**Keywords:** honey, GC-O, SPME.

For further information please contact: [sirli@tftak.eu](mailto:sirli@tftak.eu)

## DETERMINATION OF NITRATE AND NITRITE LEVELS OF MINERAL WATER AND DRINKING WATER SAMPLES SOLD IN TURKEY

**Özgül Özdeştan, Tuğçe Erol, Burcu Acar**

Food Engineering Department, Faculty of Engineering, Ege University, 35100, Izmir-Turkey

Nitrate and nitrite levels in our natural water supplies are important indicators of water quality. Nitrite has several adverse effects upon human health. Nitrite can interact with hemoglobin to form methemoglobin by oxidation of ferrous iron ( $Fe^{2+}$ ) to the ferric state ( $Fe^{3+}$ ) thus preventing or reducing the ability of blood to transport oxygen, a condition described as methemoglobinemia that is dangerous, especially in infants (the so-called blue-baby syndrome). In the stomach, the reaction between nitrite and secondary amines leads to the formation of nitrosamines (N-nitroso compounds), some of which are known as carcinogenic, teratogenic, and mutagenic and increase risk of cancer of the stomach and esophagus. The aim of this study was to determine the levels of nitrate and nitrite in commonly consumed mineral water and drinking water samples in Izmir in Turkey. Spectrophotometric method was used for the determination of nitrate and nitrite levels in thirty samples. The principle of the method was reduction of nitrate to nitrite with cadmium acetate solution and zinc powder, and then treatment with Griess reagent. Fifteen brands of mineral water and drinking water samples were analyzed to determine nitrate and nitrite levels. Results were evaluated statistically. According to the results of the present study, nitrate and nitrite levels in the mineral water and drinking water samples were not found in concentrations considered to be hazardous in terms of public health.

**Keywords:** drinking water, mineral water, nitrate, nitrite.

For further information please contact: [ozgulozdestan@gmail.com](mailto:ozgulozdestan@gmail.com)

## SOLVENT EXTRACTION OF EGG YOLK OIL FROM LIQUID EGG YOLK

**Aleksandrs Kovalcuks, Mara Duma**

Department of Chemistry, Food Technology Faculty, Latvia University Of Agriculture, 2 Liela Street, Jelgava, Latvia

The egg yolk lipids have a very high nutritional value. Due to the fatty acid profile, high oil soluble vitamin and lecithin content egg yolk oil can be used as a very good additive to a human nutrition. There are several methods for oil extraction from egg yolks are known, but in this manuscript solvent extraction of egg yolk oil from the liquid egg yolk were studied as a most economically reasonable. The aim of this study was to compare two different solvent mixtures ethanol/chloroform (30/70 by volume) and 2-propanol/hexane (30/70 by volume) for oil extraction from liquid egg yolk and determine quality and nutritional properties of extracted oils. As a liquid egg yolk was used for extraction of oil, the choice of the solvents was based on solvents polarities. Also boiling temperature and toxicity of the solvents were taken in account. The yield of extracted crude oil, water content, solvent residue, fatty acid profile and  $\beta$ -carotene content were determined and compared. The results show that extraction with 2-propanol/hexane gave higher yield of the crude oil than ethanol/chloroform,  $28.90 \pm 0.27\%$  and  $26.37 \pm 1.04\%$  respectively. High water content and solvent residue in both oils means that there is a purification of solvent extracted egg yolk oil is needed. There was no significant difference in fatty acid profile in both oils, but  $\beta$ -carotene content was higher in oil extracted with 2-propanol/hexane  $81.02 \pm 0.37 \text{ mg kg}^{-1}$ , than in ethanol/chloroform extract  $73.16 \pm 1.53 \text{ mg kg}^{-1}$ .

**Keywords:** solvent extraction, egg yolk oil.

For further information please contact: [aleksandrskovalcuks@ibcox.lv](mailto:aleksandrskovalcuks@ibcox.lv)

## WHEAT VARIETIES CAN BE DIFFERENTIATED BY THEIR SENSORY PROFILES

Gerrard Starr, Wender L. P. Bredie, [Åse S. Hansen](#)

Department of Food Science, Rolighedsvej 26, 1958 Frederiksberg C, University of Copenhagen Denmark

The flavour of bread is influenced by the dough fermentation and baking processes, and it has not been considered that the wheat varieties could have any influence on bread flavour. The aim of this work was to investigate if it is possible in the first place to differentiate between wheat varieties by their sensory profiles of cooked grains. In this study sensory profiles were established for 24 samples of cooked wheat grain representing different wheat species, landraces and cultivars. The samples were evaluated by a trained sensory panel, and based on the results, the wheat samples could be divided into groups based on their sensory properties. Ancient wheat species, landraces and older cultivars were dominated by flavour of oat porridge and bulgur, while the flavour of more recent cultivars were described as wild rice, cooked malt, bitter and cocoa. Bitter flavour positively correlated to dark appearance. This work will be continued to investigate if the wheat varieties have influence on the flavour of the corresponding bread.

**Keywords:** wheat variety, cooked grain, sensory profile, flavour.

For further information please contact: [aah@food.ku.dk](mailto:aah@food.ku.dk)



## EGG PASTA (ERİŞTE) PRODUCED FROM WHOLE GRAIN OAT FLOUR

Ömer Güvendi, Erkan Yalcın

Department of Food Engineering, Faculty of Engineering & Architecture, Abant İzzet Baysal University, 14280 Gölköy Campus, Bolu, Turkey

Egg pasta, which is a traditional product, is usually called as '*Erişte*'. *Erişte* is made of bread wheat flour (BWF), semolina, water, salt and egg. In this study, *eriştes* were produced by incorporating refined or whole grain oat flours (ROF, WOF, respectively) at different levels (25, 50 and 100%; w/w) instead of BWF. Some chemical and quality properties of *eriştes* were investigated and compared to the control *eriştes* prepared with BWF or durum semolina. The highest ash, protein and titration acidity contents were obtained with the *erişte* prepared with 100% WOF. The crude oil contents of controls and oat incorporated *eriştes* changed between 1.2–6.1%. The brightness (*L*) values of the oat incorporated *eriştes* were lower than the controls. An increasing of WOF level caused gradually an increase in the redness (*a*) of *eriştes*. The yellowness (*b*) values of WOF incorporated *eriştes* were higher than ROF incorporated *eriştes* and control *erişte* produced with BWF. Cooking properties of *eriştes* prepared with oat flours were generally lower than those of controls. Total dietary fiber contents of *eriştes* prepared with ROF or WOF were in the ranges of 5.29–9.16%, or 8.41–18.25%, respectively.  $\beta$ -glucan contents of uncooked *eriştes* were generally higher than that of cooked *eriştes*. WOF containing uncooked *eriştes* had higher  $\beta$ -glucan content than those of ROF containing ones. Total phenolic compound contents of all cooked *eriştes* considerably decreased, and the reduction was largely observed in WOF included *eriştes*. Antioxidant activities of oat included uncooked *eriştes* were higher than that of controls.

**Keywords:** oat, whole grain, egg pasta, *erişte*, dietary fiber,  $\beta$ -glucan.

For further information please contact: [yalcin\\_e@ibu.edu.tr](mailto:yalcin_e@ibu.edu.tr)

## INVESTIGATION OF TOTAL DIETARY FIBRE, VITAMIN B<sub>1</sub> AND B<sub>2</sub> CONTENT IN DRY MIXTURES FOR PASTA PRODUCTION

**Solvita Kalnina, Tatjana Rakcejeva, Ilze Gramatina, Daiga Kunkulberga**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

Cereal-based foods have been staples for humans for millennia. Cereal grains contain the macronutrients (protein, fat and carbohydrate, dietary fibre) required by humans for growth and maintenance. They also supply important minerals, vitamins and other micronutrients essential for optimal health. Traditionally wheat flour is used for pasta production. No essential data is found about several whole grain flour uses in pasta production. The main purpose of the current research was to investigate total dietary fibre and vitamin B<sub>1</sub> and B<sub>2</sub> content in dry mixtures made from several types' whole grain flour for pasta production. In 2012 harvested from State Priekuli Plant Breeding Institute (Latvia) convectional rye 'Kaupo', wheat 'Zentos', hull-less barley PR 5099 and triticale 9405-23 grains was used in the experiments. For mixtures wheat flour 'Extra' From Ltd. 'Dobeles Dzirnavniesks' was used too. Following quality parameters of flours using standard methods was evaluated: total dietary fibre content was measured by Fibertec system 1010 Heat Extractor corresponding to ISO 5498 and vitamins B<sub>1</sub> and B<sub>2</sub> were measured by AOAC Official method 986.27 and 970.65 respectively. In the present research it was determined, that there are no found significant differences in vitamins B<sub>1</sub> and B<sub>2</sub> content in analysed flour samples. However lowest vitamins content was obtained for hull-less barley whole grain flour and highest – for whole wheat. Significant differences in dietary fibre and vitamins content were obtained in analysed whole grain flour mixtures.

**Keywords:** grains, vitamins, dietary fibre, pasta, mixture.

For further information please contact: [solvita.kalnina@inbox.lv](mailto:solvita.kalnina@inbox.lv)

**IN VITRO ANTIOXIDANT CAPACITY OF BREWER'S SPENT GRAIN****Vaida Kitrytė, Andrius Šaduikis, Petras Rimantas Venskutonis**

Department of Food Science and Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilenu Rd. 19, LT-50254, Kaunas, Lithuania

Brewers' spent grain (BSG), produced in large quantities throughout the year by small and large scale breweries, is the most abundant solid by-product of the brewing process. Although rich in various bioactive compounds, BSG is mainly utilized to produce animal feeds and fertilizers, while its applications for the development of natural dietary antioxidants and foods with particular functional properties are rather scarce up to date.

In order to broaden the knowledge in this field, total phenolic content, radical scavenging capacity and ferric reducing power of BSG and, in comparison, initial malt mixture (97.7% Pilsen, 2.2% Munich, 0.1% Karahel Dark) before and during wort mashing, was evaluated employing the novel QUENCHER approach for the Folin-Ciocalteu's, DPPH and FRAP assays, respectively.

Although 40% decrease in the total phenolic content ( $8.40 \text{ mg gallic acid g}^{-1}$ ) was determined, radical scavenging capacity ( $\text{TEAC}_{\text{DPPH}} = 6.51 \text{ mg Trolox g}^{-1}$ ) and ferric reducing power ( $\text{TEAC}_{\text{FRAP}} = 17 \text{ mg Trolox g}^{-1}$ ) of BSG remained high, comprising 96% and 88% of the initial malt activity, respectively. Therefore, the obtained results suggest that the losses in the content of phenolic compounds during wort mashing could be partially compensated via the heat-induced formation of novel compounds with potential antioxidant activity *in vitro*, such as melanoidins from the Maillard reaction.

**Keywords:** antioxidant activity, brewer's spent grain, malt, phenolic compounds.

**Acknowledgement.** This research was supported by the Research Council of Lithuania (Grant No. SVE-06/2011).

For further information please contact: [vaida.kitryte@ktu.lt](mailto:vaida.kitryte@ktu.lt)

## EVALUATION OF CONSERVATION CONDITIONS ON NUTS PROPERTIES

**Raquel P. F. Guiné**<sup>1,2</sup>, **Cátia F. F. Almeida**<sup>1</sup>, **Paula M. R. Correia**<sup>1,2</sup>

<sup>1</sup> Department Food Industry, ESAV, Quinta da Alagoa, Ranhados, 3500-606Viseu, Portugal

<sup>2</sup> CI&DETS – Polytechnic Institute of Viseu, Campus Politécnico, Repeses, 3504-510 Viseu, Portugal

Dried fruits like nuts are very much appreciated, but because of their low water activity may be susceptible to undesirable changes during storage. Therefore, this work was undertaken to study the effect of different storage conditions on three types of nuts commonly consumed in Portugal (almond, hazelnut and walnut). The samples were originated from different countries and while most had the internal skin on, one sample had it off. The storage conditions tested were: ambient temperature, high temperatures (50 and 50 °C) and low temperatures (refrigeration at + 2 °C and freezing at – 15 °C). The characteristics evaluated were water activity, moisture content, colour and texture.

The results obtained in the present work allowed concluding that the storage conditions that best preserve the characteristics of nuts are those at low temperatures, because, while the treatments at high temperatures induced in general more changes, the refrigeration and freezing systems had a lower effect on the products characteristics, particularly moisture, water activity, hardness and friability. Also the results indicate that the nuts stored under all conditions tested had values of water activity lower than 0.6, thus guaranteeing stability at the microbial and enzymatic levels. It was further concluded that the internal skin had a great influence on the characteristics of the nuts, particularly texture and colour, for all treatments tested.

**Keywords:** almond, colour, hazelnut, walnut, texture.

For further information please contact: [raquelguine@esav.ipv.pt](mailto:raquelguine@esav.ipv.pt)

## THE WETTABILITY AND SURFACE FREE ENERGY OF ACORN STARCH GELS ISOLATED BY ALKALINE AND ENZYMATIC METHODS

**Paula M. R. Correia<sup>1,2</sup>, Susete Gonçalves<sup>1</sup>, Helena Gil<sup>3</sup>, Jorge Coelho<sup>3</sup>**

<sup>1</sup> Department Food Industry, Agrarian High School of Viseu, Quinta da Alagoa Estrada de Nelas, 3500-606 Viseu, Portugal

<sup>2</sup> CI&DETS, Polytechnic Institute of Viseu, Av. Coronel José Maria Vale de Andrade, Campus Politécnico, 3504-510 Viseu, Portugal

<sup>3</sup> Faculty of Science and Technology of Coimbra University, Rua Sílvio Lima Univ. Coimbra - Pólo II, 3030-790 Coimbra, Portugal

Wettability may be a convenient parameter providing information on surface properties of starch gels surface. In food technology, a better understanding of the surface properties of gels can be useful in developing new food products and food components. The gelatinized starch has the property of forming gels, and when it is dehydrated, it forms a hard, transparent, bright, and resistant film. Starch biofilms are produced from gelatinization and after retrogradation of starch. This work aimed to study acorn starch gels wettability and their surface free energy, as well as the colour.

*Quercus suber* and *Quercus rotundifolia* fruits were dry and flour were produced. Starch was isolated from acorn flours by an alkaline and enzymatic laboratory scale methods. Starch gels films were prepared with starch suspensions of 1.2 and 3% from the isolated acorn starches. Contact angles were measured on dry starch gel films. Colour of films was measure using a colorimeter and the classification by CIELAB system.

The isolation method influenced the wettability of the acorn starch films form heated 3% starch suspensions. The acorn films presented high contact angles, meaning that films are hydrophobic, with less water affinity, for both starch isolation method, between 69.9–74.3° for *Q. rotundifolia* and 68.6–70.2° for *Q. suber*. The surface energy was different for acorn species and isolation methods, and it is high, which mean that acorn starch presented high intramolecular interactions forces. Films also presented similar transparency and were yellow brown in colour. Acorn starch films isolated through enzymatic method were browner.

**Keywords:** acorn fruits, starch, films, isolation methods, contact angle.

For further information please contact: [paularcorreia@hotmail.com](mailto:paularcorreia@hotmail.com)

## INFLUENCE OF PRE DRYING TREATMENT ON PHYSICAL PROPERTIES OF CARROTS

Maria João Barroca<sup>1</sup>, Susana A. Sérgio<sup>2</sup>, Raquel P.F.Guiné<sup>2,3</sup>, Paula M. R. Correia<sup>2,3</sup>

<sup>1</sup> Department of Biological and Chemical Engineering - Coimbra Institute of Engineering, Coimbra, Portugal

<sup>2</sup> Department of Food Industry, ESAV, Polytechnic Institute of Viseu, Viseu, Portugal

<sup>3</sup> CI&DETS – Polytechnic Institute of Viseu, Viseu, Portugal

Carrot (*Daucus carota* L.) is one of the most commonly used vegetables for human nutrition due to its pleasant flavour, nutritive value, and great health benefits related to its antioxidant, anticancer, healing, and sedative properties. Although carrots are widely consumed as fresh vegetables, due to their perishable nature, they also are subjected to different processes such as freezing, canning or dehydration to extend their shelf-life for distribution and storage. In the present work, the effect of pre-treatment of ascorbic acid on color changes and texture were investigated during hot convective drying at 60 °C. The pre-treatments were performed at 0.25% and 1% of ascorbic acid with pre-treatment times of 60 and 90 minutes. Changes in color and total color difference were evaluated by the CIELab color system and the texture of dried carrots was expressed in hardness, springiness, and cohesiveness. Regarding the total color difference, for the dried carrots soaked with ascorbic acid at both concentrations, it was observed that the pre-treatments did not have an effect on reducing the browning reactions. With respect to textural attributes, non-significant differences were observed in springiness and cohesiveness of untreated and pre-treated dried carrots, but the hardness increases at the pre-treatment time 90 minutes.

**Keywords:** pre-treatment, ascorbic acid, color, moisture content, texture.

For further information please contact: [mjbarroca@gmail.com](mailto:mjbarroca@gmail.com)

## PHYSICALLY-CHEMICAL PARAMETERS OF LATVIAN FRESH CRANBERRIES

**Karina Ruse, Tatjana Rakcejeva**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela iela 2, Jelgava, Latvia

Cranberries belong to a group of evergreen dwarf shrubs or trailing vines in the genus *Vaccinium* subgenus *Oxycoccus*. Berries contain a diverse array of nutrients with recognized biological activities that promote or contribute to health. The aim of the research was to evaluate physically-chemical parameters of Latvian fresh cranberries. The research was accomplished on fresh Latvian wild and large-berry cranberries harvested in Kurzeme region: wild cranberries and large-berry cranberries variety 'Steven', 'Ben Lear', 'Bergman', 'Pilgrim' and 'Early Black'. The following quality parameters of cranberries were analysed using standard methods: anthocyanins (spectrophotometric), colour (using the colour system CIE L\*a\*b\*), organic acids (high-performance liquid chromatography (HPLC)), polyphenols (HPLC), pH value (LVS ISO 1132:2001) The research results confirm a close interaction (strong positive correlation ( $r=0.919$ )) between the colour  $a^*$  component intensity and anthocyanin content. The highest content of benzoic acid was determined in large-berry cranberries of the cultivar 'Early Black' –  $13.66 \text{ mg } 100 \text{ g}^{-1}$ , which was by 56% higher than in wild cranberries –  $5.98 \text{ mg } 100 \text{ g}^{-1}$ , and by 65% higher than in the cultivar 'Steven' berries –  $4.82 \text{ mg } 100 \text{ g}^{-1}$ . The highest content of polyphenol compounds was found in cranberries of the cultivars 'Pilgrim', 'Early Black', and 'Steven'; while the lowest – in cranberries of the cultivar 'Bergman'. The average pH value for all samples was 2.465; it is slightly lower than found in the scientific literature.

**Keywords:** anthocyanins, organic acids, polyphenols, cranberries.

For further information please contact: [karinaruse@inbox.lv](mailto:karinaruse@inbox.lv)

## CONTENT AND ISOMERIC RATIO OF LYCOPENE IN 'SEMLO' VARIETY OF TOMATO

Dalia Urbonavičienė<sup>1,2</sup>, Pranas Viškėlis<sup>1,2</sup>

<sup>1</sup> Department of Food Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilėnu Rd., Kaunas, Lithuania

<sup>2</sup> Biochemistry and Technology Laboratory, Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kaunas str., Bābtai, Kaunas distr., Lithuania

Tomatoes (*Solanum lycopersicum* L.) are food staples that contain high levels of lycopene. Lycopene is an important nutrient, since it is a potent antioxidant. The heat and light induces lycopene oxidation and isomerization of the all-*trans*-form to the *cis*-form. Lycopene *cis*-isomers have been described to be more bioavailable than the naturally occurring in fresh tomato *trans*-isomers. High-performance liquid chromatography (HPLC) has been employed as a powerful technique to quantify low levels and various forms of carotenoids in foods. The analysis of carotenoids has been routinely performed by reversed-phase HPLC, because of its improved separation efficiency. The aim of this study was to verify the type and position of substituents in lycopene perform the appropriate chemical reactions in 'Semlo' variety of tomato. To verify geometric configuration, carry out iodine-catalyzed isomerization. Total lycopene and lycopene isomers were identified using high pressure liquid chromatography method with a diode array detector. Results of the study show that the  $\lambda_{\max}$  values of *trans*-lycopene will shift 3–5 nm to a lower wavelength whereas those of *cis*-lycopene (such as 13-*cis* and 9-*cis*-lycopene) will shift by the same amount to longer wavelengths.

**Keywords:** lycopene, isomerisation, HPLC, diode array detector.

**Acknowledgement.** This work was partly supported by a grant from the Research Council of Lithuania, No. SVE-02/2011.

For further information please contact: [dalia.mieliauskaite@stud.ktu.lt](mailto:dalia.mieliauskaite@stud.ktu.lt)



## THE INFLUENCE OF FERMENTATION TEMPERATURE ON THE DEVELOPMENT OF EXOPOLYSACCHARIDES IN YOGHURT PRODUCTION

**Jana Feldmane<sup>1</sup>, Inga Ciprovica<sup>1</sup>, Paveļs Semjonovs<sup>2</sup>, Raimonds Linde<sup>2</sup>**

<sup>1</sup> Faculty of Food Technology, Latvia University of Agriculture, 2 Liela Street, Jelgava, Latvia

<sup>2</sup> Institute of Microbiology and Biotechnology, Latvia University, 4 Kronvalda Boul., Riga, Latvia

Exopolysaccharides (EPS) have potential for development and exploitation as functional ingredients with health and economic benefits in dairy industry. The information on the biosynthesis, molecular organisation and fermentation conditions of EPS is rather scarce and the kinetics of EPS formation is poorly described. This study was designed to evaluate the effect of fermentation temperature on the development of lactic acid bacteria (LAB) starters EPS production potential. The commercial starters (Harmony 1.0, Twist 1.0 and YF-L902, Chr.Hansen, Denmark) are used for yoghurt production. Milk samples were incubated at 38 °C, 40 °C and 43 °C for 7, 6 and 5 hours, respectively, reaching pH 4.5. EPS and lactic acid concentration, LAB colony forming units (CFU) were measured in yoghurt samples using an appropriate analytical technique or standard procedures.

The production of intracellularly synthesized EPS varies roughly from 25.28 to 440.81 mg L<sup>-1</sup> during fermentation. The fermentation temperature significantly contributes to EPS concentration because the increased rate of fermentation temperature is attributed to increased metabolic activity of LAB, respectively from 2.7\*10<sup>7</sup> to 4.1\*10<sup>7</sup> CFU mL<sup>-1</sup>. Thermophilic strains produce maximal amounts of EPS under conditions optimal for growth. There isn't established the correlation between the amount of EPS and CFU of LAB in samples fermented at different temperatures, but there is found stable CFU concentration in samples with higher EPS concentration during the shelf-life of yoghurt. EPS in their natural environment are thought to play a role in the protection of the microbial cell against desiccation to phagocytosis and phage's attack, osmotic stress, adhesion to solid surfaces and biofilm formation. The fermentation temperature has a crucial role for the development of yoghurt quality and functional properties.

**Keywords:** exopolysaccharides, lactic acid bacteria, starters, yoghurt, fermentation.

For further information please contact: [inga.ciprovica@llu.lv](mailto:inga.ciprovica@llu.lv)

## QUALITY CHANGES OF NATURALLY FERMENTED KVASS DURING PRODUCTION STAGES

**Ivo Lidums, Daina Karklina, Asnate Kirse**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia

Commercially available beverages sold as kvass are kvass drinks and malt extract drinks, made by diluting grain extract concentrates with water and adding colourings, different flavours and artificial sweeteners. Kvass quality parameters are defined by the Republic of Latvia Cabinet Regulation No 926/2010 Quality and classification requirements for kvass and kvass (malt) beverage. Naturally fermented kvass is made from rye bread rusks without additional additives. The aim of this research was to assess the quality changes of naturally fermented kvass during production stages. Experiments were carried out at the Latvia University of Agriculture Department of Food Technology. Dry matter (refractometer, ISO 6496), active acidity (LVS EN ISO 10523:2012) and sensory properties (25 panelists; linescale ISO 4121:2003) were analysed in kvass samples during production stages.

During fermentation stage of naturally fermented kvass, pH drops from 4.08 to 3.77 and in later production stages pH is between 3.82 to 3.88, pH levels do not exceed the index values of the Cabinet Regulation.

Relative dry matter content reduced from 5.96% to 4.94%. Sensory evaluation showed that the intensity of flavour, aroma and acidity was most pronounced in kvass sample C (matured for 156 h), however, colour was most pronounced in kvass sample A (matured for 36 h). Longer maturation process aids in the formation of more robust flavour as well as yeast and protein residue.

**Keywords:** kvass, dry matter, active acidity, sensory evaluation.

For further information please contact: [ivo@riela.lv](mailto:ivo@riela.lv)

**EXTRUDED BEAN PRODUCT QUALITY EVALUATION**

**Liene Strauta<sup>1</sup>, Sandra Muizniece-Brasava<sup>1</sup>, Ina Alsina<sup>2</sup>, Tatjana Rakcejeva<sup>1</sup>**

<sup>1</sup> Department of Food technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

<sup>2</sup> Institute of Soil and Plant Sciences, Faculty of Agriculture, Latvia University of Agriculture, Strazdu street 1, Jelgava, Latvia

The aim of study was to develop food product made from beans (*Phaseolus vulgaris* L.) and to evaluate quality. Research was carried out at Latvia University of Agriculture Faculty of Food Technology. White beans were used in experiments. Beans were boiled, crushed and extruded with one screw extruder. Different additives were used, as ball peppers, tomatoes, spinach, garlic and red beet. Products quality were analysed at Faculty of Food Technology and Scientific Agronomic Research laboratory. Parameters as crude protein content, ash content, pH and colour were determinate. People at international exhibition "Riga Food 2014" were asked to give their opinion about experiment product. Average protein content for *Phaseolus vulgaris* L. extruded products were 25.5±0.4% of DM. Average ash content was 4.99±0.05% of DM and pH – 5.77. Dry matter was averagely 91.59±0.03%. No more than 5% of lignified protein had been found in product. In the same time sample of fresh *Vicia faba* L. was crushed extruded. The same analysis was made for this sample, indicating higher protein content – 34.8±0.4% of dry matter, higher pH – 6.33 and averagely the same ash and dry matter content.

**Keywords:** beans, extrusion, protein, ash.

For further information please contact: [kunka@inbox.lv](mailto:kunka@inbox.lv)

## EFFECTS OF STARCH CONCENTRATIONS ON PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF CAPE GOOSEBERRY LEATHER (PESTIL)

Osman Onur Kara, Erkan Karacabey, Erdoğan Küçüköner

Food Engineering Department, Engineering Faculty, Suleyman Demirel University, Isparta, Turkey, 32260

Pestil is a traditional Turkish snack, which is a kind of fruit leather. Fruit leathers are although classified as a confection, they are considered as alternative and healthy food snack. A wide variety of fruits are suitable for fruit leather production including grapes, apricots, plums, mulberries and apples. In this study, Cape gooseberry (*Physalis peruviana L.*) was studied which fruit attracted considerable attention in recent times. Cape gooseberry leather was produced at three different concentrations of starch (5%, 8%, 10%) and for each sample drying was performed at 80 °C in a cabin type dryer. The effects of starch concentration on physicochemical and functional properties (total phenolic and carotenoid contents and antioxidant activity) of Cape gooseberry leather were investigated and investigated results were compared with each other and with fresh ones. At the end of the process contents of phenolics (Folin-Ciocalteu method), carotenoids (acetone extraction measured with spectrophotometer) and antioxidant activity (free radical scavenging activity, DPPH) of leathers were low compared to fresh fruits. Changes in these functional compounds and antioxidant activity were found to be significant ( $p < 0.05$ ). Significant starch concentration dependent change in titratable acidity was determined. Thickness was not affected statistically significantly ( $p > 0.05$ ) by starch concentration. Cape gooseberry leather could be considered as a value-added product since its health beneficial potential and being alternative.

**Keywords:** Total phenolic content, carotenoid, DPPH, fruit leather.

For further information please contact: [erdogankucukoner@sdu.edu.tr](mailto:erdogankucukoner@sdu.edu.tr)

## APPLICATION OF ENZYMATIC TREATMENT TO IMPROVE THE CONCENTRATION OF BIOACTIVE COMPOUNDS AND ANTIOXIDANT POTENTIAL OF WHEAT AND RYE BRAN

**Vitalijs Radenkovs<sup>1,2</sup>, Dace Klava<sup>2</sup>, Inta Krasnova<sup>1</sup>**

<sup>1</sup> Latvia State Institute of Fruit-Growing, Graudu street 1, Dobele, Latvia

<sup>2</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

The present study was undertaken to establish the effect of enzymatic treatment on the content of total phenolic compounds and antioxidant activity in enzymatically treated bran. Enzymatic hydrolysis of bran was carried out by  $\alpha$ -amylase from *Bacillus amyloliquefaciens* (Sigma Aldrich) for breakdown the 1–4 and 1–6-glycosidic linkages. Multi enzyme complex (Viscozyme L) containing a wide range of carbohydrases were used for depolymerisation of cellulose and hemicelluloses molecules. The 80% ethanol was used to extract the antioxidant compounds from bran. Free radical scavenging activity of samples was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH.) assay and the data were expressed in Trolox equivalents (TE) per 100 g<sup>-1</sup> of sample, as well the reducing power was determined using FRAP assay and the data were expressed in the same indices. The obtained results showed that the enzymatically treated bran samples had the highest concentration of total phenolic compounds, on the other hand the enzymatically treated bran showed higher antioxidant potential than non-enzymatically treated bran samples. Extract from enzymatically treated rye bran had the highest concentration of phenolic compounds, 1230 mg GAE 100 g<sup>-1</sup> DW. The lowest concentration of phenolic compounds was found in untreated wheat bran samples and this amount was equal to 377 mg GAE 100 g<sup>-1</sup> DW. Two different methods of evaluation of the bran antioxidant activity showed potential usefulness of enzymatic treatment.

**Keyword:** phenolic compounds, antioxidant activity, bran, enzymatic hydrolysis.

For further information please contact: [vitalijs.rad@inbox.lv](mailto:vitalijs.rad@inbox.lv)

## EFFECT OF PULSED ELECTRIC FIELD TREATMENT OF BLUEBERRIES ON JUICE YIELD AND QUALITY

**Ramunė Bobinaite<sup>1</sup>, Saulius Šatkauskas<sup>1</sup>, Nerijus Lamanauskas<sup>2</sup>, Pranas Viškelis<sup>2</sup>,  
Gianpiero Pataro<sup>3</sup>, Giovanna Ferrari<sup>3,4</sup>**

<sup>1</sup>Vytautas Magnus University, K. Donelaičių st. 58, Kaunas, Lithuania

<sup>2</sup>Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kaunas st. 30, Babtai, Kaunas distr. Lithuania

<sup>3</sup>University of Salerno, Via Giovanni Paolo II 132, Fisciano (SA), Italy

<sup>4</sup>ProdAl scarl, Centre on Agro-Food Productions, Via Ponte don Melillo, c/o University of Salerno, Fisciano (SA), Italy

Traditional methods used to increase juice yield of fruits include heating and/or enzymatic treatment, which can have a negative impact on chemical and sensory quality of juice. Pulsed electric field (PEF) is a non-thermal treatment that can be used to improve mass transfer of inner liquids and intracellular compounds from plant materials by inducing permeabilization of the cell membranes. The objective of this study was to evaluate the effect of PEF pretreatment of blueberries (*Vaccinium myrtillus* L.) on the juice yield and quality of the juice. PEF pretreatment of constant electric field strength ( $3 \text{ kV cm}^{-1}$ ) and varying specific energy ( $1\text{--}10 \text{ kJ kg}^{-1}$ ) was applied to blueberries prior to their mechanical pressing. The juice yield and quality parameters of the juice (Brix°, pH, total phenolics, total anthocyanins, antioxidant activity) were evaluated and compared to juice obtained without PEF application (control). PEF pretreatment of blueberries increased the juice yield by 30% as compared to the control. Total phenolics content of the juice obtained from PEF pretreated berries was from 27% (energy input  $1 \text{ kJ kg}^{-1}$ ) to 45% (energy input  $10 \text{ kJ kg}^{-1}$ ) higher than that of the control juice. Similarly, application of PEF prior to juice pressing improved the total anthocyanins concentration in the juice up to 77% as compared to the control. Higher specific energy input resulted in better release of phenolic compounds and anthocyanins into blueberry juice. The ferric reducing antioxidant power increased from  $4.8 \mu\text{mol TE mL}^{-1}$  in control juice up to  $6.5 \mu\text{mol TE mL}^{-1}$  in juice of PEF pretreated (energy input  $10 \text{ kJ kg}^{-1}$ ) blueberries. In conclusion, with this study we demonstrated that PEF pretreatment of blueberries increased juice yield and improved phytochemical quality of the juice.

**Keywords:** PEF, juice extraction, phytochemicals, antioxidant capacity.

For further information please contact: [ramune.bobinaite@gmail.com](mailto:ramune.bobinaite@gmail.com)

## INFLUENCE OF THE LYOPHILISED VEGETABLE ADDITIVE ON THE FUNCTIONAL PROPERTIES OF MEAT PRODUCTS

**Viktorija Eisinaite, Rimante Vinauskiene, Ina Jasutiene, Daiva Leskauskaite**

Food Science and Technology Department, Faculty of Chemical Technology, Kaunas University of Technology, Radvilenuų Str. 19, Kaunas, Lithuania

Worldwide there are a number of meat products with vegetable additives. Usage of vegetables can improve emulsifying properties of meat, increase the water holding capacity, and reduce thermal losses. It also allows increasing the amount of dietary fibre in meat products. The aim of this work was to evaluate composition and functional properties of model minced meat products and smoked sausages with onion, leek, celery, peas, parsley, and green beans additives. Vegetables were freeze-dried and put in different quantities into model meat products (0.5%, 1% and 3%) and cold smoked sausages (1.5% or 3%). Content of minerals in all samples were similar – the largest 2.33% in sample with celery, and the lowest 1.81% in sample with onions. Fat content in the samples with vegetable additives was found 13.62–14.94%, in the control sample it was a little bit higher – 15.62%. Content of protein in all investigated samples were from 21.32% to 24.64%. All investigated vegetable additives increased water holding capacity and reduced thermal losses. When content of vegetable additive increased, water holding capacity and yield also increased. The greatest impact on yield increase has lyophilized celery: 0.5% of celery increased yield by 1.51% and the addition of 3% – by 6.48%. Content of benzoic and free glutamic acid as well as active acidity was higher in cold smoked sausages with vegetable additives compare to control sample. Addition of vegetables affects the sensory and colour characteristics of the products, but all the products were acceptable to consumers.

**Keywords:** meat product, vegetables, chemical composition, colour.

**Acknowledgement.** Research was funded by a grant No. SVE-07/2011 and SVE-07/2014 from the Research Council of Lithuania

For further information please contact: [viktorija.eisinaite@ktu.lt](mailto:viktorija.eisinaite@ktu.lt)

## OAT HULLS AND SEA BUCKTHORN POMACE – A POTENTIAL SOURCE OF ANTIOXIDANTS FOR HEMPSEED OIL

Sindija Zēberga, Maija Strēle, Anna Vojevodova, Inese Mierina, Māra Jure

Faculty of Material Science and Applied Chemistry, Riga Technical University, Paula Valdena Street 3, Riga, Latvia

Hempseed oil, as well as other oils containing polyunsaturated fatty acids, is subjected to oxidation processes caused by air, heat or light. Usually these processes are suppressed by addition of various synthetic phenol type antioxidants. The aim of current research was to increase oxidative stability of vegetable oils with natural antioxidants. Herein, we demonstrate that the oxidative stability can be increased with natural antioxidants present in oat hulls and sea buckthorn pomace – by-products of food processing. Extracts from oat hulls or sea buckthorn pomace were prepared by maceration of ground plant material in the hempseed oil. The extraction was accelerated by ultrasound. It was established that the highest amount of polyphenols in extracts of both plant materials can be achieved within 30 min; further increase of extraction time sometimes even reduced the total amount of polyphenols. The highest amount of polyphenols (Folin-Ciocalteu method) in sea buckthorn extracts was  $7.73 \pm 0.29$  mg GAE  $100 \text{ g}^{-1}$ , but in oat hull extracts –  $4.63 \pm 0.21$  mg GAE  $100 \text{ g}^{-1}$ , when extracts were prepared by ultrasonification of hempseed oil containing 5% wt of plant material. Various amounts of plant material additives were used for extraction under optimized conditions. The highest antioxidant activity (detected at accelerated oxidation conditions and expressed as ratio of time when peroxide value of sample and blank reaches 48 meq.  $\text{O}_2 \text{ kg}^{-1}$ ) – 1.51 and 1.40 to 1.44, respectively – had extracts obtained from 1% wt additive of sea buckthorn pomace or 2.5-5% wt additive of oat hulls. The prepared hempseed oil extracts demonstrated higher oxidative stability than hempseed oil containing 0.02% additive of synthetic antioxidant BHT.

**Keywords:** hempseed oil, oat hull, sea buckthorn pomace, oxidative stability.

For further information please contact: [mara@ktf.rtu.lv](mailto:mara@ktf.rtu.lv)



## GAS CHROMATOGRAPHIC DETERMINATION OF POLAR AND NON-POLAR PESTICIDES IN APPLE MATRICES BY USING DIFFERENT SAMPLE PREPARATION METHODS

**Géraldine Giacinti<sup>1,2</sup>, Valérie Simon<sup>1,2</sup>, Christine Raynaud<sup>1,2</sup>**

<sup>1</sup> Université de Toulouse, INPT, LCA (Laboratoire de Chimie Agro-Industrielle), ENSIACET, 4 Allée Emile Monso, Toulouse, France

<sup>2</sup> INRA, LCA (Laboratoire de Chimie Agro-Industrielle), ENSIACET, Toulouse, France

Pesticides are of great importance in crop production. They are widely used to fight against pests and diseases. Therefore, day after day, pesticides control has become an important matter for food industry because there is a great deal of concern about healthy diet, especially for baby food. European guideline 76/895/EEC limits drastically pesticide residues in fruits. Anyway, new sanitary requirements are emerging since the past few years that harden the market. Simultaneously, multiple studies are carried out in analytical chemistry to improve residues analysis in food matrixes. Previous works have shown that more than 90% of pesticides residues in the apple skin Extraction techniques can be adapted according to the polarity of targeted compounds. The aim of this research is to adapt extraction techniques according to physical/chemical properties of the target compounds.

A rapid, specific and sensitive multiresidue method based on the Quick Easy Cheap Effective Rugged and Safe (QuEChERS) sample preparation method and gas chromatography-ion trap/mass spectrometry in the mass tandem mode (GC/MS<sup>n</sup>) for the routine analysis of 12 pesticides among which Captan, Chlorpyrifos, Flonicamid, Fludioxonil in apple peel has been developed. Solid phase extraction (SPE) and HPTLC have been tested as an alternative and/or complement to solid dispersive phase extraction (SDPE). Evaluation of the method was made by comparison of recovery values, limits of quantitation (LOQ) in relation with EU MRLs for pesticides in apple fruits. Peel or fruit extraction can affect the quantitative response. The method was successfully applied to the analysis of commercially available apple samples.

**Keywords:** pesticides, apple, GC/MS<sup>n</sup>, sample preparation.

For further information please contact: [geraldine.giacinti@ensiacet.fr](mailto:geraldine.giacinti@ensiacet.fr)

## RHEOLOGY, TECHNOLOGICAL AND SENSORIAL CHARACTERISTICS OF FORTIFIED DRINK PRODUCTS WITH FIBERS

**Ausra Simoneliene, Ernesta Trečiokiene, Giedre Lukosiunaite, Gediminas Vysniauskas, Ernesta Kasparavičiute**

Food Technology Department, Faculty of Technology and Landscaping, Kauno kolegija/University of Applied Sciences, Pramonės pr. 22, Kaunas, Lithuania

Fruits, vegetables and grain all produce a complex carbohydrate known as fiber that plays an important role in overall health. As fiber passes through gastrointestinal system, it isn't absorbed or digested like protein or fat is. Instead, it stays in intestines to produce soft, formed stools that pass easily through body. Fiber also combines with fluid to create a gel-like substance that helps lower the level of cholesterol and glucose in blood. To make yoghurt even more beneficial to health and to replace conventional stabilizers with newer, healthier ones a research has been carried out, during which conventional processing aids used to improve the consistence of yoghurt, were replaced with orange pulp, pectin, bamboo and cane fibers. This study evaluated the effect of the supplementation of the same dietary fiber on the syneresis, stability, pH, acidity, dry matter content, viscosity and sensory evaluation of yogurt, juices and juice drinks. Dry matter content evaluation results showed that all the fibers were able to increase the dry matter content of yoghurt, juices and juice drinks. Viscosity measurements confirmed that fiber improved the consistence of yogurt. Results indicate that the Citri-Fi fiber is an almost applicable ingredient for the design of new high value-added yoghurt, juices and juice drinks.

**Keywords:** dietary fiber, yoghurt, juice drinks, texture.

For further information please contact: [ausra.simoneliene@go.kauko.lt](mailto:ausra.simoneliene@go.kauko.lt)

## NUTRITIONAL EVALUATION OF PULSE SPREADS IN COMPARISON TO NUTRIENT RECOMMENDATIONS

**Asnate Kirse, Daina Karklina**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

Non-dairy and reduced fat/calorie spreads are becoming important for health conscious people; as well as increasing consumer choice, animal product alternatives have the potential to contribute to overall public health. Pulses and pulse products are primarily popular among vegetarian and health conscious consumers and could benefit people struggling with dietary changes.

Therefore, the aim of this research was to analyse and collate nutritional values of four commercially available pulse (chickpeas or soy) spreads and one newly developed pulse (bean) spread in comparison to recommended daily intake (RDI) of nutrients for adolescents and adults.

Bean spread was made of ground re-hydrated cooked seeds of beans, to which salt, spices and other ingredients were added. Macro-nutrients were determined according to standard methods. Nutritional values of commercially available pulse spreads were given according to product label information.

The results show that there are significant nutritional differences among the tested pulse spreads ( $p < 0.05$ ). A serving (100 g) of pulse spreads covers 5.2–9.8% protein, 3.8–32.2% fat, 1.5–3.8% carbohydrates and 3.4–14.0% energy of RDI for adolescents while 6.9–12.0% protein, 5.7–46.8% fat, 1.7–4.1% carbohydrates and 4.2–16.8% energy of RDI is covered for adults.

A serving covers the least of RDI for male adolescents and the most for female adults out of the four groups. Pulses are a good source of B group vitamins; however, pulse spreads are low in folic acid. Solely the new bean spread also contains significant amount of thiamine.

**Keywords:** pulse spreads, nutritional value, recommended daily intake.

For further information please contact: [asnate.kirse@gmail.com](mailto:asnate.kirse@gmail.com)

**DETERMINATION OF GLUTEN IN FLOUR**

**Laila Ozola<sup>1</sup>, Evita Straumite<sup>1</sup>, Maris Lazdins<sup>2</sup>**

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

<sup>2</sup> Department of Microbiology and Biotechnology, Faculty of Biology, University of Latvia, Kronvalda bulv. 4, Riga, Latvia

Gluten-free products exclude all ingredients containing wheat, barley, rye, spelt and kamut proteins. The term “gluten-free” does not refer to the total absence of gluten. In definition of gluten-free, some residual amount of gluten is allowed; this amount is strictly regulated by Codex Alimentarius Standard. EU Commission Regulation No 41/2009 recommends that products not exceeding 20 mg kg<sup>-1</sup> of gluten should be considered gluten-free. Gluten is composed of distinct portions of monomeric, alcohol soluble gliadins and polymeric, prolamine rich glutenins, which are responsible for flour processing characteristics in bakery industry.

The aim of this research was to detect and analyse gluten content of various commercially available flour.

Research was divided in two parts – traditional commercially gluten-free flour (amaranth, soy, buckwheat, maize, rice) and cereals with gluten (oat, barley, rye, wheat) were analyzed to verify real amount of gluten. Thirty flour samples were analyzed in total.

Enzyme-linked immunosorbent assay (ELISA) Codex Alimentarius Method declared as Type 1 method for detection of gluten. Sandwich enzyme immune assay for the quantitative analysis of prolamins from flour was used in study. A microtiter plate spectrophotometer was used for quantification.

The results of gluten determination show that mostly all traditionally gluten-free flour not exceeding recommended amount of gluten. Amount of gluten in few samples are close to permitted limit (20 mg kg<sup>-1</sup>), which could explain the lack of safety rules during the technological process.

**Keywords:** gluten-free, gliadin, ELISA, cereals, gluten.

For further information please contact: [lailaozola@inbox.lv](mailto:lailaozola@inbox.lv)

## BIOTECHNOLOGY OF DAIRY PRODUCTS WITH HERBAL EXCIPIENTS FOR NUTRITION OF SCHOOL-AGE CHILDREN

**Svetlana Beliakova, Ludmila Krasnikova**

Department of Chemistry and Molecular Biology, Institute of Refrigeration and Biotechnologies, ITMO University, Lomonosov Str., 9, St. Petersburg, Russia

For rational nutrition of school children we propose to prepare the drinks on a combined milk-plant basis, which contains chickpeas or lentil flour. Chickpeas flour has a high content of manganese, selenium, zinc and vitamins in the optimal proportions. Lentils flour possesses of iron but hasn't fat. The protein mass fraction of lentils flour is greater than 30 % and its amino acids are well absorbed by the body. The aim of this work was the development of technology and formulations of acidic dairy products for school meals, by use of probiotic strains *L. acidophilus* 5e and *S. thermophilus* M in a ratio of 1 : 2, contained lentil or chickpeas flour. It was established that adding of these flours enhances the activity of Lactic acid bacteria and it leads to an increase in their amount in the finished product (up to one hundred million per cm<sup>3</sup>), and accordingly to reducing of the milk clotting time. The best taste and consistency organoleptic characteristics were in samples containing 1.6% of flour. The experimental samples possessed also improved rheological properties; the highest viscosity was in product containing lentil flour.

**Keywords:** acid dairy products, chickpeas, lentil.

For further information please contact: [krasnikoval@yandex.ru](mailto:krasnikoval@yandex.ru)

**DETERMINATION OF THE CONTENT OF COENZYMES Q<sub>9</sub> AND Q<sub>10</sub>  
IN PORK MEAT FROM DIFFERENT BREEDS****Sónia C. Andrade<sup>1</sup>, Raquel P. F. Guiné<sup>1,2</sup>, Luísa C. P. Roseiro<sup>3</sup>**<sup>1</sup> Department Indústrias Alimentares – Escola Superior Agrária de Viseu, Viseu, Portugal<sup>2</sup> CI&DETS – Instituto Politécnico de Viseu, Viseu, Portugal<sup>3</sup> Instituto Nacional de Investigação Agrária e Veterinária, Lisboa, Portugal

Meat contains basic and essential nutrients to humans, and recently has been given a special attention to the presence of bioactive compounds.

The objective of this work was the simultaneous determination of coenzymes Q<sub>9</sub> and Q<sub>10</sub> in pork meat, using HPLC. For this study were used 122 samples from different muscles and different breeds of pork meat. Besides, it was also evaluated the influence of animal breed and muscle type in the contents of CoQ<sub>9</sub> and CoQ<sub>10</sub>.

The results showed that the breed influenced significantly the mean content of CoQ<sub>9</sub> (0.70 mg 100 g<sup>-1</sup>) and CoQ<sub>10</sub> (3.76 mg 100 g<sup>-1</sup>) ( $P < 0.0001$ ), being this significantly higher in the meat from the breed Alentejano when compared to the other breeds (Large White and Landrace). The type of muscle was also responsible for the variation in the levels of coenzymes in the samples analysed ( $P < 0.05$ ) and ( $P < 0.0001$ ) respectively.

From the results obtained it was concluded that the breed Alentejano presented the highest contents in both coenzymes (CoQ<sub>9</sub> and CoQ<sub>10</sub>) and that, among the muscles evaluated, the muscle *Semimembranosus* (*Sm*) showed higher concentrations of CoQ<sub>10</sub>.

**Keywords:** chromatographic analysis, coenzyme Q<sub>9</sub>, coenzyme Q<sub>10</sub>, pork meat.

For further information please contact: [soniandrade89@hotmail.com](mailto:soniandrade89@hotmail.com)

## EFFECTS OF DIFFERENT EXTRACTION TECHNIQUES ON CAPE GOOSEBERRY FRUIT EXTRACTS

**Erkan Karacabey, Fırat Çınar, Erdoğan Küçüköner**

Food Engineering Department, Engineering Faculty, Suleyman Demirel University, Isparta, Turkey

Extraction process of bioactive compounds from their natural sources is an important step for the utilization of these substances as ingredients and additives in food, nutraceutical, pharmaceutical and cosmetic industries. Cape gooseberry, being relatively new fruit, was studied due to its high functional potential and health promoting effect. Extraction techniques have been widely investigated to evaluate the process performance in terms of yield of such valuable substances. In the present study it was aimed to figure out changes in the functional composition of Cape gooseberry fruit extracts obtained by stirred solvent extraction at room temperature and ultrasound assisted extraction. Ethanol/water extraction of Cape gooseberry fruit was investigated. Extracts produced by ultrasound assisted- and stirred extractions at room temperature were found to be rich in terms of total phenolic content ( $1.87\pm 0.05$  mg g<sup>-1</sup> DW fruit and  $1.86\pm 0.02$  mg g<sup>-1</sup> DW fruit, respectively) and to display high antioxidant activity measured by DPPH method (64% and 67% inhibition, respectively). Results indicated that both extraction methods provided high potential fruit extracts

**Keywords:** DPPH, Cape gooseberry, ultrasound assisted extraction, stirred solvent extraction.

For further information please contact: [erkankaracabey@sdu.edu.tr](mailto:erkankaracabey@sdu.edu.tr)

## NON-PRICE FACTORS THAT INFLUENCE CONSUMERS' WASTED FOOD AMOUNTS

**Tatjana Tokareva, Aija Eglīte**

Faculty of Economics and Social Development, Latvia University of Agriculture, Svetes street 18, Jelgava, Latvia

Each year the price of food products gradually increases, and some economists point out that to reduce the food prices, the food production increase must be managed. But even if some people suffer from hunger, others simply discard their food, so the possible food production increment can also increase wasted food amounts. One of the possible solutions to food product insufficiency is to cut down wasted food amounts. The main aim of this paper is to identify the non-price related factors that influence people to waste their food, look at food wasting matter from seller and buyer point of view, and also to identify the solutions to food wasting reduction. The results are based on research of theoretical guidelines and pilot research conducted in 2013, in which participated 605 respondents. Pilot research results shows that people are less concerned about reducing food wastage when it comes to environmental problems, but are the most motivated if they see a real opportunity to save money. So to motivate people waste less people need to be shown how their food wasting habit affect them economically.

**Keywords:** packaging, environment, storage, planning, labelling.

For further information please contact: [tatjana.tokareva@inbox.lv](mailto:tatjana.tokareva@inbox.lv), [aija.eglite@llu.lv](mailto:aija.eglite@llu.lv)



## HIGH-OXYGEN MODIFIED ATMOSPHERE PACKAGING OF ORGANIC MEATS?

**Friedrich-Karl Lücke, Sonja Schreiber**

Department of Nutritional, Food and Consumer Sciences, Fulda University of Applied Sciences,  
Marquardstr. 35, 36039 Fulda, Germany

In the last few years, it became widespread to package fresh meat for retail under modified atmosphere containing 70–80% oxygen (“high O<sub>2</sub>-MAP”). Oxygen preserves the bright-red colour of oxymyoglobin which is (sometimes erroneously) perceived by many consumers as an indicator for freshness while CO<sub>2</sub> (20–30%) inhibits obligate aerobic bacteria such as psychrotrophic *Pseudomonas* spp., the common spoilage agents for unpackaged fresh meat. On the other hand, high oxygen partial pressure has been shown to cause some oxidative changes in the meat, resulting in sensory deviations.

Use of high O<sub>2</sub>-MAP is also legally permitted for the packaging of organic meats. This may be regarded as being in conflict with the principle of “processing food with care” as stipulated by Article 6 of the Regulation (EU) 834/2007 on organic production and labelling of organic products. Therefore, the aim of our research was to provide information to decision-makers in the organic food chain on the necessity of high O<sub>2</sub>-MAP for organic meats. Literature data from market research show that even consumers of organic food seek “convenience” in purchasing and preparing it. Hence, of the major associations of organic agriculture in Germany, only Demeter e. V. prohibits the use of high O<sub>2</sub>-MAP. Literature data also indicate that undesirable changes of the meat could be delayed by reducing the oxygen content in the packages to about 40–50%, with only a slight reduction of shelf life. In our view, this would be a good compromise between “convenience” and eating quality.

**Keywords:** meat, packaging, modified atmosphere, organic.

For further information please contact: [friedrich-karl.luecke@he.hs-fulda.de](mailto:friedrich-karl.luecke@he.hs-fulda.de)

## PACKAGING MATERIAL AND STORAGE-INDUCED QUALITY CHANGES IN FLEXIBLE RETORT POUCH POTATOES' PRODUCE

**Aija Ruzaike, Sandra Muižniece-Brasava, Lija Dukajska**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela street 2, Jelgava, Latvia

Experiments have been carried out at the Latvia University of Agriculture Department of Food Technology. The aim of this work was to assess the quality changes of potatoes' produce in dry butter and mushroom dressings which was thermally treated in vacuum packed soft retort pouches and stored along 12 month at the ambient temperature of  $+18\pm 2$  °C. A retort pouch is a heat-resistant bag made of laminated plastic films or foil. It is then heat-sealed and sterilized by pressure cooking in a retort. Two laminated polymers with barrier properties: transparent polyamide/polyethylene (PA/PE) and light proof polyethylene terephthalate / aluminum / polyamide / polypropylene PET/ALU/PA/PP were used. Samples were analysed immediately after retort thermal treatment; and in further after 1, 2, 3, 4, 6, 8, 10 and 12 storage months. The quality changes of potatoes' produce during storage were characterized by measuring some parameters such as structure, pH, colour and microbiological parameters. Data obtained emphasize the importance of selected laminate PET/ALU/PA/PP with Al layer preventing light transparency which could provide stable quality of ready to eat retort pouch thermally treated potatoes' produce for long-duration up to 12 months.

**Keywords:** retort pouch, quality, storage, potatoes.

For further information contact: [aija.ruzaike@gmail.com](mailto:aija.ruzaike@gmail.com)

## ANTIOXIDANT ACTIVITY OF *BERGENIA CRASSIFOLIA* L. EXTRACTS ISOLATED BY PRESSURIZED LIQUID EXTRACTION

**Vaida Kraujalienė, Petras Rimantas Venskutonis**

Department of Food Science and Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilėnų Rd. 19, Kaunas, Lithuania

The aim of this study was to evaluate the process of isolation of bioactives compounds from leaves (BL) and roots (BR) of *B. crassifolia* using pressurized liquid extraction (PLE) with different polarity solvents, namely: hexane, acetone, ethanol:water (80:20) and water and to assess their ability to stabilize rape seed oil using Oxipres method.

The yields of *B. crassifolia* extracts obtained by PLE from roots and leaves were greatly dependent on the extraction solvent. The highest total phenolic content (TPC) expressed in gallic acid equivalents (GAE) in 1 g of dry weight (dw) was found in BR acetone extract (238 mg GAE g<sup>-1</sup> dw), which was approx. 22 times higher than in hexane extracts (10.7 mg GAE g<sup>-1</sup> dw). TPC in ethanol:water and water extracts of BR were, 194 and 134 mg GAE g<sup>-1</sup> dw, respectively. In case of BL extracts the highest TPC value was determined for ethanol:water extract, 189 mg GAE g<sup>-1</sup> dw, which was approx. 2.5 times higher than in acetone extract (75 mg GAE g<sup>-1</sup> dw) and more then 5.5 times higher then in water extract (32.7 mg GAE g<sup>-1</sup> dw). The lowest TPC value was measured for BL hexane extract, 5.65 mg GAE g<sup>-1</sup> dw.

The acetone extracts of BL and water extract of BR found to be the most effective natural antioxidants measured by the Oxipres method, their 0.5% additives prolonged oxidation initiation period of rape seed oil 1.86 and 1.79 times, respectively.

**Keywords:** antioxidant activity, *Bergenia crassifolia* L., pressurized liquid extraction, polyphenolics.

For further information please contact: [vaidakraujaliene@gmail.com](mailto:vaidakraujaliene@gmail.com)

## MICROBIOLOGICAL QUALITY OF MEAT, MEAT PREPARATIONS AND MEAT PRODUCTS

**Aija Melngaile, Elīna Ciekure, Olga Valciņa**

Institute of Food Safety, Animal Health and Environment BIOR, Lejupes Street 3, Riga, Latvia

The aim of the research was to perform trend analysis to reveal probably gaps and shortcomings in monitoring of microbiological contamination of meat, meat preparations and meat products produced in Latvia. The results on microbiological contamination of foodstuffs obtained in frame of producers' self-control were used in the research. In total, 12 food groups, including fresh meat, minced meat, breaded pork chop, different types of sausages, frankfurters, smoked meat products, aspic and liver pate were investigated. Using one-way analysis of variance (ANOVA) significant differences were revealed between many food groups studied, as well as big fluctuations in aerobic plate counts (APC) were demonstrated inside certain food groups. According to the findings of the research, APC was significantly different ( $p=0.001<0.05$ ;  $F=4.139$ ,  $F_{crit}=2.214$ ,  $F>F_{crit}$ ) in sausages. The maximum average APC ( $1.4\times 10^6\pm 2.3\times 10^6$  CFU g<sup>-1</sup>), as well as maximum APC ( $4.8\times 10^6\pm 2.3\times 10^6$  CFU g<sup>-1</sup>) was found in liver sausage and blood sausage. APC was largely variable in smoked meat products (average APC was  $1.1\times 10^5\pm 3.6\times 10^5$  CFU g<sup>-1</sup>). Significant difference ( $p=0.011<0.05$  and  $F=6.109$ ,  $F_{crit}=3.634$ ,  $F>F_{crit}$ ) was revealed with regard to APC of aspics during the first and sixth day of storage. Hygiene microorganisms (*Escherichia coli*) and pathogens (e.g. *Salmonella spp.*) most often were detected in raw meat and meat preparations. Presence of coliforms was also detected in meat aspics and meat pate. The results of the research suggest that development and usage of guidelines of good manufacturing practice for purposeful monitoring of microbiological contamination risk of meat, meat preparations and meat products is relevant to ensure high level of protection of consumers' health.

**Keywords:** microbiological contamination, meat, meat preparations and meat products, good manufacturing practice.

For further information please contact: [aija.melngaile@bior.gov.lv](mailto:aija.melngaile@bior.gov.lv)

## PHYTASE ACTIVE YEASTS ISOLATED FROM BAKERY SOURDOUGHS

Lina Nuobariene, Nils Arneborg, Åse Solvej Hansen

Department of Food Science, Faculty of Science, University of Copenhagen, Rolighedsvej 30,  
DK-1958 Frederiksberg, Denmark

Nowadays, consumption of whole-grain bread is gaining popularity across the world due to its many health promoting effects. Despite that whole grains contain 20–70% of the daily requirements of the minerals, their absorption in human gut are very low due to antinutritional phytate. To increase the bioavailability of minerals, enzymatic degradation of phytate is needed.

The aim of this study was to isolate and identify phytase active yeasts from sourdoughs. The use of selected microorganisms with high phytase activity could find use as starter cultures to improve mineral bioavailability in whole-grain bread fermented in short time as alternative to sourdough bread. In addition, purification and characterization of high-active extracellular phytase produced by generally recognized as safe (GRAS) yeast species *Saccharomyces cerevisiae* was done.

The screening of phytase-positive strains was carried out at temperature of 30°C and pH 5.5, conditions optimal for leavening of bread dough. To investigate whether the yeasts produce phytases, selective defined minimal medium, containing phytate as the only phosphate source, was developed. Phytase activity was determined colorimetrically by measuring the inorganic phosphate released by enzyme. One unit (U) of phytase activity was defined as the amount of phytase that liberates 1 µmol of inorganic phosphate per minute under the assay conditions.

Specific extracellular phytase activities of yeasts were at least 20-fold higher than the intracellular activities. The highest activities were observed in two *Saccharomyces cerevisiae* isolates, i.e. L1.12 (10.6 U/10<sup>10</sup> CFU) and L6.06 (8.2 U/10<sup>10</sup> CFU). The purified phytase produced by *S. cerevisiae* was most active at pH 4.0 and 35 °C. This phytase is quite stable at pH range from 3.5 to 5.5 and temperature range from 25 °C to 40 °C.

**Keywords:** phytase, sourdough, yeast, *Sacharomycces cerevisiae*.

For further information please contact: [aiva@food.ku.life](mailto:aiva@food.ku.life)

**ENZYMATIC TREATMENT OF GELATIN FILMS****Aleksandr Shleikin, Ivan Shatalov, Aleksandrina Shatalova**

Department of Chemistry and Molecular Biology, Institute of Refrigeration and Biotechnologies, ITMO University, Lomonosov Str., 9, St. Petersburg, Russia

The current acute problem of food industry is processing of secondary protein-containing raw materials, resulting in the production of foodstuffs. This served as a prerequisite for extending the application of low-value proteins by incorporating them into the biodegradable and edible materials in order to further their use as packaging materials for food products. However despite the high barrier properties of the protein materials against different gases, they have weak mechanical properties. To improve these are the different techniques are used based on a crosslinking of protein chains. The aim of this work is to study the influence of microbial transglutaminase enzyme preparation on the mechanical characteristics of food packaging films based on gelatin. In the experiments were used films obtained from porcine gelatin and treated by microbial TG Activa EB (Adjinomoto Co). It was established that the examples treated by enzyme preparation were more durable but less flexible. Increasing of breaking strength along with a decrease in elasticity can be explained by the formation of more dense and ordered polymer network due to the new isopeptide bonds building between the protein macromolecules and as a result was developed the mobility reduction of individual network wiring.

**Keywords:** transglutaminase, gelatin film, strength, elasticity.For further information please contact: [shatalovaaleks@mail.ru](mailto:shatalovaaleks@mail.ru)

**HEALTH-RELEVANT FOOD  
PRODUCTS AND ISSUES**

# FOODBALT 2014



**SALT REDUCTION OF BREADS BY ADDING SPICES**

**Jörg Hampshire, Louisa Page, Andreas Kruke, Nadine Lauber, Maxi Müller, Vanessa Rosin, Andreas Seifert, Carolin Wagner, Sophia Wagner, Lisa Winkler**

Department of Nutritional, Food and Consumer Sciences, Fulda University of Applied Sciences, Marquardstrasse 35, Fulda, Germany

The aim of this study is to investigate the effect on consumer acceptance of bread by decreasing the content of table salt and adding simultaneously caraway seeds. Objectives of this investigation are three bread variations with reduced table salt content in flour (S) and different contents of caraway seeds (CW): S 0.8%/CW 1.0%; S 0.6%/CW 1.0% and S 0.6%/CW 1.2% and a standard bread (S 1.8%/CW 1.0%). 37 seniors and 78 younger persons scored the samples on a 5-point-scale for product acceptance, salt perception and the taste for caraway seed. The elderly scored the salt perception of the standard bread and the bread with raised percentage of caraway seeds (S 0.6%/CW 1.2%) „just about right.” The other bread variations have been scored “a little too low salt.” Only the caraway seeds perception of the standard bread has been scored “just about right”. The overall acceptance of the standard bread (“good”) was better scored than the three salt reduced bread variations (“neither good nor bad”).

The young consumers perceived all salt reduced variations as “a little too low” or “just about right” in salt ( $p > 0.05$ ). The percentage of caraway seeds has been scored “just about right”. The overall acceptance of the three salt reduced bread variations has been scored “neither good nor bad”.

The elderly did not perceive the reduced salt content as it was probably covered by the taste perception of caraway seeds. Possibly the caraway seed content has to be raised to improve the acceptability by the elderly.

**Keywords:** bread, salt reduction, caraway seeds.

For further information please contact: [joerg.hampshire@he.hs-fulda.de](mailto:joerg.hampshire@he.hs-fulda.de)

## PHYTOSTEROLS IN RICE BRAN AND USAGE OF RICE BRAN IN FOOD INDUSTRY

**Özgül Özdeştan, Burcu Acar, Tuğçe Erol**

Ege University, Faculty of Engineering, Food Engineering Department, 35100, Izmir, Turkey

Phytosterols are very important for daily diet that can not be synthesized by human body. Main sources of phytosterols are vegetable oils, seeds, legumes and cereals. Phytosterols prevent cholesterol absorption therefore lower total and LDL cholesterol level in blood. Also plant sterols might protect against certain types of cancer such as colon, breast and prostate. Rice bran is the best source of total lipids and phytosterols based on raw material. Rice bran oil contains very high concentrations of cycloartenol and 24-methylenecycloartanol, which made up over 40% of the total phytosterols. Rice bran contains 12–22% oil, 11–17% protein, 6–14% fiber, 10–15% moisture, and 8–17% ash. Also, It is rich in vitamins, including vitamin E, thiamin, niacin, and minerals like aluminum, calcium, chlorine, iron, magnesium, manganese, phosphorus, potassium, sodium, and zinc. Furthermore, presence of antioxidants like tocopherols, tocotrienols, and  $\gamma$ -oryzanol also brighten prospects of rice bran utilization for humans as functional ingredient to reduce the life threatening disorders. To improve quality and nutrition of food product, rice bran can be evaluated as a potential food ingredient. It has been used in food as full-fat, defatted bran, bran oil, and protein concentrates. Rice bran is used by the food industry in the production of baked foods, snacks, crackers, breads, cereals, pastries, pancakes, noodles, muffins, biscuits. In this review, phytosterols found in rice bran which impacts on human health and the usage of rice bran in food industry are discussed in general terms.

**Keywords:** bioactive compound, cereals, phytosterol, rice bran.

For further information please contact: [ozgulozdestan@gmail.com](mailto:ozgulozdestan@gmail.com)

**PREPARATION OF DRY EXTRACT OF SEA BUCKTHORN LEAVES****Raimondas Raudonis<sup>1,2</sup>, Lina Raudonė<sup>1</sup>, Valdimaras Janulis<sup>1</sup>, Pranas Viškelis<sup>2</sup>**

<sup>1</sup> Department of Pharmacognosy, Lithuanian University of Health Sciences, Mickeviciaus str. 9, LT-44307, Kaunas, Lithuania

<sup>2</sup> Institute of Horticulture, Lithuanian Research Center for Agriculture and Forestry, Kauno str. 30, LT-54333, Babtai, Kaunas distr., Lithuania

Qualitatively prepared dry extracts are advantaged over conventional fluid extracts. They possess higher stability and concentration of bioactive compounds, facility of standardization and quality control. Pharmacological and clinical studies indicated that flavonoids of sea buckthorn (*Hippophaë rhamnoides*) have a wide spectrum of physiological activities on cardiovascular system.

In this work the spray-drying and freeze-drying processes were evaluated for production of dry extracts of sea buckthorn leaves. The purpose was to identify the best drying method that provides the highest content of flavonoids.

The humidity of dry extracts prepared using different drying techniques meets the requirements for dry extracts indicated in European Pharmacopoeia (5% m/m). Dry residue of hydroalcoholic extract of *H. rhamnoides* leaves was determined according to Eu Ph method and yielded in 31.9%. Due to the adhesion from powder in the compartments of the drying equipment, greater mass loss was determined for spray-drying (yield 22.1%) than for freeze-drying process (yield 24.5%). Using high-performance liquid chromatography (HPLC) seven flavonoids were identified: rutin, hyperoside, isorhamnetin 3-O-rutinoside, isorhamnetin 3-O-glucoside, quercetin, kaempferol, isorhamnetin. Predominant compounds were flavonol glycosides which were chosen as markers for quantitative control of dry extracts. Insignificant differences in amounts of flavonol glycosides were determined in spray dried and freeze dried extracts. The dried extracts of *H. rhamnoides* leaves presented the appearance of a light green homogeneous dry powder that is considered of good appearance for the development of functional food ingredients with potential enhanced nutritional and health benefits.

**Keywords:** sea buckthorn, *Hippophaë rhamnoides*, dry extract, flavonoids.

For further information please contact: [raimondas.raudonis@gmail.com](mailto:raimondas.raudonis@gmail.com)

## DETERMINATION OF THE OPTIMAL RATIO OF RECIPE INGREDIENTS IN THE PROCESS OF DESIGNING CONFECTIONERY PRODUCTS FOR FUNCTIONAL PURPOSES

**Polina Smolikhina, Evgeniia Muratova**

Department of Technologies and Equipment for Food and Chemical Production, Technological Institute, Tambov State Technical University, Sovetskaya Street, Tambov, Russia

The aim of this study was to develop new recipes of confectionery products for functional purposes in accordance with predetermined criteria of optimization.

The paper formulates the problem of recipe optimization relating to the class of multicriteria nonlinear programming problems, and shows the algorithm developed for its solution. As an example, the article gives the formulation and solution of the problem that involves designing candy recipes with mixed jelly-whipped body. The choice of ratio between layers of combined body enriched with functional ingredients was carried out according to four criteria (energy value, carotenoids, dietary fiber, and the cost of the finished product) under the given constraints on technological and consumer product characteristics.

The solution of the multicriteria problem identified a number of effective points belonging to the sphere of Pareto. The final choice of possible options was made on the basis of the ratio “price–quality” tailored to meet the daily requirements of micronutrients and organoleptic evaluation of the product. Adjustment of the layers provides a wide range of jelly-whipped candies with original organoleptic characteristics and a given set of micronutrients that can be recommended for different categories of the population. Varying the composition of recipe mixtures from possible set of raw ingredients, enriching them with micronutrients, can influence on the physiological effect of finished products.

The proposed approach can be recommended for the recipe designs of complex multi-component food systems with specified set of characteristics in terms of multiple alternatives of ingredient composition and interchangeability of raw materials.

**Keywords:** recipe calculations, multicriteria optimization.

For further information please contact: [topt@topt.tstu.ru](mailto:topt@topt.tstu.ru), [oda@admin.tstu.ru](mailto:oda@admin.tstu.ru)

## LEAF VEGETABLES AS SOURCE OF PHYTOCHEMICALS

**Māra Dūma<sup>1</sup>, Ina Alsina<sup>2</sup>, Solvita Zeipiņa<sup>2,3</sup>, Līga Lepse<sup>3</sup>, Laila Dubova<sup>2</sup>**

<sup>1</sup> Department, of Chemistry Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>2</sup> Institute of Soil and Plant Sciences, Faculty of Agriculture, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>3</sup> Pure Horticultural Research Centre, Abavas Street 2, Pure, Tukuma district, Latvia

Different vegetables are considered as sources of human health promoting components. Leaf vegetables are widely used in human diet, they are low in calories and fat, but high in dietary fibers, content of minerals, such as iron and calcium and very high in phytochemicals such as vitamin C, carotenoids, lutein and others. On the one hand phytochemicals are a plant's way of protecting itself. They help shield tender buds and sprouts from predators, the toxic elements, and pollution. On the other hand they have beneficial effect on human health. Genotype along with growing and management conditions can affect the content and the composition of phytochemicals in plants.

The aim of research is to determine the content of phytochemicals (chlorophyll a and b, total carotenoids, lutein, vitamin C) in leaf vegetables, the lettuce (*Lactuca sativa* L.), spinach (*Spinacia oleracea*), green and violet basil (*Ocimum Basilicum*), mustard (*Brassica juncea*) and nettles young sprouts (*Urtica dioica*) grown in an open field during years 2009–2013. The content of plant pigments were determined spectrophotometrically, the titrimetric method was used for determination of vitamin C content.

It was found out that young nettles sprouts and spinach will be the good source of chlorophyll, basil (green and violet) contains more than 0.4 mg 100 g<sup>-1</sup> total carotenoids, but for correcting the deficiency of vitamin C it is useful to use basil, young nettles sprouts and mustard.

**Keywords:** leaf vegetables, phytochemicals.

For further information please contact: [Mara.Duma@llu.lv](mailto:Mara.Duma@llu.lv)

## EVALUATION OF NUTRITION VALUE OF ROMAN SNAIL'S (*HELIX POMATIA*) MEAT OBTAINED IN LATVIA

Daina Ikauniece<sup>1,2</sup>, Aleksandrs Jemeljanovs<sup>2</sup>, Vita Sterna<sup>3</sup>, Vita Strazdina<sup>1</sup>

<sup>1</sup> Laboratory Sigulda, Institute of Food Safety, Animal Health and Environment BIOR, Instituta street 1, Sigulda, Latvia

<sup>2</sup> Faculty of Veterinary medicine, Latvia University of Agriculture, K.Helmaņa street 8, Jelgava, Latvia

<sup>3</sup> Department of Agro-ecological Research, State Stende Cereals Breeding Institute, „Dizzemes”, Dizstende, Libagi parish, Talsi County, Latvia

Roman snail (*Helix pomatia*) meat is a favoured product in many European countries as well as in other continents. Of late, its consumption is growing also in Latvia. Investigations about biochemical composition and nutritional value of snail meat are few. Therefore the following objective was set forth for our research: evaluate the nutrition value of the Roman Snail meat obtained in Latvia. Investigations were performed at the Research Institute of Biotechnology and Veterinary Medicine „Sigra,” of Latvia University of Agriculture from 2011 to 2013. The chemical analyses of 35 samples were done. In the studied samples protein, amino acids, intramuscular fat, fatty acids and cholesterol content were by standard methods determined. The average protein content detected in snail meat samples were 12.86 mg 100 g<sup>-1</sup> fat content 1.11 mg 100 g<sup>-1</sup>. It was calculated the ratio of total saturated and polyunsaturated fatty acids, results are 20.39% and 44.06% of total fatty acids content respectively. Research shows that Snail meat is low in lipids. It could be recommended as meat with excellent nutritional qualities.

**Keywords:** *Helix pomatia*, nutritional value, biochemical composition.

For further information please contact: [daina\\_ikauniece@inbox.lv](mailto:daina_ikauniece@inbox.lv)

## NUTRITIONAL CHARACTERISTICS OF WILD BOAR MEAT HUNTED IN LATVIA

Vita Strazdina<sup>1,2</sup>, Aleksandrs Jemeljanovs<sup>3</sup>, Vita Sterna<sup>4</sup>, Daina Ikauniece<sup>1</sup>

<sup>1</sup> Laboratory Sigulda, Institute of Food Safety, Animal Health and Environment BIOR, Instituta street 1, LV 2150, Sigulda, Latvia

<sup>2</sup> Faculty Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, LV 3004, Jelgava, Latvia

<sup>3</sup> Faculty of Veterinary Medicine, Latvia University of Agriculture, K.Helmaņa street 8, Jelgava, LV 3004, Jelgava, Latvia

<sup>4</sup> Department of Agro-ecological Research, State Stende Cereals Breeding Institute, „Dižzemes”, Dižstende, Lībagi parish, Talsi County, Latvia

Wild game meat is considered as significant source of healthy food, and its share in consumption in recent years, increasing in size. Investigations about biochemical composition of game meat, including wild boar (*Sus scrofa scrofa*) meat are not very much. Aim of our investigation was evaluate nutrition value of wild boar meet after hunting in Latvia. Nutritional characteristic of wild boar meat was based on the investigations carried out in different regions of Latvia. In the studied samples protein, amino acids, intramuscular fat, fatty acids, cholesterol and microelement content were determined. The average protein content detected in wild boar meat samples were 20.88 mg 100 g<sup>-1</sup> fat content 3.45 mg 100 g<sup>-1</sup>. It was calculated the ratio of total saturated fatty acids, ω-6 and ω-3, results are 42.98; 13.63 and 3.05% of total fatty acids content respectively. The content of microelements Fe and Zn in samples were 3.44 and 3.73 mg kg<sup>-1</sup> it was higher than provides with meat of domestic animals. The results of investigation confirmed preference of wild boar meat in human health in comparison with beef or pork.

**Keywords:** game meat, nutritional value, dietetic product.

For further information please contact: [vitastrazdina@inbox.lv](mailto:vitastrazdina@inbox.lv)

## THE DIFFERENT PROTEIN SOURCES FEEDING IMPACT ON THE QUALITY OF PORK

Lilija Degola

Latvia University of Agriculture, Faculty of Agriculture, Jelgava, LV 3001, Latvia

The study was conducted to determine the quality of pork after feeding soybean meal and peas as protein sources to fattening pigs. The research was done in two pig farms in Latvia. The four fattening pig groups were conducted (two in each holding), according of pig origin, age and live weight. In holdings one pig group was soybean meal and the other peas group with 10 animals each. The pig groups received different amount of the protein feeds (soybean meal 15%, peas 28% and 15%) blended into a mixture of concentrated feed. The chemical analyses of prepared pig feed were determined in laboratory for dry matter, crude protein, crude fiber, fat, ash, Ca and P. During the study was monitored the live weight of pigs. Pig carcasses were weighed and analyzed for such parameters: the length of the carcass, backfat, internal fat, muscle-eye area, ham weight, pork chops weight, bone and meat weight. Chemical content of pork analyzes in muscle. The samples of meat were taken from the *musculus longissimus lumborum et thoracis* 24 hours *post mortem* and subsequently subjected to the chemical analysis. The results showed that about 3–5% higher increase in live weight gain showed groups of pigs, which fed the peas. The differences was significant ( $P < 0.05$ ). The carcass parameters showed a tendency to accumulate more fat tissue in pigs body (0.5–0.7 kg more internal fat) in peas groups. The backfat on last rib was from 12–15 mm, 1–4 mm more than pigs groups which as protein additive fed soybean meal. The pork chemical analyses were such: fat content in muscle for peas groups were 6.5–7.2% and were significant difference with soybean pig groups (3.8–4.0%) ( $p < 0.05$ ). The crude protein was 22.4–23.6% and 24.1%, accordingly in peas and soybean groups. The tryptophan and proline relationship was 0.35. The obtained results confirm that peas as alone protein source in pig diets showed a tendency to increase the fat content in pork and proline content was twice higher than tryptophan.

**Key words:** pig, peas, nutrition, amino acid, pork.

For further information please contact: [lilija.degola@llu.lv](mailto:lilija.degola@llu.lv)



## THE INFLUENCE OF GELLING AGENT ON THE QUALITY OF NON-SUGAR MARMALADE CANDIES

**Anastasija Kutaceva, Solvita Kampuse**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

The natural fruit marmalade candies are becoming more and more popular between consumers during last decades as valuable and healthy tucker. But in the diet of many people the consumption of such products are very limited due to high content of sugar. Therefore it is necessary to find alternative products.

The aim of this research was to evaluate the influence of gelling agent to the quality of marmalade candies without added sugar.

Three types of gelling agents were used in this experiment: LM pectin (Gen pectin LM-104-AS, LM-104-AS-FS), agar, and gelatine. The marmalade candies were made from apple puree (70%), raspberry puree (30%), and as sweetener the steviol glycoside powder was used. The prepared mass was divided into two parts: one part was putted in plastic boxes for cooling, but the other was foamed with mixer and then left for cooling. The colour (in CIE L\* a\* b\*), hardness (with Texture analyser), the moisture content, pH, and ascorbic acid (with iodometric method) content were analysed to all prepared samples.

The highest pH value (pH 3.872), and the foaming ability was to samples prepared with gelatine, but the highest hardness were detected to unfoamed samples made with agar (10.46 N) and gelatine (11.74 N). There were no significant differences ( $p > 0.05$ ) in ascorbic acid content of marmalade candies made with different gelling agents.

**Keywords:** marmalade candies, gelling agents, texture, ascorbic acid.

For further information please contact: [skampuse@inbox.lv](mailto:skampuse@inbox.lv)

## COMPARISON OF DIETARY FIBRE CONTENT IN DIFFERENT FIBRE SOURCES

**Liene Jaundzeikare, Ilze Beitane**

Department of Nutrition, Faculty of Food Technology, Latvia University of Agriculture, 2 Liela Street, Jelgava, Latvia

Dietary fibre is an important component of human's nutrition. It is the common name for all carbohydrate components occurring in foods that are non-digestible in the human small intestine. It is known that deficiency of dietary fibre in food, provoke disturbance of intestinal tract, for example, constipation and that different fibre sources have different composition and quantities of dietary fibre. Therefore the task of research was to investigate the content of total, soluble and insoluble dietary fibre in different fibre sources such as wheat and rye bran, defatted flaxseeds, chicory and Jerusalem artichoke powder.

The results of research showed that total dietary fibre content in different fibre sources ranged between 41.76% and 59.42%, where the lowest total dietary fibre (TDF) content was determined for wheat bran and the highest for Jerusalem artichoke powder. The content of TDF in defatted flaxseeds and Jerusalem artichoke powder was significantly higher comparing with other samples ( $p < 0.05$ ). Whereas dried chicory and Jerusalem artichoke powder were important sources of soluble dietary fibre, which significantly differed from other analysed samples ( $p < 0.05$ ). The significant part of SDF content made inulin, which contain in dried chicory was 94.3% of total SDF and in Jerusalem artichoke powder – 97.7%. The significantly higher amount of IDF was determined in wheat and rye bran, defatted flaxseeds ( $p < 0.05$ ) comparing with dried chicory and Jerusalem artichoke powder.

**Keywords:** bran, flaxseeds, chicory, Jerusalem artichoke, fibre.

For further information please contact: [Ilze.Beitane@lu.lv](mailto:Ilze.Beitane@lu.lv)

**QUALITY AND SAFETY OF  
PROCESSED FOODS**

## THE INFLUENCE OF FERMENTED WITH CERTAIN LACTOBACILLI *SATUREJA MONTANA* AND *SATUREJA HORTENSIS* ON THE QUALITY AND SAFETY OF CHICKEN MEAT

Erika Skabeikyte<sup>1</sup>, Emilija Lepeskaite<sup>1</sup>, Elena Bartkiene<sup>1</sup>, Grazina Juodeikiene<sup>2</sup>,  
Daiva Vidmantiene<sup>2</sup>, Audrius Maruska<sup>3</sup>, Ona Ragazinskiene<sup>4</sup>

<sup>1</sup> Department of Food Safety and Quality, Veterinary Faculty, Lithuanian University of Health Sciences, Tilzes g. 18, Kaunas, Lithuania

<sup>2</sup> Department of Food Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilenu pl. 19, Kaunas, Lithuania

<sup>3</sup> Department of Biochemistry and Biotechnologies, Faculty of Natural Science, Vytautas Magnus University, Vileikos st. 8, Kaunas, Lithuania

<sup>4</sup> Kaunas Botanical Garden, Vytautas Magnus University, Z. E. Zilibero st. 6, Kaunas, Lithuania

The aim of this study was to investigate the effects of the fermented with different lactic acid bacteria (LAB) *Satureja montana* (Sm) and *Satureja hortensis* (Sh) on the quality and safety parameters of the chicken meat. For the herbs solid state (SSF) and submerged fermentation (SMF) with *Pediococcus acidilactici* KTU05-7, *Pediococcus pentosaceus* KTU05-8 and *Lactobacillus sakei* KTU05-6 were used. Chicken meat surface was treated with SSF and SMF Sm and Sh products. It was found that in Sm and Sh substrate in experiment used LAB produce more L-(+) than D-(-) lactic acid isomers. SMF plant products pH was found lower and total titratable acidity (TTA) higher than SSF plant products. The LAB strains showed good growth in SSF and SMF Sm and Sh media (was found from 5.4 log<sub>10</sub> CFU g<sup>-1</sup> till 9.7 log<sub>10</sub> CFU g<sup>-1</sup> respectively). The concentration of biogenic amines (BA) in all analysed chicken meat products treated with fermented herbs was far below levels causing a health risk. Also, the chicken meat treatment with fermented herbs has a positive impact on the organoleptic and technological parameters of the meat. We conclude that SSF and SMF with in experiment used LAB Sm and Sh could be used as marinade for the chicken meat and this is natural and safe way to increase the organoleptic and technological parameters of the chicken products.

**Keywords:** chicken meat, fermentation, *Lactobacilli*, *Satureja montana*, *Satureja hortensis*.

For further information please contact: [erika.skabeikyte@lva.lt](mailto:erika.skabeikyte@lva.lt)

## THE EFFECTS OF pH, $a_w$ , AND LACTIC ACID BACTERIA ON *LISTERIA MONOCYTOGENES* IN FERMENTED SAUSAGES

Indulis Silinš

Institute of Food and Environmental Hygiene, Faculty of Veterinary Medicine, Latvia University of Agriculture, Helmaņa street 8, Jelgava, Latvia

The survival of inoculated in a cold-smoked sausages *Listeria monocytogenes* strain was studied. The sausages were prepared with and without starter cultures. The survival limits of *L. monocytogenes* and lactic acid bacteria (LAB) were determined as colony forming units per gram ( $\text{cfu g}^{-1}$ ) depending on water activity ( $a_w$ ) and pH on 0, 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> days of maturation. The decreasing water activity conditioned by moisture (weight) loss during ripening and pH decrease ensured negative polynomial growth rate of inoculated *L. monocytogenes*  $-0.27 \text{ lg} (\text{cfu g}^{-1})$  each day of ripening time, and  $-0.65 \text{ lg} (\text{cfu g}^{-1})$  on the first 7 days of maturation. A significant Pearson's correlation ( $p < 0.01$ ) was established between decreased values of *L. monocytogenes* count,  $a_w$ , salt concentration and LAB growth in sausages during the ripening period of 21 days. The main parameters, maintained negative exponential growth rate of *L. monocytogenes* in cold smoked sausages, are  $a_w$  value decrease and LAB (starter culture), which stopped *L. monocytogenes* growth at the beginning of cold-smoked sausage maturation. If fermentation process went technically and hygienically correctly, the fermented (cold-smoked) sausages could be one of the safest meat products, because in real practice a low level contamination has been seen. The remaining count of *L. monocytogenes* in cold-smoked sausage depends on the possible initial contamination level and could exceed the European Union regulation value  $2.0 \text{ lg} (\text{cfu g}^{-1})$  for ready-to-eat products when contamination at first is more than  $\text{lg } 5.0$ .

**Keywords:** *Listeria monocytogenes*, lactic acid bacteria, cold smoked sausages, water activity, pH.

For further information please contact: [indulis.sil@inbox.lv](mailto:indulis.sil@inbox.lv)

## SHREDDED CARROTS QUALITY PROVIDING BY TREATMENT WITH HYDROGEN PEROXIDE

Ingrida Augspole<sup>1</sup>, Tatjana Rakcejeva<sup>2</sup>, Zanda Kruma<sup>2</sup>, Fredijs Dimins<sup>1</sup>

<sup>1</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela Str. 2, LV-3001, Jelgava, Latvia

<sup>2</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Str. 2, LV-3001, Jelgava, Latvia

Carrots are a vegetable crop providing a source of important nutritional compounds, but their shelf-life, especially for shredded carrots, is not so long. Minimally processed carrots are very common in developed countries and are gaining popularity due to their convenience and freshness. Hydrogen peroxide ( $H_2O_2$ ) is also a well-studied oxidant agent, directly toxic to pathogens. It has both bacteriostatic and bactericidal activity.

The purpose of the present research was to investigate hydrogen peroxide ( $H_2O_2$ ) influence on shredded carrots chemical composition. Shredded carrots were treated with 0.5%, 1.0% and 1.5%  $H_2O_2$  water solution for  $30\pm 1$  s,  $60\pm 1$  s and  $90\pm 1$  s. The major sugars (fructose, glucose and sucrose) were determined by applying the method of high performance liquid chromatography (HPLC). The total phenol content was determined spectrophotometrically according to the Folin–Ciocalteou method and antiradical activity was determined using the DPPH<sup>•</sup> (2,2-diphenyl-1-1-picrylhydrazyl radical) assay.

Significant influence of  $H_2O_2$  water solution concentration and treatment time on analyzed shredded carrots quality parameters was found. It was detected that antiradical activity decrease by approximately 30% in average in shredded carrots after treatment with disinfectant, total phenolic content by approximately 50% in average and sugars by approximately 49% in average. For the maximal quality parameters preservation recommendable  $H_2O_2$  water solution concentration is 1.5% and treatment time  $30\pm 1$  s. As a result the content of phenolic decrease by 36%, antiradical activity by 20%, total sugars by 44%. As well, the content of fructose decreases by 48%, glucose by 18% and sucrose by 39%.

**Keywords:** total phenols, antiradical activity, sugars,  $H_2O_2$ .

For further information please contact: [ingrida.augspole@inbox.lv](mailto:ingrida.augspole@inbox.lv)

**DETERMINATION OF AFLATOXIN LEVELS IN CASHEWS BY HPLC****Ismail Yilmaz<sup>1</sup>, Mehmet Aluc<sup>2</sup>**<sup>1</sup> Namik Kemal University, Agriculture Faculty, Department of Food Engineering, Tekirdağ/Turkey<sup>2</sup> Karin foods, Cumayeri Düzce, Turkey

The problem of food contamination with aflatoxin is one of current concern and has received a great deal of attention during the last three decades. Aflatoxins are a group of highly toxic secondary metabolic products as some *Aspergillus* species. Aflatoxins are carcinogenic, mutagenic, teratogenic and immunosuppressive to most animal species and humans. They are considered to be one of the most important food contaminants affecting food safety and public health. The aim of the study is to determine the level of aflatoxin in cashew imported from India. Samples were analyzed by reverse phase HPLC containing post column derivatization and fluorescence detection after immunoaffinity column clean-up. AOAC (999.07) was used in as the methodology of the study. In this study, aflatoxin B1 and total aflatoxin (B1+B2+G1+G2) were analyzed in totally 50 samples of cashew. A total of 50 samples of cashew samples were obtained randomly from supermarkets in Istanbul. Aflatoxin was found in 14 out of 50 samples (28%) of cashew (B1: 0.26–0.32 ppb; total: 0.5–0.84 ppb). All positive samples did not exceed the maximum limit of 2 µg kg<sup>-1</sup> set by EU regulations for AFB1 and AFT (4 µg kg<sup>-1</sup>). Although the aflatoxin contamination in cashew samples are very low, aflatoxin analysis should be done strictly for human health.

**Keywords:** aflatoxin, cashew, HPLC.

For further information please contact: [iyilmaz@nku.edu.tr](mailto:iyilmaz@nku.edu.tr)

## DETERMION OF AFLATOXIN CONTAMINATION IN SOME DRIED NUTS AND SPICES BY ELISA

**Ismail Yilmaz, Hafize Garipođlu**

Namik Kemal University, Agriculture Faculty, Department of Food Engineering, Tekirdađ, Turkey

This study aimed to determine the total aflatoxin levels in some dried nuts and spices by ELISA (Enzyme-linked Immunosorbent Assay). In this study, 1158 some dried and spices samples (513 hazelnut, 179 pistachio, 244 almond, 52 peanut, 143 walnut, 2 mahlep, 9 sahlepl, 8 cinnamon and 8 black pepper) were randomly obtained from markets and spices shops in Istanbul. Total aflatoxin contamination was determined in 156 (30%) of 513 hazelnut, in 93 (51.96%) of 179 pistachio, in 107 (43.85%) of 244 almond, in 23 (55.95%) of 52 walnut, in 23 (44.23%) of 52 peanut, in 2 (100%) of 2 mahlep, in 7 (78.78%) of 9 sahlepl, in 6 (75%) of 8 cinnamon and in 6 (75%) of 8 black pepper. Therefore, monitoring of aflatoxins is necessary to ensure that they are not present at levels that may pose health risks to the public and controls should be done strictly and more often by authorities.

**Keywords:** aflatoxin, nuts, ELISA.

For further information please contact: [yilmaz@nku.edu.tr](mailto:yilmaz@nku.edu.tr)



## IMPACT OF THE DEGREE OF MATURITY ON APPLE QUALITY DURING STORAGE

Karina Juhneviča-Radenkova<sup>1,2</sup>, Līga Skudra<sup>2</sup>, Māra Skrīvele<sup>1</sup>, Dalija Segliņa<sup>1</sup>,  
Anita Olšteine<sup>1</sup>

<sup>1</sup> Latvia State Institute of Fruit Growing, 1 Graudu str., Dobele, Latvia

<sup>2</sup> Department of Food Technology, Latvia University of Agriculture, 2 Liela str., Jelgava, Latvia

The main objective of this work was determine optimum harvest date in apples, which are to be kept in long term storage. The effect of storage conditions and inhibitor of ethylene 1-methylcyclopropene (1-MCP) treatment on ethylene production and quality of apples stored in normal and controlled atmosphere conditions was evaluated during one successive season 2012/2013. Experiments were carried out at the Latvia State Institute of Fruit-Growing. Treated and untreated (control) apples were stored for six months in the cold storage rooms at  $2\pm 0.5$  °C under normal atmosphere (NA) conditions or controlled atmosphere (CA) with 1.0% O<sub>2</sub>, 2.0% CO<sub>2</sub>, 97% N<sub>2</sub> and 1.5% O<sub>2</sub>, 2.5% CO<sub>2</sub>, 96% N<sub>2</sub>. Directly after storage and after shelf life (additionally 14 days at 18 °C) internal ethylene concentration was determined. The following quality parameters were recorded as well: flesh firmness (FF), total soluble solids (TSS), titratable acidity (TA), Streif's index, the Jager index and the FARS index, fruit weight, and starch index. Internal ethylene concentration was significantly lower for the 1-MCP treated fruits, both directly after storage in NA or CA and after shelf life. The obtained results give the possibility to conclude that the almost all cultivars which are early harvested were suitable for storage in modified atmosphere, while the later harvesting give the possibility for storage in normal atmosphere as well as were suitable for 1-MCP treatment.

**Keywords:** 1-MCP, apple quality, controlled atmosphere.

For further information please contact: [karina.juhnevica@lvai.lv](mailto:karina.juhnevica@lvai.lv)

## INFLUENCE OF FLOUR CHARACTERISTICS ON QUALITY OF BAKING PRODUCTS

Aušra Steponavičienė<sup>1</sup>, Ingrida Kraujutienė<sup>2</sup>, Nijolė Vasiliauskienė<sup>1</sup>

<sup>1</sup> Catering Department, Technology and Landscape faculty, Kaunas kolegija /University of Applied Sciences, Pramonė pr. 22, Kaunas 50387

<sup>2</sup> Food Technology Department, Technology and Landscape faculty, Kaunas Kolegija/University of Applied Sciences, Pramonė pr. 22, Kaunas 50387

Technological properties of the flour determine structure features of grain. Each grain of part the chemical composition and nutritional value is different. Cereals (wheat, rye and etc.) about 80% of the total grain consists the endosperm (source of starch and protein). Production of flour, endosperm is the most important part of the grain, which determines the yield of flour. Generally, the larger grains, the higher the yield of flour. According to many scientists that content of the protein of both wheat and flour made from them is one of the main criteria for the quality of flour baked goods. Of flour, due of a little gluten, prepared biscuit or fragile dough, due a lot of gluten-free - yeast dough and flaky pastry. Often received poor quality products of confectionery for the preparation of the improper selection of gluten-free flour. Gluten is allergy-causing in substances of list. Persons following the gluten free diet, should choose the products containing buckwheat, rice, corn, oats, peas, etc.

Technological research (production of cakes and pastries), evaluation of the different techniques and choose the type of wheat flour (type 550D and Spelta) and without gluten (peas and buckwheat), canceling allergen – gluten. The work has been carried out in Kaunas University of Applied Sciences, Faculty of Land and Food Technology Laboratory of Cooking. Baked products were evaluated after 1 day. The sensual analysis has been performed. The results showed that sensorical features of cakes baked of traditional 550D, Spelta, peas and buckwheat flour were acceptable in contrast to yeast products which were baked of gluten-free flour. Buckwheat flour leavened baked ware was crumbly, not suitable consistency and merchantable appearance, of pea flour – less crumble, but it was hard.

**Keywords:** wheat, buckwheat, pea flour, Spelta.

For further information please contact: [ausra.steponaviciene@go.kauko.lt](mailto:ausra.steponaviciene@go.kauko.lt)

## QUALITY OF DRINK ENRICHED BY SOY PROTEIN ISOLATE AND PREBIOTIC DIETARY FIBER AND ITS INFLUENCE ON HUMAN HEALTH

**Algirdas Liutkevičius<sup>1</sup>, Vilma Speičienė<sup>1</sup>, Aldona Mieželiene<sup>1</sup>, Gitana Alenčikienė<sup>1</sup>,  
Arvydas Kaminskas<sup>2</sup>, Algis Abaravičius<sup>2</sup>**

<sup>1</sup> Food Institute, Kaunas University of Technology, Taikos av. 92, Kaunas, Lithuania

<sup>2</sup> Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine, Medicine Faculty, Vilnius University, M. K. Čiurlionio str. 21, Vilnius, Lithuania

The aim of the research was to create technology of the functional drink enriched by soy protein isolate (4 g 100 g<sup>-1</sup>) and prebiotic dietary fiber inulin (2 g 100 g<sup>-1</sup>) and establish its influence on human health.

It was determined that essential factors that influence the physical and microbiological stability of soy-prebiotic drink are such: selection of suitable pH of the drink matrix (pH 6.8–7.2), usage of pectin like most suitable stabilizer, short-term mechanical treatment of drink matrix at a temperature of 60 °C, homogenization, and pasteurization at 75–80 °C for 2 min or sterilization at 121 °C for 12 min.

Product made in pilot plant was supplied for medical investigations. Study was performed in a randomly selected 18–29 year old group of volunteers (n=30). The group of people were given 0.5 l per day drink enriched by soy protein and prebiotic dietary fiber for 21 day. Before and after the product consumption blood samples were taken and investigated for the concentrations of total cholesterol, cholesterol of low-density and high-density lipoproteins, triglycerides, fibrinogen, C reactive protein, glucose. The blood samples were taken and analysed at the Faculty of Medicine of Vilnius University and at Vilnius University Hospital Santariškių Clinics.

Results showed that there was statistically significant decrease of oxidized low-density lipoprotein cholesterol concentration ( $p \leq 0.05$ ) after a 21 day period consumption of drink, while other data remained unchanged.

**Keywords:** soy protein, fiber, human health.

For further information please contact: [vilma.speiciene@ktu.lt](mailto:vilma.speiciene@ktu.lt)

## THE ANTAGONISTIC EFFECT OF LACTOBACILLI ON PATHOGENIC AND SPOILAGE BACTERIA DURING MEAT FERMENTATION

**Irena Mačionienė, Dovilė Jonkuvienė, Joana Šalomskienė**

Food Institute, Kaunas University of Technology, Taikos av. 92, LT-51180, Kaunas, Lithuania

The aim of the study was to determine the antagonistic effect of starter culture *Lactobacillus sakei* against *Salmonella typhimurium* and *Escherichia coli* during meat fermentation. *S. typhimurium* and *E. coli* cultures were grown on PCA slants at 37 °C for 24 h. *L. sakei* was grown on MRS slants at 30 °C for 48 h anaerobically. Minced pork (fat content 30%) salted by 2% of NaCl was inoculated with suspensions of bacteria ( $10^8$  CFU ml<sup>-1</sup>) and the samples with following samples were prepared: *L. sakei*; *L. sakei* + *S. typhimurium*; *L. sakei* + *E. coli*; *E. coli*; *S. typhimurium*. Samples were thoroughly mixed, tucked into proteins hells and fermented at 22 °C, 48 h, then at 20 °C, 48 h. The number of lactobacilli, *S. typhimurium* and *E. coli*, as well as the pH, was determined at the beginning of the fermentation process and during the process after 24 h, 48 h, 72 h and 96 h.

*L. sakei* had an antagonistic effect against the growth of *E. coli* and *S. typhimurium*. During the fermentation process, in samples with *L. sakei* the number of *E. coli* and *S. typhimurium* decreased by 100 and 35 times, respectively. *L. sakei* showed the stronger antagonistic activity against *E. coli* than against *S. typhimurium*. During the fermentation, pH of meat decreased from 5.7 to 4.9–5.0. The antagonistic activity of lactobacilli could occur in meat due to the decrease of pH and production of antimicrobial substances inhibiting the growth of *S. typhimurium* and *E. coli*.

**Keywords:** Lactobacilli, pathogens, minced pork, meat fermentation.

For further information please contact: [irena.macioniene@ktu.lt](mailto:irena.macioniene@ktu.lt)

## THE EFFECTS OF DIHYDROQUERCETIN, LINALOOL, THYMOL AND LACTIC ACID AGAINST SPOILAGE BACTERIA AND PHYSICOCHEMICAL PROPERTIES OF MINCED PORK MEAT

**Anita Rokaitytė, Gintarė Zaborskienė**

Department of Food Safety and Quality, Veterinary Academy, Lithuanian University of Health Sciences, Tilžės st. 18, Kaunas, Lithuania

The aim of this study was to evaluate the effect of natural antimicrobial substances against spoilage microorganisms and extend the shelf life of minced pork meat.

Minced pork meat samples were divided into three groups. First group was treated with 0.02% dihydroquercetin, 0.5% thymol and 2.0% lactic acid solution. Second group consisted of samples treated with 0.02% dihydroquercetin, 0.5% linalool and 2.0% lactic acid solution. Third group was treated with 0.02% dihydroquercetin and 2.0% lactic acid solution. Control group was left untreated. All minced pork meat samples were tested for the levels of pH, total aerobic bacterial count, *Escherichia coli*, mold and yeast counts and biogenic amines.

Seven days later the level of pH in samples treated with bioactive substances was significantly lower  $5.54 \pm 0.02$  compared to control sample  $5.93 \pm 0.02$  ( $p \leq 0.05$ ). Bioactive substances have also considerably reduced the level of total bacterial count from  $7.99 \log_{10} \text{CFU g}^{-1}$  to  $7.01 \log_{10} \text{CFU g}^{-1}$  ( $p \leq 0.05$ ), depending on used bioactive compound, while the count of *E. coli* was completely destroyed only in the third sample group. However, bioactive substances did not lower the count of yeasts and moulds. Additionally, only small amounts of biogenic amines were found in all samples.

**Keywords:** dihydroquercetin, linalool, thymol, lactic acid, minced meat.

For further information please contact: [rokaityte@lva.lt](mailto:rokaityte@lva.lt)

## EFFICIENCY OF NISIN AND ITS PRODUCERS IN CONSERVATION OF PUDDINGS

**Dmitriy Tcoj, Ludmila Krasnikova**

Department of Chemistry and Molecular Biology, Institute of Refrigeration and Biotechnologies, ITMO University, Lomonosov Str., 9, St. Petersburg, Russia

Flavour and biological value of food products significantly depend on the microbiological processes in them. Development of alien microflora leads to various defects of taste and consistency of the finished product. Development of effective methods to control undesirable microflora is very important for food industry. Lantibiotic nisin or its producing culture of *Lactococcus lactis* are used to prevent microbial spoilage. Nisin is recognized as safe by the European Parliament. It inhibits the development of gram-positive bacteria, including pathogenic staphylococcus, bacillus of botulism, listeria, etc. Mechanism of biological action of nisin involves a violation of the permeability of bacteria cytoplasmic membrane.

The aim of this study was investigation of nisin and its producer effects to maintain the quality and to extend the shelf life of such dessert as pudding.

The main sources of puddings contaminated microflora are raw materials and additives. They include eggs, milk, sugar, starch, vanilla and other ingredients. In result it was chosen concentration of nisin, safeguarding the quality of puddings during 20–25 days at a temperature of 6–8 °C and reduces the spore-forming microflora two orders as compared to control.

Furthermore, the use of 10% *Lactococcus lactis* culture instead of nisin also provokes a decrease of Gram-positive bacteria amount in the pudding during storage.

**Keywords:** pudding, conservation, nisin, *Lactococcus lactis*.

For further information please contact: [krasnikoval@yandex.ru](mailto:krasnikoval@yandex.ru)

## DETERMINATION OF ACRYLAMIDE LEVELS IN SELECTED FOODS IN LATVIA AND ASSESSMENT OF THE POPULATION INTAKE

Iveta Pugaieva<sup>1,2</sup>, Laura Žumbure<sup>1</sup>, Aija Melngaiļe<sup>1</sup>, Vadims Bartkevičs<sup>1,2</sup>

<sup>1</sup> Institute of Food Safety, Animal Health and Environment BIOR, Lejupes Street 3, Riga, Latvia

<sup>2</sup> University of Latvia, Faculty of Chemistry, Kr. Valdemara street 48, Riga, Latvia

The aim of this study was to investigate acrylamide levels in foods obtained from the Latvian market. Eight sample groups including traditional Latvian food products (rye bread, rye bread enriched with seeds, dried fruits or vegetables, fine rye bread (sweet-and-sour bread), wheat bread, potato chips, coffee, pastry products, dried bread products and gingerbread) were analyzed for their acrylamide content. A total of 435 samples were analyzed for acrylamide concentration using the ultra high performance liquid chromatography with tandem mass spectrometric detector and QuEChERS sample preparation methodology. An appropriate average recovery (106%), within-laboratory repeatability (3–10%) and limit of quantification ( $10 \mu\text{g kg}^{-1}$ ) was specific to the applied UPLC-MS/MS methodology. Results revealed that the acrylamide content of processed foods shows a great variation between different food groups as well as between brands and within brands. Highest concentration of acrylamide was revealed in potato chips with average concentration  $564 \mu\text{g kg}^{-1}$ . No single bread sample has exceeded the European Commission Recommendation 2013/647/EU although the addition of seeds, fruits or vegetables clearly had an increasing effect on acrylamide concentration in bread. The dietary exposure assessment was performed, using analytical results on acrylamide levels in certain food groups and the relevant food consumption data. The calculated margin of exposure (MoE) indicates high dietary intake of acrylamide by certain consumers that may potentially cause adverse health effects. Therefore, adequate efforts should be made to diminish acrylamide levels in processed foods in order to reduce the dietary risk to the human health for Latvian population.

**Keywords:** acrylamide, Latvian food, population intake.

For further information please contact: [iveta.pugaieva@bior.gov.lv](mailto:iveta.pugaieva@bior.gov.lv)

## ANTIMICROBIAL RESISTANCE OF *LISTERIA MONOCYTOGENES* AND *LISTERIA INNOCUA* ISOLATED FROM FISH PROCESSING PLANT ENVIRONMENT AND RAW SALMON

**Ineta Simonavičienė, Arturas Stimbirys, Donata Andrulionyte**

Department of Food Safety and Quality, Lithuanian University of Health Sciences, Veterinary Academy, Tilžės str. 18, LT-47181, Kaunas, Lithuania

Antimicrobial resistance in foodborne pathogens and therapeutical intervention has always been an important issue in public health context.

*Listeria monocytogenes* unlike other food-borne infectious pathogens can multiply in foods stored in the refrigerator. Because of mortality up to 30%, *L.monocytogenes* can be dangerous, especially for neonates and older people. It can be a reason for antibiotic resistance transfer to humans via the food chain because of using the antimicrobial agents in veterinary for food animals treatment (Teuber, 2001).

The aim of the present study was to identify antimicrobial resistance of *Listeria spp.* and *Listeria monocytogenes* isolated from salmon processing plant environment and raw salmon.

The study was performed at Lithuanian University of Health Sciences in December 2013–February 2014. In total, 30 *Listeria* species, 6 *Listeria innocua* isolated from the food-processing environment, 15 *Listeria monocytogenes* strains, isolated from the food-processing environment and 9 *Listeria monocytogenes* strains isolated from raw fish, were analysed. Antimicrobial susceptibility was tested by the agar dilution method in accordance with CLSI (2006). Four antimicrobial agents were tested: tetracycline (TE), erythromycin (ERY), streptomycin (S), and ciprofloxacin (CIP) (all Sigma-Aldrich, MO, USA). The MIC (Minimum inhibitory concentration) was defined as the lowest concentration that produces complete inhibition of growth of *Listeria* species.

MIC study showed that all *L. monocytogenes* and *L. innocua* strains isolated from raw salmon samples and processing environments are equally resistant to all tested antimicrobial and were resistant to less than  $8 \mu\text{g ml}^{-1}$  streptomycin concentration. The lowest concentration of antimicrobial agents inhibits growth *L. monocytogenes* and *L. innocua* was ciprofloxacin ( $1 \mu\text{g ml}^{-1}$ ). Less sensitive *Listeria spp.*, were to erythromycin ( $2 \mu\text{g ml}^{-1}$ ) and tetracycline ( $2 \mu\text{g ml}^{-1}$ ).

**Keywords:** *Listeria monocytogenes*, antimicrobial resistance, salmon.

For further information please contact: [ineta.simonaviciene@lva.lt](mailto:ineta.simonaviciene@lva.lt)



## INFLUENCE OF DIFFERENT SELENIUM CONCENTRATION ON THE PROTEIN AND STARCH CONTENT IN RYE MALT

**Kristina Antonenko<sup>1</sup>, Viesturs Kreicbergs<sup>1</sup>, Anda Linīņa<sup>3</sup>, Daiga Kunkulberga<sup>2</sup>**

<sup>1</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>2</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>3</sup> Institute of Agrobiotechnology, Faculty of Agriculture, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

The research object was rye malt. Experiments were carried out at the Faculty of Food Technology of the Latvia University of Agriculture. The main aim of this study was to investigate the influence of different selenium concentrations on the content of protein and starch in rye malt. The protein, starch, also hectolitre mass were tested by Grains Analyzer Infratex 1241 (Sweden), the Falling number of grains was analysed using standard Hagberg-Perten method, according the ISO 3093:2009. Rye grain of 95% viability were soaked at temperature  $6\pm 2$  °C for 2 days and germinated at temperature  $6\pm 2$  °C for 3 days, using sodium selenate  $\text{Na}_2\text{SeO}_4$  solutions (Se concentration  $3 \text{ mg L}^{-1}$ ,  $5 \text{ mg L}^{-1}$ ,  $10 \text{ mg L}^{-1}$ ), dried in the oven for 24 hours at temperature of 70 to 112 °C. The germination of grain with deionised water served as a control. The obtained results showed that the increase of selenium concentration in solution is changing hectolitre mass (from 59.3 to 60.6  $\text{kg hL}^{-1}$ ), the content of protein (from 11.4 to 11.9%), starch (from 76.7 to 78.9%), and falling number (from 81.0 to 90.5 s) in rye malt comparing with control sample.

**Keywords:** rye, rye malt, selenium.

For further information please contact: [Viesturs.Kreicbergs@llu.lv](mailto:Viesturs.Kreicbergs@llu.lv)

## POTENTIAL OF IMAGE ANALYSIS BASED SYSTEMS IN FOOD QUALITY ASSESSMENTS AND CLASSIFICATIONS

Sebahattin Serhat Turgut, Erkan Karacabey, Erdoğan Küçüköner

Food Engineering Department, Engineering Faculty, Suleyman Demirel University, Isparta, Turkey, 32260

Increasing life standards, developing technology, growing importance of food quality and safety lead food industry to search new analysis methods. In addition, high consumer expectation and increasing population forces manufacturers to find fast and accurate techniques. The present study was aimed to prepare a summary about computer aided image processing systems covering working principles and applications for different analysis of food products. Image processing systems have recently been considered in this extent and results have revealed that computer aided these techniques can provide all these needs in a non-destructive way for samples. These techniques can be adapted to a wide range of food and agriculture products like meat, bakery products, dairy products, vegetables but primarily fruits. Image processing can be utilized for different purposes related to these product groups. Size and shape based classification, defects detection, microbial safety, quality grading and variety determination are mainly investigated topics. Literature survey indicates favourable reported results. Generally small scale investigations have been presented, but some of them could find a place for industrial application with high success. Computer aided image processing has been taken increasing interests of researcher for its potential in the applications for food technologies.

In the present study it was aimed to prepare a summary about computer aided image processing systems covering working principles and applications for different analysis of food products. As a conclusion it could be said that computer aided image processing systems reveal high potential in food industry.

**Keywords:** image processing, fast analysis method, food quality, classification.

For further information please contact: [erdogankucukoner@sdu.edu.tr](mailto:erdogankucukoner@sdu.edu.tr)

**A STUDY ON THE SHELF LIFE OF WALNUT SUMMER HALVA****Ali Batu<sup>1</sup>, Filiz Elyıldırım<sup>2</sup>**<sup>1</sup> Department of Food Engineering, Engineering Faculty, Mevlana University, 42003, Konya, Turkey<sup>2</sup> Seyidoglu Food Processing Factory, 75 Street # 5 Hadımköy, İstanbul Turkey

In this study, the changes in chemical, physical and microbiological properties of walnut summer halva (SWH) were analyzed during the 120 days of storage under 3 different storage temperatures (8, 20 and 30 °C). This study was carried out to analyse the 90 different pieces of 150 g WSH. Samples were taken on the 1st, 30th, 60th, 80th, 100th and 120th days of the storage for both chemical and physical analysis. Additionally, on the 60th, 80th, 100th and 120th days samples were taken for the microbiological analysis. The research results showed that the storage temperature and period of WSH caused the fat inside the product rise to the surface. This caused oil leakage in the product. Pungency, which shows the amount rancidity in the liquid oil and WSH, is an important quality criterion. During the storage at 8 °C the pungency of the WSH had increased during the 120 days. However the bitterness of the product appeared at 20 °C and at 30 °C on the 100th and 80th day respectively. It was observed that water activity was not affected excessively by temperature and storage time. According to the results of the study, Minolta L\* values were affected by temperature and storage time. Hardness in texture was observed in all samples at lower storage temperatures. It was estimated that microbiological load of products increased with prolonging of the storage time and increasing of temperature.

**Keywords:** summer halva, walnut, water activity, microbiological analyses, storage.

For further information please contact: [ali\\_batu@hotmail.com](mailto:ali_batu@hotmail.com)

## THE EFFECT OF FRESH AND FROZEN JUICES OF CHERRY BERRIES AGAINST BACTERIA AND YEAST

Daiva Jasinauskienė, Neringa Kasnauskytė, Dovilė Jonkuvienė, Antanas Šarkinas

Food Institute, Kaunas University of Technology, Taikos av. 92, LT-51180, Kaunas, Lithuania

The aim of the study was to determine the antimicrobial activity of newly derived 5 cherry hybrids. The fresh and frozen juices obtained from investigated cherry berries were screened for their antibacterial activities against the reference bacterial strains of *Listeria monocytogenes*, *Salmonella Typhimurium*, *Bacillus cereus*, *Escherichia coli* and *Staphylococcus aureus*, the lactic acid bacteria (LAB) of *Streptococcus thermophilus*, *Lactobacillus bulgaricus*, *Lactobacillus lactis* subsp. *lactis*, *Bifidobacterium bifidum* and *Lactococcus lactis* subsp. *cremoris* and the yeast of *Sacharomyces cerevisiae* and *Rhodotorula rubra in vitro* using the agar well diffusion method.

The antimicrobial activity of fresh and frozen juices of cherry berries varied depending on the tested microorganisms and a broad inhibiting effect was observed against gram-positive and gram-negative bacteria. The susceptibility of LAB to investigated juices was found to be lower than to other tested bacteria, while the growth of yeast was not prevented by the juices of cherry berries. It was also observed that juices retained their antimicrobial activity during frozen storage.

The application of various LAB strains as starter cultures in model milk medium supplemented with antimicrobially active substances extracted with methanol from cherry berries demonstrated non inhibiting growth of LAB during 24 h at 30 °C or 37 °C by measuring the dynamic of cells count. These obtained results showed a high potential to apply biologically active substances of cherry berries in practice for fermented milk products as supplements demonstrating the high inhibitory activity against pathogenic bacteria.

**Keywords:** cherry hybrids, fresh juice, frozen juice, antimicrobial activity.

**Acknowledgement.** Research was funded by a grant No.HIB-2011-01 / SVE01/11 from the Research Council of Lithuania. This research was performed in cooperation with the Institute of Horticulture Lithuanian Research Centre for Agriculture and Forestry.

For further information please contact: [antanas.sarkinas@ktu.lv](mailto:antanas.sarkinas@ktu.lv)

**TRENDS IN NEW PRODUCT AND  
TECHNOLOGY DEVELOPMENT**

# FOODBALT 2014

## STORAGE STABILITY OF MICROENCAPSULATED EXTRA VIRGIN OLIVE OIL POWDER

Aslı Zungur<sup>1</sup>, Mehmet Koç<sup>2</sup>, Buket Yalçın<sup>1</sup>, Figen Kaymak-Ertekin<sup>1</sup>, Semih Ötleş<sup>1</sup>

<sup>1</sup> Department of Food Engineering, Faculty of Engineering, Ege University, Bornova, Izmir, Turkey

<sup>2</sup> Department of Food Engineering, Faculty of Engineering, Adnan Menderes University, Aydin, Turkey

Microencapsulation process is an application that aims to increasing stability of food components (oil, pigments, aroma, etc.) during the process and storage. Microencapsulation of extra virgin olive oil is aimed to convert olive oil to powder form with high oxidation stability, phenolic and antioxidant content during spray drying process and storage period. In this study, the storage stability of microencapsulated extra virgin olive oil powder which was coated with maltodextrin and whey protein isolate as wall material was investigated by evaluating microencapsulation efficiency, peroxide value, phenolic content and antioxidant activity during storage in aluminium polyethylene pouches at 25 °C and 50%RH for 180 days. The results showed that microencapsulation efficiency, phenolic content and antioxidant activity of microencapsulated extra virgin olive oil powder decreased by 16.0%, 44.6% and 58.6% as compared to initial value during storage. However the peroxide value of sample was increased from 11.6 meq O<sub>2</sub> kg<sup>-1</sup> to 35.6 meq O<sub>2</sub> kg<sup>-1</sup> at the end of storage period. The trend of microencapsulation efficiency, phenolic content, antioxidant activity and peroxide value of microencapsulated extra virgin olive oil showed that the experimental data clearly fitted the first-order kinetic model ( $C=C_0 \times e^{-kt}$ ) during storage. Although microencapsulation efficiency of samples changed slightly, phenolic content and antioxidant activity decreased while peroxide value of sample increased sharply during storage. This circumstance possibly was caused by small particle size and/or huge surface area of olive oil powder.

**Keywords:** microencapsulation, extra virgin olive oil, storage, oxidation.

For further information please contact: [figen.ertekin@ege.edu.tr](mailto:figen.ertekin@ege.edu.tr)

## SENSORY AND STRUCTURAL PROPERTIES OF PANCAKES WITH PEA AND BUCKWHEAT FLOUR

Ilze Beitane<sup>1</sup>, Gita Krumina-Zemture<sup>1</sup>, Iriša Murniece<sup>2</sup>

<sup>1</sup> Department of Nutrition, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>2</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

The flour produced from pea and buckwheat, due to their amino acids content possesses important nutritional properties and is gluten free, therefore it makes them be useful for people with celiac disease. The treatment of celiac disease is gluten free diet, thus it is important to produce gluten free products with high nutritional value. The aim of the research was to evaluate the effect of pea and buckwheat flour on colour, sensory and structural properties in pancakes. Results of the research showed that during and after frying process pancakes kept its shape when 100% of pea flour was used. The structure of pancakes was changed from harder to the softer and was mealier due to the pea flour replacement to the buckwheat flour. When for pancake preparation 100% of buckwheat flour was used during frying pancakes fall apart – did not keep the shape. Obtained results in sensory analysis show pea and buckwheat flour effect on pancake colour and taste. When for pancake frying higher amount of buckwheat flour was used the colour became darker, the structure was softer and buckwheat taste was predominant. In the analysis of sensory properties chosen experts indicated that pancakes with 40% and 60% of added buckwheat flour were the most pleasant.

During colour (CIE L\* a\* b\* system) and texture analysis the same tendency of the changes was presented. Tendency to decrease of colour indices L\* and b\* in pancakes was shown when amount of buckwheat flour was increased.

**Keywords:** pea flour, buckwheat flour, sensory properties, texture, colour.

For further information please contact: [Ilze.Beitane@llu.lv](mailto:Ilze.Beitane@llu.lv)



## PORE SIZE DISTRIBUTION OF EGGPLANTS DRIED BY DIFFERENT DRYING METHODS

Ayca Aydogdu<sup>1,2</sup>, Gulum Sumnu<sup>1</sup>, Serpil Sahin<sup>1</sup>

<sup>1</sup> Department of Food Engineering, Middle East Technical University, 06800, Ankara, Turkey

<sup>2</sup> Department of Food Engineering, University of Necmettin Erbakan, 42090, Konya, Turkey

The main objective of this study is to investigate the effects of hot air drying and microwave-infrared combination drying on porous structure of eggplants. Hot air drying was performed in a tray dryer at 50 °C with an air velocity of 1.5 m s<sup>-1</sup>. In microwave-infrared combination oven, different microwave powers (30%, 40% and 50%) were combined with different infrared powers (10%, 20%). At the end of drying process, initial moisture content decreased from 14 kg water kg<sup>-1</sup> dry solid to approximately 0.13 kg water kg<sup>-1</sup> dry solid for eggplants. Pore size distributions of dried samples were analyzed with mercury porosimetry. Pores in different samples were characterized by cumulative intrusion curves which showed total volume of mercury intruded the pore volume in any pore size range and the threshold diameter. Cumulative intrusion curves had a sharp rise that indicated existing macro pores on the surface. Unlike microwave–infrared combination dried eggplants, hot air dried eggplants did not have pores above 200 µm size. Threshold diameter of eggplants dried in microwave-infrared combination oven were in the range of 48.86 µm to 73.42 µm which were greater than that of hot air dried eggplant, 42.47 µm. Microwave-infrared combination drying provided more porous structure than hot air dried ones due to higher internal pressure. As infrared and microwave power increased, threshold diameter increased and eggplants with more porous structure were obtained.

**Keywords:** microwave, infrared, drying, eggplant, porosity.

For further information please contact: [serp@metu.edu.tr](mailto:serp@metu.edu.tr)

## PRODUCTION OF GLUTEN-FREE SOURDOUGH BREADS PREPARED WITH CHESTNUT AND RICE FLOUR

Ilkem Demirkesen Mert<sup>1</sup>, Osvaldo H. Campanella<sup>2,3</sup>, Gulum Sumnu<sup>1</sup>, Serpil Sahin<sup>1</sup>

<sup>1</sup> Department of Food Engineering, Middle East Technical University, Dumlupinar Bulvarı, Ankara, Turkey

<sup>2</sup> Department of Agricultural and Biological Engineering, Purdue University, 225 South University, West Lafayette, IN, USA

<sup>3</sup> Whistler Carbohydrate Research Center, Purdue University, 745 Agriculture Mall Drive, West Lafayette, IN, USA

In order to meet the rising demand of celiac patients for high quality and healthier products, the old biotechnological process, sourdough technology, was applied in gluten-free bread-making. In present study, the effect of the addition of different amounts of sourdough (0%, 20% and 40%) on the rheological behavior of gluten-free chestnut-rice dough formulations as well as the on quality parameters (pH, total titratable acidity (TTA), firmness and volume) of chestnut-rice breads was pointed out. The increasing levels of sourdough addition caused reductions in pH and increases in TTA values of samples. The addition of sourdough led to decreases in complex modulus ( $G^*$ ) of dough samples showing softening of dough. Addition of sourdough improved the quality of gluten-free breads, especially their texture, beyond a certain amount. Therefore, the highest specific volume and the lowest firmness values were obtained from gluten-free breads with the addition of 20% sourdough. However, higher level (40%) of sourdough addition had detrimental effect on volume and texture of breads. The results of present study showed that addition of 20% of sourdough can be used to improve the quality of gluten-free chestnut-rice breads.

**Keywords:** chestnut, gluten-free bread, rice, sourdough.

For further information please contact: [gulum@metu.edu.tr](mailto:gulum@metu.edu.tr)

## TECHNOLOGICAL ASPECTS OF THE RESULTS IN RHEOLOGICAL STUDIES OF CANDY MASS

**Evgeniia Muratova, Polina Smolikhina**

Department of Technologies and Equipment for Food and Chemical Production, Technological Institute, Tambov State Technical University, Sovetskaya Street, Tambov, Russia

The aim of the research was to study the rheological behavior of different candy mass recipes in order to optimize technological modes for processes of tempering and molding products with specified structural and mechanical properties. The objects of the study were fondant, jelly and whipped semi-finished products made according to the classic recipes and with involving vegetable powders and phytonutrients. According to the research results the effect of dosing and dispersion of phytonutrients and vegetable powders on candy mass viscosity at different temperatures and strain rates allowed to develop recommendations for selecting modes of thermomechanical processing of fondant and jelly masses at the stage of tempering and molding.

It was found that the nature of changes in plastic strength of semi-finished products depends on modes of structure formation and influence of additives of plant origin on this process. The research showed that powder additives contribute to significant reduction in the duration of structure formation.

The paper also studies the effect of phytonutrients and vegetable powders on the strength of adhesive contacts between the layers of candy mass in forming multilayered confectionery products. Defined interval of strength values of adhesive contacts allows to prevent delamination and to formulate the main requirements to the conditions and methods for molding candies with a combined body.

The obtained results of complex rheological studies make it possible to implement the evidence-based approach to the management of technological processes of confectionery products manufacture and ensure the achievement of specified technological and consumer characteristics.

**Keywords:** rheology, adhesion, candy mass, phytonutrients.

For further information please contact: [topt@topt.tstu.ru](mailto:topt@topt.tstu.ru), [oda@admin.tstu.ru](mailto:oda@admin.tstu.ru)

**CHEMICAL AND SENSORY PROPERTIES OF RICOTTA CHEESE**

**Jurate Slapkauskaite, Jurgita Zaboraitė, Dalia Sekmokiene**

Department of Food Safety and Quality, Veterinary Academy, Lithuanian University of Health Sciences, Tilzes str. 18, Kaunas, Lithuania

Whey is the liquid by-product of cheese and cottage cheese manufacture from milk. The whey has many biological active materials, especially proteins. One of the possibilities, how to increase the whey using for dairy products, as well as food in general, is using of essential oils and extracts.

The objective of the study was to prepare fresh ricotta cheese and evaluate the effect of honeybush (*Cyclopia intermedia*) and Chinese hibiscus (*Hibiscus rosa-sinensis*) tea extracts enrichment on the chemical composition and sensory properties of ricotta. The chemical composition analysis (dry matter, protein, fat, lactose, ash, energy value) and sensory properties were evaluated by ten panellists.

Chemical analysis showed that ricotta with Chinese hibiscus extract had the highest fat content of 0.23% while the control sample had the lowest 0.15%. Also, ricotta produced with honeybush extract had the highest protein content 0.62%, while the control sample had the lowest 0.58%.

The sensory evaluation showed that ricotta cheese was generally acceptable. The study recommends the introduction of ricotta cheese by dairy industry to meet the local need.

**Keywords:** chemical composition, sensory properties, ricotta, *Cyclopia intermedia*, *Hibiscus rosa-sinensis*.

For further information please contact: [slapkauskaite@lva.lt](mailto:slapkauskaite@lva.lt)

## FISH AND SEAFOOD RAW MATERIALS – PROMISING SOURCE FOR DEVELOPMENT OF VALUE-ADDED FOOD PRODUCTS

**Pavels Semjonovs, Ilze Denina, Arturs Patetko, Dagnija Upite, Raimonds Linde,  
Lilija Auzina, Rita Scherbaka**

Laboratory of Industrial Microbiology and Food Biotechnology, Institute of Microbiology and Biotechnology, University of Latvia, Kronvalda bulv. 4, Riga, Latvia

The demand for seafood products has rapidly grown worldwide in recent years, in the developed countries mostly due to the opinion that fish is an indispensable component of the healthy diet. Recently fish and fish products are increasingly promoted as functional foods, and applications of marine nutraceuticals as well as a role of fish products as integral part of healthy diet has been extensively studied. Cross-disciplinary scientific research constantly provides new insights in the interaction between diseases genetic predisposition, specific health risk factors, nutritional habits, and the functional activity of individual nutrients. Many health benefits are attributed to fish products consumption including risk reduction for a number of diseases: cardiovascular health and blood pressure, arthritis, vitamin and mineral deficiencies. Fish and fish products have inherent functional properties. These nutrients and bioactives can be isolated and added to a wide range of foods, thereby enhancing their functional value. Therefore seafood should be treated as valuable raw material for further development of value-added healthy foods and nutraceuticals especially by application of promising methods of microbial or enzymatic bioconversion in the production processes which will be performed within the ERDF granted project “Value added functional foods from fish by-products” Nr. 2013/0061/2DP/2.1.1.0/13/APOA/VIAA/035.

**Keywords:** functional foods, fish, seafood, nutraceuticals.

For further information please contact: [pavels.semjonovs@lu.lv](mailto:pavels.semjonovs@lu.lv)

## EVALUATION OF YEAST CULTURES FOR DEVELOPMENT OF FERMENTED APPLE-JUICE BASED NON-ALCOHOLIC BEVERAGES

**Arturs Patetko, Pavels Semjonovs, Ilze Denina**

Laboratory of Industrial Microbiology and Food Biotechnology, Institute of Microbiology and Biotechnology, University of Latvia, Kronvalda bulv. 4, Riga, Latvia

Nowadays broad chose of soft drinks is available for consumers. Unfortunately, mainly they richly contain synthetic food additives such as flavorings, colorants, sweeteners, and preservatives etc. witch downside effects for consumer health is widely discussed. Naturally fermented fruit and vegetable juices-based non- or low-alcoholic beverages could be proposed as an advanced alternative for widespread of unhealthy soft drinks. Yeast strains *Saccharomyces cerevisiae* MBI-R1118 and *Saccharomyces cerevisiae* MBI-R70424 were used to evaluate the ethanol production as compared with two low-ethanol producing strains – *Zygosaccharomyces rouxii* MBI-R2532 and *Saccharomyces ludwigii* MBI-R3447. Ethanol, glucose, fructose, sucrose concentrations, biomass production, acidity and organoleptic properties as well were monitored during this research. Various carbon sources were assayed for their influence on the ethanol yield in the modified Sabouraud medium. It was shown that both strains of *S. cerevisiae* produce an unacceptable high amount of ethanol, which is more than 0.5% vol., while for the other two cultures *Z. rouxii* and *S. ludwigii* relatively lower ethanol production was characteristic. Thus, during the research the pasteurized apple juice was fermented with above mentioned *Z. rouxii* and *S. ludwigii* strains. After 48 h the ethanol concentration of 0.48% vol. in the fermented apple juice (which contained initially 60.4 g L<sup>-1</sup> of glucose and 15.0 g L<sup>-1</sup> of fructose as dominant carbon sources) has been reached for *Z. rouxii* strain and 2.1% vol. for *S. ludwigii* strain. It was shown that chosen yeast strains have a great potential for further development of fermentation technology of naturally fermented juices-based low-alcoholic beverages.

**Keywords:** fermented beverage, non-alcoholic, low-alcoholic, juice based, yeasts.

For further information please contact: [pavels.semjonovs@lu.lv](mailto:pavels.semjonovs@lu.lv)

**PROTEIN BAR MANUFACTURING ABILITIES**

**Orestas Levuškinas, Ignas Šeputis, Viktoras Liorančas**

Department of Food Technology, Faculty of Technologies, Klaipėda's State College, Bijunu Str. 10, Klaipėda, Lithuania

Nowadays life is very fast paced, often people diet is irregular, and the body does not get all the essential nutrients. For athletes it is even harder, because they do not eat any ordinary food. They require a balanced diet and this diet based on high amount of proteins, which gives energy, burns fat and helps to build lean muscle mass after exercises. Protein shakes solve the nutritional need, but they are not a convenient way to get the required amount of proteins, so the aim of this study was to create a new product – protein bar. During manufacturing process, the main ingredients were natural whey proteins. In this research the most satisfying production technology, which would produce a delicious, fast absorbed and attractive appearance snack protein bar was combined. Three flavor options were created in this study; nutrient composition, comparative sensory analysis and the number of colony-forming units per gram ( $\text{cfu g}^{-1}$ ) were carried out. According sensory properties and nutrients composition, new product was compared with some analogical protein bars from market. It can be concluded, that the new protein bar had more positive sensory assessments and nutrient composition, especially amount of proteins, was higher than in market ones. Microbiological analysis showed that new product is safe; staphylococcus, salmonella and total bacteria count were below standard.

**Key words:** natural whey protein, protein bar, sensory properties.

For further information please contact: [orestas.levuskinas@gmail.com](mailto:orestas.levuskinas@gmail.com)

## THE INFLUENCE OF PRE-TREATMENT METHOD ON THE FAT CONTENT DECREASE IN FRENCH FRIES

**Solvita Kampuse, Aleksandrs Jefimovs, Tatjana Rakcejeva**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela Street 2, Jelgava, LV-3001, Latvia

French fries are very popular product in many countries. But this product together with potato chips is included in the group of unhealthy products due to high content of fats, acrylamid, and peroxyde value. Therefore **the aim** of this research was to evaluate the pre-treatment methods for reducing the fat content, and improving other quality parameters.

Before frying the potato strips were blanched in hot water at 85 °C, and dried in microvave-vaccum dryer for 3, 6 and 8 min, and in conventional dryer with air ventilation for 15 min at 60 and 80 °C, and 10 min at 100 °C temperature. The frying was done at 170 °C for 1.5–2.0 min. The colour (in CIE L\*a\*b\*), texture (with texture analyser), the moisture content, and the total fat content were analysed for all prepared samples.

The best preliminary drying technology was drying in the conventional dryer at 100 °C temperature for 10 min. The product prepared with this technology had the lowest total fat content (3.4%), and the lowest hardness (lowest maximal cutting force: 11.3 N). The lowest moisture content was to sample dried in microvave-vaccum dryer for 8 min (36.84%). This sample was also the hardest one (maximal cutting force: 52.41 N). There were no significant differences ( $p>0.05$ ) in colour (L\*a\*b\*) values between control samples and samples dried in conventional dryer but the samples dried in microvave-vaccum dryer became darker than control samples (lower L\* value 57.37)

**Keywords:** French fries, preliminary drying, total fat content.

For further information please contact: [skampuse@inbox.lv](mailto:skampuse@inbox.lv)



## DRIED VENISON PHYSICAL AND MICROBIOLOGICAL PARAMETER CHANGES DURING STORAGE

**Ilze Gramatina, Laima Silina, Liga Skudra, Tatjana Rakcejeva**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

The aim of the current research was to determine changes in physical and microbiological parameters of dried venison during storage. For the experiments the meat (0.02×4.00×7.00 cm) pieces were marinated in “teriyaki sauce” marinade (composition: teriyaki sauce, sweet and sour sauce, taco sauce, soy sauce, American BBQ sauce hickory, sesame oil, garlic, garlic salt, tabasco red pepper sauce) at 4±2 °C temperature for 48h. To improve the meat textural properties sodium monophosphate was added in part of marinade too. After marinating meat samples were dried in microwave-vacuum drier MUSSON–1, packaged in vacuum pouches made from polymer film (PA/PE) with barrier properties and storage for 4 months at +18±1 °C temperature in dark. The following physical and microbiological parameters of dried meat were evaluated after 35, 91 and 112 storage days using standard methods: pH (AACC 02-52), colour by Colour Tec PCM/PSM (CIE L\*a\*b\* system) and texture by TA. XT. plus Texture Analyser, the total count of mesophilic aerobic and facultative anaerobic microorganisms (Ref. Nr. 01–140), *Enterobacteriaceae* spp. (Ref. Nr. 01–295) and lactic acid bacteria (Ref. Nr. 01–135). Experimentally it was ascertained, that the shelf-life of dried venison with sodium monophosphate additive is 91 day and without sodium monophosphate additive – 112 days. During experiments significant differences were detected in meat colour and texture changes. Within experiments it was proved, that dried meat colour stability and texture is possible to provide during storage by adding of sodium monophosphate at marinade.

**Keywords:** venison, drying, microwave-vacuum drier.

For further information please contact: [ilzegramatina@inbox.lv](mailto:ilzegramatina@inbox.lv)

## PREPARATION AND ENCAPSULATION PROPERTIES OF PROPYLENE OXIDE AND OCTENYL SUCCINIC ANHYDRIDE MODIFIED STARCHES

Ieva Vidžiūnaitė<sup>1</sup>, Ina Jasutienė<sup>1</sup>, Milda Keršienė<sup>1</sup>, Rima Klimaviciute<sup>2</sup>,  
Ramune Rutkaite<sup>2</sup>

<sup>1</sup> Department of Food Science and Technology, Faculty of Chemical Technology, KTU, Radvilenu 19, Kaunas, Lithuania

<sup>2</sup> Department of Polymer Chemistry and Technology, Faculty of Chemical Technology, KTU, Radvilenu 19, Kaunas, Lithuania

Large quantities of starch are chemically and/or physically modified to obtain desired properties for different applications. Among a number of chemical modification methods, hydroxypropylation (HP) and esterification with octenyl succinic anhydride (OSA) are common methods for chemical modification achieved by placing substituent groups along the polymeric chain. When modified with OSA, the normally hydrophilic starch gains a hydrophobic element resulting in whole molecules with amphiphilic character. Meanwhile, HP of starch imparts improved shelf life, cold water swelling and reconstituting properties to a formulated product. A unique application of such specialty food starches is in preparation of oil-in-water emulsions, which can be used for encapsulation of important food ingredients like vitamin D. The aim of this work was synthesis of HP and/or OSA modified potato starches, preparation and characterisation of oil-in-water-emulsions and encapsulation of vitamin D. Hydroxypropylated potato starch (PS-HP) with degree of substitution ( $DS_{HP}$ ) of 0.2 was obtained by the etherification of native potato starch with propylene oxide in the presence of alkaline catalyst. OSA starches (PS-OSA) and OSA hydropropylated starches (PS-HP-OSA) with  $DS_{OSA}$  varying from 0.007 to 0.02 were obtained from the esterification reaction between OSA and hydroxyl groups of starch or hydroxypropylated starch, respectively. The characteristics and stability of the 20% rapeseed oil-in-water emulsions stabilized with 2% of modified starch derivative was investigated. By assessment of creaming index it was established that PS-HP-OSA emulsions have better stability compared to that of PS-OSA emulsions. The retention and stability of vitamin D during storage of emulsions was established.

**Keywords:** starch, hydroxypropylation, octenyl succinic anhydride, vitamin D.

**Acknowledgement.** The authors are grateful to the Research Council of Lithuania and National Paying Agency under the Ministry of Agriculture for financial support of the project MT 1131.

For further information please contact: [ramune.rutkaite@ktu.lt](mailto:ramune.rutkaite@ktu.lt)

## ANTHOREFINERY FOR FOOD, FEED AND NON FOOD: DREAM OR REALITY?

**Thierry Talou, Tian Ming Zhao, Quang Hung Nguyen**

Laboratoire de Chimie Agro-industrielle, INPT-ENSIACET, Université de Toulouse, 4 Allée Emile Monso, 31432 Toulouse, France

Insects have served as a nutritional, tasty and safe food source for people for tens of thousands of years, all over the planet. Today entomophagy, aka practice of eating insects, including arachnids and myriapods, is rare in the developed world, but eating insects is a common and popular practice in many developing regions of Central and South America, Africa, Australia and Asia. In Ghana, winged termites are collected and fried, roasted, or made into bread while in Cambodia tarantulas are eaten and are one of the more popular foodstuffs sold to tourists. In South Africa, insects are eaten with cornmeal porridge and in China, beekeepers are considered virile, because they regularly eat larvae from their beehives. Gourmands in Japan savor aquatic fly larvae fried in sugar and soy sauce and candied grasshoppers, known as inago, are also a favorite cocktail snack. De-winged dragonflies boiled in coconut milk with ginger and garlic is a delicacy in Bali. In Latin America cicadas, fire-roasted tarantulas, and ants are prevalent in traditional dishes. One of the most famous culinary insects, the agave worm, is eaten on tortillas and placed in bottles of mezcal liquor in Mexico. Regarding a recent survey of the Food and Agriculture Organization (FAO) of the United Nations, an estimated 1 500 species are recorded as edible insects and due to their high proteins and low carbohydrates contains, their processing appears as an option for feeding the planet in 2050. Consequentially, several projects around the world are in progress for exploitation of insects as an alternative protein source for animal and human nutrition. But applying to insects the concept of biorefinery, e.g. sequential valorization processing allowing valuable components fractionation, while not penalizing the subsequent valorization of residual solid by-products, could be an interesting option for producing bio-sourced feed and non-food products. The poster will present a prospective study on anthorefinery concept applied to several edible insects species, allowing production of aromatic extract (maengdana) from leaving animals, proteins and lipids from dried animals, neutraceuticals (insect tea) and bio-fertilizers from feces.

**Keywords:** anthorefinery, insects, flavoring, food, feed.

For further information please contact: [thierry.talou@ensiacet.fr](mailto:thierry.talou@ensiacet.fr)

## OPTIMIZATION OF MANUFACTURING TECHNOLOGY OF SOFT CHEESE

**Ruta Budreckiene, Agne Struzeckiene**

Department of Biochemistry, Veterinary Academy, Lithuanian University of Health Sciences,  
Tilzes str. 18, Kaunas, Lithuania

The aim of this work was optimization of production processes and determination of the goals settings of the optimal values in production of investigatory soft cheese. Consequently, fat and protein ratio of the prepared pasteurized milk mixture for soft cheese production, and their influence on the fat content in dry matter of final product was determined, moisture of the coagulum and the final product established and the coagulum moisture content and coagulum drying effect on the duration of the final product moisture investigated.

It was established that the largest fat content in dry matter of final product (52.21%) is by the fat/protein ratio of – 1.14, and the lowest (41.69%) – by the ratio of 0.83. Optimal pasteurized mixture of milk fat/protein ratio for soft cheese is from 0.830 to 0.962. The ideal fat/protein ratio for given soft cheese – 0.89. The lowest moisture content of the final product ( $51.9\pm 0.08\%$ ) was obtained by the coagulum moisture at  $76.1\pm 0.07\%$ , and the highest –  $55.0\pm 0.09\%$ , when coagulum moisture was  $71.4\pm 0.13\%$ . The optimal coagulum moisture range, conforming to corporate standards for the final product moisture soft cheese is from 69.01 to 75.55%. The longest drying time of the coagulum (35 min) corresponds to the minimum moisture content of the final product –  $51.438\pm 0.492\%$ . The maximum moisture content of the final product  $54.87\pm 0.381\%$  was obtained, when the coagulum drying time was 30 minutes. This period of time is also optimal drying time for coagulum of investigatory soft cheese.

**Keywords:** milk, soft cheese, coagulum.

For further information please contact: [rutbudr@lva.lt](mailto:rutbudr@lva.lt)

**FOOD CHEMISTRY, ANALYSIS  
AND QUALITY ASSESSMENT**

## BERRY AND FRUIT JUICES AS POTENTIAL UNTRADITIONAL ACIDITY REGULATORS IN BEER MASHING

Ingmārs Cinkmanis, Sanita Vucāne, Ilze Čakste

Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

Acids traditionally used for acidification of mash (lactic acid, phosphorus acid) provide optimal medium pH, however, it is theoretically possible to choose such agents that would complete several tasks, not only ensuring the regulation of pH, but also enriching the content of wort extract substances. Berry and fruit juices (cranberry, black currant, red currant, quince, apple and lemon) containing different organic acids, such as citric acid, malic acid, tartaric acid and fumaric acid, have similar properties, although they can not only acidify mash but also increase the content of extract substances in wort. The aim of the research was to production of the beer wort by using untraditional acidity regulators. The content of pH, organic acids, extract and carbohydrates were determined.

Results of the analysis of mash pH changes showed, that it is possible to reduce pH replacing traditional acidification regulators (lactic acid, phosphoric acid) with berry and fruit juices. The pH was practically in all the mashing stages in the limits of  $5.14 \pm 0.02$  up to  $5.19 \pm 0.02$ . Berry and fruit juices containing organic acids considerably influence the content of wort extract substances. It was observed during the experiments that berries and fruit contain only citric acid (lemon, black currant and red currant juices) show a lower content of extract substances, i.e., glucose and maltose, comparing to cranberry, apple and quince juices that additionally also contain malic and tartaric acids. The optimal berry and fruit mashing acidification regulators were quince and cranberry juices.

**Keywords:** acidity regulators, pH, mashing, wort.

For further information please contact: [Ingmars.Cinkmanis@llu.lv](mailto:Ingmars.Cinkmanis@llu.lv)

## INFLUENCE OF FLESH COLOUR ON CAROTENOID AND TOTAL PHENOLIC CONTENT IN POTATO TUBERS

Irisa Mūrniece<sup>1</sup>, Lolita Tomšone<sup>2</sup>, Ilze Skrābulē<sup>3</sup>, Aija Vaivode<sup>3</sup>

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>2</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>3</sup> State Priekuli Plant Breeding Institute, Zinatnes Street 2, Priekuli, Latvia

Polyphenols are recognized as the most abundant antioxidants in our diet. Potatoes are a good source of these compounds. Phenolic compounds represent a large group of minor chemical constituents in potatoes, which play an important role in determining their organoleptic properties. Further, phenolics have a wide-array of health providing characteristics. The aim of this research was to determine the influence of flesh colour of potato tubers on carotenoid and total phenolic content (TPC). In cooperation with the State Priekuli Plant Breeding Institute (Latvia), sixteen potato genotypes were studied. The highest TPC and carotenoid content was determined in potato tubers of Purple Peru variety when conventionally cultivated. Correlation was found between TPC and colour L\* ( $r=-0.813$ ). Carotenoid content, TPC and dry matter content (DM) of potatoes vary significantly according to the type of cultivation practise and depending on variety. There are common tendencies in the changes of DM, TPC and carotenoid content – the variety was most significant factor ( $p<0.001$ ).

**Keywords:** potato, colour, carotenoid, organic, conventional.

**Acknowledgement.** The authors acknowledge financial support from the project „Sustainable use of local agricultural resources for development of high nutritive value food products (Food)” within the National Research Programme “Sustainable use of local resources (earth, food, and transport) – new products and technologies (NatRes)” (2010.-2013.).

For further information please contact: [irisa.murniece@llu.lv](mailto:irisa.murniece@llu.lv)

## THE INFLUENCE OF METEOROLOGICAL CONDITIONS ON WINTER WHEAT WHOLEMEAL PROTEIN CONTENT AND RHEOLOGICAL PROPERTIES

**Anda Linina<sup>1</sup>, Antons Ruza<sup>1</sup>, Daiga Kunkulberga<sup>2</sup>, Tatjana Rakcejeva<sup>2</sup>**

<sup>1</sup> Institute of Agrobiotechnology, Faculty of Agriculture, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

<sup>2</sup> Department of Food technology, Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

The aim of this investigation was to clarify variation of protein content on winter wheat (*Triticum aestivum* L.) grain, water absorption and mixing properties of wholemeal dough, depending on harvest year weather conditions (2010–2012) and cultivar. Trial included winter wheat varieties 'Bussard' and 'Zentos'. The farinograph water absorption (WA) and wholemeal dough mixing characteristics—dough development time (DDT), dough stability time (ST) and degree of softening (DS12) were tested by Brabender Farinograph (ICC 115/1). For all the winter wheat quality parameters the cultivars and year effects was statistically significant ( $p < 0.05$ ). The influence of year was confirmed on higher level for grain protein content and wholemeal dough stability time, compared with the cultivar effect. Cultivar had a much stronger effect on wholemeal dough water absorption, dough development time and degree of softening than year. Cultivar 'Bussard' wholemeal had higher protein content, water absorption, longer stability time and shorter degree of softening compared with 'Zentos'. The results demonstrate that the quality of the studied varieties meets the requirements for high-grade wheat for food consumption, and are suitable for wholegrain flour production and baking. The positive correlation ( $r = 0.972$ ) existed between protein content and dough stability. Protein content correlated negative ( $r = -0.893$ ) with dough degree of softening. Dough stability time had negative correlation ( $r = -0.878$ ) with degree of softening.

**Keywords:** winter wheat, protein, rheological properties, Farinograph.

For further information please contact: [anda.linina@llu.lv](mailto:anda.linina@llu.lv)



## AMYLOSE CONTENT OF RICE MARKETED IN PORTUGAL

**Paula M. R. Correia<sup>1,2</sup>**, **Tânia Santos<sup>1</sup>**, **Diogo Lemos<sup>3</sup>**, **Carla Brites<sup>4</sup>**,  
**Raquel P. F. Guiné<sup>1,2</sup>**

<sup>1</sup> Department Indústrias Alimentares – Escola Superior Agrária de Viseu, Quinta da Alagoa Estrada de Nelas, 3500-606 Viseu, Portugal

<sup>2</sup> CI&DETS – Instituto Politécnico de Viseu, Av. Coronel José Maria Vale de Andrade, Campus Politécnico, 3504-510 Viseu, Portugal

<sup>3</sup> Novarroz- Produtos Alimentares, S.A., Rua da Moura 43, 3720-581 UL, Adães, Portugal

<sup>4</sup> Instituto Nacional de Recursos Biológicos, I.P., Avenida da República, Quinta do Marquês 2784-505 Oeiras, Lisboa, Portugal

Amylose content is considered to be the most important parameter of cooking quality in rice. Presently, rice cultivars are categorized according to amylose content into three groups: low, medium and high amylose content cultivars. The specific objective of this work is to evaluate the grain amylose content of 77 cultivars, which cover *Índica* and *Japónica* subspecies, and different types of commercial rice like, aromatic (*basmati* and *thay*), wild rice, medium rice (carlose and risotto), glutinous (waxy) and parboiled rice. Generally, these types of rice are the ones commercialized in Portugal. The encountered results showed that in the same group the amylose contents were consistent, and could present great variance, as it is the case of *Indica* subspecies, which vary between 12.0% to 29.5%, and presenting the high amylose percentages. Thus, these intermediate amylose rices could give moist and tender upon cooking. It is also important to mention that amylose consists of linearly linked glucose molecules and is relatively resistant to digestion, hence the term “resistant starch”. This means that these rice cultivars with a greater proportion of starch in the form of amylose tend to have a lower glycemic index, and could be recommended for special diets. The low values were presented for glutinous rice (1.9% and 3.3%), which means that these type of rice do not expand in volume, are glossy and sticky, and remain firm when cooked. Intermediate values were found for parboiled rice. The majority of rice types presented low amylose content, range from 9% to 19%.

**Keywords:** rice, amylose.

For further information please contact: [paularcorreia@hotmail.com](mailto:paularcorreia@hotmail.com)

## EFFECT OF DIFFERENT TYPES OF HEAT TREATMENT ON INVERTASE ACTIVITY IN HONEY

**Fredijs Dimins<sup>1</sup>, Velga Miķelsone<sup>1</sup>, Pēteris Kūka<sup>1</sup>, Artūrs Niklāvs Jefremovs<sup>2</sup>**

<sup>1</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, LV 3001, Latvia

<sup>2</sup> Jelgava Gymnasium Spidola, Mātera Street 30, Jelgava, LV 3001, Latvia

Honey is important food stuff, which is often consumed fresh or used in other meals. Liquid honey is more demanded in market, so solid honey often is heated in order to melt it. One of the most traditional ways to melt the honey is by heating using thermal treatment – usually in higher temperature than 50 °C. Using microwave ovens are very popular approach to heat food and its popularity is growing, so it is important to understand, how food and its substances are being influenced by microwave heating. One of the most heat-sensitive enzymes is invertase.

The aim of the research is to study and to compare, how invertase activity in honey is affected by heating it in the microwave oven and in the thermostat, while changing microwave oven power, heating duration and heating temperature in thermostat.

p-Nitrophenyl- $\alpha$ -D-glucopyranoside (pNPG) is used as a substrate for the determination of the sucrase number in honey. pNPG is split into glucose and p-nitrophenol by  $\alpha$ -glucosidase (invertase, sucrase). By adjusting the pH-value to 9.5 the enzymatic reaction is stopped and at the same time nitrophenol is transformed into the nitrophenolate anion, which corresponds to the amount of converted substrate and is determined photometrically at 400 nm.

Analyzing different honey samples, the following results were obtained. When honey samples were heated in 450 W microwave oven, invertase activity significantly decreased after 20 seconds. After 25 seconds invertase activity decreased 5.8 times, after 30 seconds – 12.5 times.

After heating honey samples in thermostat in 60 °C for 120 minutes, invertase activity decreased only twice.

Summarizing research results, we concluded, that invertase activity changes are significantly higher in honey samples, heated in the microwave oven, than honey samples, heated in the thermostat.

**Keywords:** honey, invertase activity, thermal treatment, microwave oven.

For further information please contact: [fredisd@tvnet.lv](mailto:fredisd@tvnet.lv)

## INFLUENCE OF FREEZING AND DRYING ON THE PHENOL CONTENT IN HORSERADISH AND LOVAGE

**Lolita Tomsons, Zanda Kruma**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

A perennial herb lovage (*Levesticum officinale* L.) and horseradish (*Armoracia rusticana* L.) contains biologically active substances and is cultivated in temperate regions of the world. The aim of the current research was to study the effect of the treatment method on the phenolic content and antioxidant activity of plants. The samples were processed using freezing (-20 °C) and drying (1 week at temperature of +24 °C, in a dark, till moisture content 10±2%), and for a comparison fresh samples were analysed. For experiments lovage leaves and stems and horseradish leaves were investigated. Plant material was extracted with ethanol using conventional extraction and total phenols, total flavonoids, antioxidant activity were determined spectrophotometrically. Individual polyphenolics were determined using HPLC. Analysis of the phenolic compounds and antioxidant activity of lovage and horseradish showed differences depending on the technological processes applied. The predominant phenolic acid in lovage samples was caffeic acid, but in horseradish leaves – chlorogenic acid, and the major flavonoid was rutin. Only sinapic acid in dry matter of lovage stems was found to be higher in the dried samples, compared to the fresh and frozen samples. One of the best traditional methods for preserving phenolic compounds and antioxidant activity of lovage leaves and stems and horseradish leaves proved to be freezing.

**Keywords:** antioxidant, horseradish, lovage, phenolic.

For further information please contact: [lolitatomsone@gmail.com](mailto:lolitatomsone@gmail.com)

## BIOGENIC AMINES FORMATION IN FERMENTED BARLEY AND WHEAT FLOUR INDUSTRY BY-PRODUCTS

**Vita Krungleviciute<sup>1</sup>, Elena Bartkiene<sup>1</sup>, Grazina Juodeikiene<sup>2</sup>, Jonė Kantautaitė<sup>1</sup>**

<sup>1</sup> Lithuanian University of Health Sciences, Tilzes g. 18, Kaunas, Lithuania

<sup>2</sup> Kaunas University of Technology, Radvilenu pl. 19, Kaunas, Lithuania

Wheat and barley, is a popular products for human consumption. From the manufacture of them remains high amount of by-products, which are good source for animal feeding. The use of lactic acid bacteria (LAB) to preserve feedstuffs for ruminants, pigs and chickens have been applied for many years, with beneficial effects. Also, the interest increased in bacteriocin-like inhibitory substances (BLIS) producing LAB because of their potential use as natural antimicrobial agents to enhance the safety of feed. Plant products fermented by lactic acid bacteria (LAB), usually is regarded as non-toxic and non-pathogenic, but some LAB species may influence biogenic amines (BA) formation. The aim of study was to evaluate the effect of solid state (SSF) and submerged (SMF) fermentation with *Pediococcus acidilactici* on biogenic amines formation in barley and wheat flour industry by-products (10/90; m/m).

Plant products were fermented with *Pediococcus acidilactici* at 32 °C 72 hours. Extraction of samples and determination of BA were carried out according to the procedures developed by Ben-Gigirey et al. (1999).

It was found that the highest content of putrescine is in not fermented products (278.5±4.3 mg kg<sup>-1</sup>). After 72 hours of fermentation putrescine concentration in products was found from 46.8 to 97.9 % lower. Histamine and tyramine content in fermented products was far below those levels causing a health risk.

We conclude that barley and wheat flour industry by-products fermentation with *P. acidilactici* could be used for safe feed stock production.

**Keywords:** wheat and barley by-products fermentation, lactic acid bacteria, biogenic amines.

For further information please contact: [vitakrungleviciute@gmail.com](mailto:vitakrungleviciute@gmail.com)

## CHEMICAL COMPOSITION OF LATVIAN WILD EDIBLE MUSHROOM *CANTHARELLUS CIBARIUS*

**Mara Kūka<sup>1</sup>, Ilze Čakste<sup>1</sup>, Ruta Galoburda<sup>2</sup>, Mārtiņš Šabovics<sup>2</sup>**

<sup>1</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

<sup>2</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela Street 2, Jelgava, Latvia

The aim of this study was to investigate the chemical composition of widely used wild edible mushroom *Cantharellus cibarius* and to compare it with mushroom *Boletus edulis*. Mushrooms *Cantharellus cibarius* were collected near Jelgava region in Latvia in late summer 2011. Mushrooms were freeze-dried to obtain dry matter that was used to determine chemical composition. To characterize the mineral content ash amount was determined; protein was determined by Lowry method (190 mg g<sup>-1</sup> of mushrooms dry matter). Methanol and hot water extracts of mushrooms were prepared. Electrical conductivity (255 μs cm<sup>-1</sup>), titratable acidity (0.238 mmol of NaOH per g of dried mushrooms) and formol number (0.163 mmol NaOH per g of mushrooms dry matter) were determined in water extract. The total content of phenolic compounds was determined by using Folin-Ciocalteu assay (5.09 mg of gallic acid equivalents per 1 g of mushrooms dry matter). β-carotene and lycopene were determined in methanol extract. Using gas chromatography-mass spectrometry (GC-MS) volatile compounds were determined in both fresh and freeze-dried mushroom *Cantharellus cibarius* and the dominant compound was found to be oct-1-en-3-ol. Results from the present study of the chemical composition of mushroom *Cantharellus cibarius* were compared with our previous results of the chemical composition of mushroom *Boletus edulis*. Although the amount of substances tested is slightly higher in mushroom *Boletus edulis*, mushroom *Cantharellus cibarius* is rich source of biocompounds and mineral substances.

**Keywords:** mushroom *Cantharellus cibarius*, chemical composition.

For further information please contact: [mara.kuka@llu.lv](mailto:mara.kuka@llu.lv)

## COMPOSITION OF CAROTENOIDS IN CALENDULA (*CALENDULA OFFICINALIS* L.) FLOWERS

**Rudite Sausserde, Kaspars Kampuss**

Institute of Agrobiotechnology, Faculty of Agriculture, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

*Calendula* (*Calendula officinalis* L.) belongs to the *Asteraceae* family. It is a medicinal plant and its flowers are used as important ingredient of pharmaceutical and food production. Most calendula research has been focused on extraction and pharmaceutical properties of bioactive compounds from flowers. Fresh calendula flowers are suggested to use as edible flowers but dried flowers – as an herbal tea and as condiment of food. *Calendula* accumulates large amounts of carotenoids in its flowers. The yellow and orange colour of petals is mostly due to the carotenoids and the shade depends on the quantity and composition of pigments. Carotenoids are known as biologically active compounds with multiple applications in therapy. It is important to humans as precursors of vitamin A and retinoids. Major factors that impact differences in the amount of total carotenoids in calendula flowers is reported to be the plant variety, colour of the ligulate and tubular florets, the place of cultivation and time of harvesting. Nowadays many important carotenoids are used as pigments – food colorants in the food industry. Carotenoids composition of calendula has not been investigated for a long time and in future the scientific research on calendula will be increased. In this review, there are explored the composition of carotenoids in calendula flowers in order to compare existing information on this plant and its different varieties as well as highlight its multi-activity properties.

**Keywords:** pot marigold, edible flowers, calendula, cultivars, carotenoids.

For further information please contact: [rudite.sausserde@llu.lv](mailto:rudite.sausserde@llu.lv)

## IMPACT OF LOW TEMPERATURE ON PROLONGED TIME TREATMENT ON THE PORCINE MUSCLE QUALITY AND SAFETY OF THE FINAL PRODUCTS

**Alvija Šalaševičienė, Lina Vaičiulytė-Funk, Irina Koscelkovskienė**

Food Technology Department, Faculty of Technology and Landscaping, Kauno kolegija / University of Applied Sciences, Pramonės pr.22, Kaunas, Lithuania

The effect of low temperature (53 °C), long time heat treatment (Tc +5 h and Tc + 17 h – holding time, Tc – core temperature equal to the water bath temperature), and vacuum depth (0.3 and 0.6  $\cdot 10^5$ Pa) on texture and microbiological safety parameters in *M. longissimus dorsi* from slaughter pigs were studied. The study involved analysis of meat moisture, toughness, cooking loss and microflora parameters. Decreasing shear force and increasing cooking loss during low temperature and long time treatment was observed at 53 °C temperature along with the treatment duration (Tc +5 h and Tc +17 h). Positive shear force and vacuum depth correlation was observed in the samples. No correlation between samples moisture content and shear force was found. Microbiological analysis revealed safety of the produced product within two weeks period storage at 4 °C temperature.

**Keywords:** long time treatment, microbiological safety.

For further information please contact: [alvija.salaseviciene@go.kauko.lt](mailto:alvija.salaseviciene@go.kauko.lt)

## EVALUATION OF RAPESEED MEAL EXTRACT EFFICIENCY FOR PREVENTION OF UNREFINED RAPESEED OIL OXIDATION

Lolita Tomsone, [Elina Sturmovica](#)

Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

After the extraction of rapeseed oil, large amount of phenolics remains in meal. The aim of the current research was to evaluate rapeseed meal extract efficiency for prevention of unrefined rapeseed oil oxidation. The rapeseed meal extract was added to unrefined rapeseed oil in various concentrations (0.5–2.0%) and stirred at  $700 \text{ min}^{-1}$  for 30 min at temperature  $20 \pm 1 \text{ }^\circ\text{C}$ . Oil samples were stored in glass vials in dark at temperature  $60 \text{ }^\circ\text{C}$ . Peroxide value and acid value were determined during 1-22 days of storage. Under these conditions, the peroxide value of control sample increased from 6.14 (on the first day) to 103.08 (on the 22<sup>nd</sup> day) meq  $\text{kg}^{-1}$  oil. By day 18 in samples with lower concentration of rapeseed meal extracts additive, peroxide value was higher, but in samples analysed after 22 days opposite tendency was observed – in samples with higher concentration of rapeseed meal also higher peroxide value (116.85 meq  $\text{kg}^{-1}$ ) was observed. Significant changes of acid value during experiment were not determined. It is possible that extract contains compounds which during long storage at high temperature accelerate lipid oxidation process. In conclusion, oilseed rape extract use for canola oil quality stabilization would require further research.

**Keywords:** rapeseed, meal, oil, extract, peroxide value.

**Acknowledgement:** State Research Programme NatRes (2010-2013) Project no. 3. „Sustainable use of local agricultural resources for development of high nutritive value food products (Food)”

For further information please contact: [elist@llu.lv](mailto:elist@llu.lv)



## EXPRESS ANALYSIS OF DETERMINING THE AMOUNT OF GLUTEN IN WHEAT FLOUR

**Viktoriya Nazarova, Viktor Balubash, Vladimir Ivanov**

Department of automatics and automation of production processes, ITMO University,  
Lomonosov str. 9, St.-Petersburg, Russia

The purpose of the work was the development of the express control method of the determination the quantity of gluten in wheat flour.

As a result of this work was established that the change of wheat flour temperature leads to change of its dielectric permeability. Besides, it was established that the amount of gluten in wheat flour also is influenced by dielectric permeability of flour. Thus, dielectric permeability of flour depends on temperature and the amount of gluten in a sample.

Existence of functional dependence of dielectric permeability of analyzed sample of wheat flour from the amount of gluten at transfer of the moisture content by gluten to a free state to heating was confirmed experimentally.

The studied dependences are the basis of the developed method of the express analysis of the amount of gluten in baking flour.

The proposed way allows to exclude the additional errors of measurements caused by a human factor and to accelerate the time of carrying out the measurements.

**Keywords:** gluten, flour wheat, moisture content.

For further information please contact: [aiapp@mail.ru](mailto:aiapp@mail.ru), [vnazarova@yandex.ru](mailto:vnazarova@yandex.ru)

## ACRYLAMIDE REDUCTION OPTIONS IN RYE BREAD

**Daiga Kunkulberga<sup>1</sup>, Ilga Gedrovica<sup>1</sup>, Vija Ozolina<sup>1,2</sup>, Inga Ciprovica<sup>1</sup>, Vita Sterna<sup>3</sup>**

<sup>1</sup> Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

<sup>2</sup> Forest Faculty, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

<sup>3</sup> State Stende Cereals Breeding Institute, Dizstende, Libagi parish, Talsi, Latvia

Acrylamide is a food contaminant can be formed in foods when heated above 120 °C, if carbohydrates, especially reducing sugars, and asparagine are present. Bread is among the products that can contain high levels of acrylamide. The aim of this study is to evaluate acrylamide content in bread samples from different varieties of rye grains from different soils and to analyse acrylamide content reduction possibilities. Within the framework of the research, soil sulphur sufficiency in experimental fields of rye was analysed, and the content of amino acids was determined in rye grains, dough and bread by using standard methods. The samples were obtained from rye grain, flour and bread, then the impact of enzyme asparaginase, rosemary extract, and citric acid on the acrylamide content in the bread were analysed. The rye bread baking tests were carried out in an industrial bakery. The results of the soil analysis indicated a deficiency of sulphur containing compounds. The usage of enzyme asparaginase in rye bread production caused no significant reduction ( $p>0.05$ ) of acrylamide content in rye bread. Analysis of the economic aspects of asparaginase utilization concluded that its utilization in production is not cost effective. The addition of rosemary extract to rye dough did not reduce the acrylamide content in bread. The addition of citric acid to rye dough reduced the content of acrylamide in rye bread by 66%, but had a negative effect on taste. Therefore, it is necessary to find the optimum quantity of citric acid that can be added to bread without changing the sensory properties of acidity and flavour.

**Key words:** rye bread, acrylamide, asparaginase, citric acid, rosemary extract.

For further information please contact: [daiga.kunkulberga@llu.lv](mailto:daiga.kunkulberga@llu.lv)

## ANTIOXIDANT ACTIVITY OF DIFFERENT BOTANICAL ORIGIN HONEY

**Violeta Čeksterytė<sup>1</sup>, Petras Rimantas Venskutonis<sup>2</sup>, Rita Kazernavičiūtė<sup>2</sup>, Bogumila Kurtinaitienė<sup>3</sup>, Jonas Balžekas<sup>1</sup>**

<sup>1</sup> Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry Akademija, Kedainiai dist., Instituto aleja, Lithuania

<sup>2</sup> Department of Food Science and Technology, Kaunas University of Technology, Radvilėnų road, 19, Kaunas, Lithuania

<sup>3</sup> Vilnius University, Institute of Biochemistry, Mokslininkų str. 12, Vilnius, Lithuania

The aim of study was to assess antioxidant activity of different botanical origin honey samples by using several assay methods. Thirteen honey samples including monofloral willow, rape, lime, caraway, white clover, bluebell, and polyfloral were obtained from 9 collections sited in Lithuania. The total content of phenolic compounds (TPC) measured with Folin-Ciocalteu reagent varied in the range from 0.380 (rape origin) to 1.726 (bluebell honey) mg gallic acid equivalents in 1 g. Antioxidant activity was evaluated by measuring DPPH<sup>·</sup> and ABTS<sup>·+</sup> scavenging capacities and Oxygen Radical Absorbance Capacity (ORAC) assays. The mean values of DPPH<sup>·</sup> and ABTS<sup>·+</sup> scavenging capacity was 0.75 and 0.88 mg TE g<sup>-1</sup> (Trolox equivalent), respectively, while the mean ORAC value was 8354 μmol TE g<sup>-1</sup>.

The correlation coefficients were determined between TPC and DPPH<sup>·</sup>, ABTS<sup>·+</sup> and ORAC values. Strong linear correlation (0.968) was found for ABTS<sup>·+</sup> scavenging values, while for DPPH<sup>·</sup> values it was rather moderate (0.611). Negative and weak linear relationship was found between phenolic compounds and ORAC (-0.231). It may be explained by the different mechanisms of these assays. TPC determination, DPPH<sup>·</sup> and ABTS<sup>·+</sup> scavenging capacity assays are based mainly on a single electron transfer reaction, while ORAC is based on hydrogen atom transfer to peroxyradicals which are generated in the applied reaction system. Different phenolic compounds are present in honey and total antioxidant capacity of honey depends both on the concentration of these compounds and their structures.

**Keywords:** honey, phenolic compounds, antioxidant activity.

**Acknowledgment.** This research was funded by a grant (No. SVE-01/2012) from the Research Council of Lithuania

For further information please contact: [violeta@lzi.lt](mailto:violeta@lzi.lt)

## COMPOSITION OF THE ESSENTIAL OIL OF PEPPERMINT (*MENTHA PIPERITA* L.)

**Aija Dizgalve, Kaspars Kampuss, Rudite Sausserde**

Institute of Agrobiotechnology, Faculty of Agriculture, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

The aim of this review is to explore composition of the essential oil of peppermint (*Mentha piperita* L.) in order to compare existing information on peppermint oil composition, as well as yield and quality parameters of this plant and its varieties. Peppermint is a multipurpose plant and economically the most important essential oil containing herb in the world. They content biologically active constituents and are also used in food in medicine. Essential oils of mint are used in flavour foods. They essential oil composition contains menthol, menthone, carvone, piperitone, carotens, pulegone and etc. The menthol in the oil is a represented in free forms. The medicinal attributes of plants are owing to their constituent components, such as alkaloids, glycosides, saponins, vitamins, organic acids, mineral salts, volatile oils, and antibiotics. Peppermints leaves and flowers contain essential oil which is used to improve the flavour of some medicines, in perfumery and the cosmetic industry as a fragrance, and in the food industry as a spice. Peppermints oil is a big favourite among the food industry, and can be found as a flavouring agent in gums, candy, ice cream, and pastries. Nowadays for highest essential oil content have a wide selection of promising cultivars that could be further used for developing of more qualitative production and quality characteristics.

**Keywords:** *Mentha piperita*, essential oil, menthol, cultivars.

For further information please contact: [ajia.dizgalve@llu.lv](mailto:ajia.dizgalve@llu.lv)

## EFFECT OF METHANOL WHEAT AND RYE BRAN EXTRACTS ON THE STABILITY OF MEAT HAMBURGERS

Vaida Šulniūtė<sup>1</sup>, Petras Rimantas Venskutonis<sup>1</sup>, Jordi Rovira Carballido<sup>2</sup>,  
Isabel Jaime Moreno<sup>2</sup>

<sup>1</sup> Department of Food Science and Technology, Kaunas University of Technology, Radvilėnų Rd. 19, Kaunas, Lithuania

<sup>2</sup> Department of Biotechnology and Food Science, University of Burgos, Plaza Misael Bañuelos s.n., Burgos, Spain

The aim of the study was to determine the influence of wheat and rye bran extracts on the stability of beef meat hamburgers by monitoring gas composition, pH, colour parameters, metmyoglobin ratio and *thiobarbituric acid reactive substances* (TBARS). Five different samples of beef meat hamburgers were prepared: control, with 0.4% wheat and rye bran methanol extracts and with 0.8% wheat and rye bran methanol extracts. All hamburgers were packaged with MAP (30% CO<sub>2</sub> / 70% O<sub>2</sub>) and storage at 4 °C for 15 days.

The oxygen was decreasing (from 72.7% to 60.1%) and carbon dioxide was increasing (from 19.2% to 22.7%) during 15 days and this can be linked to the bacteria growth. The minimum pH had control (5.82±0.01) and beef hamburgers with 0.4% methanol rye bran extract (5.92±0.02) (day 15). Characteristics of meat color (L\* a\* b\*) were measured by spectrophotometer using CIE Lab space. Red colour was better preserved in hamburgers with 0.8% methanol wheat bran extracts throughout the 15 days of storage. The lowest % of metmyoglobin was found in hamburgers with 0.8% methanol wheat bran extracts followed by hamburgers with 0.8% methanol rye bran extract, meaning that the colour of these samples was better preserved. The slowest formation of oxidation products (TBARS) during storage was also found in hamburgers with 0.8% methanol wheat bran extracts. It may be concluded that hamburgers with 0.8% of wheat bran, obtained with methanol was the most efficient in preserving beef hamburgers during storage.

**Keywords:** hamburgers, bran, lipid oxidation, beef.

**Acknowledgement.** The study was supported by Research Council of Lithuania, grant no. SVE06/2011

For further information please contact: [vaida91@yahoo.com](mailto:vaida91@yahoo.com)

## THE CONTENT OF POLYPHENOLS AND ANTHOCYANINS IN BLACK CHOKEBERRY (*ARONIA MELANOCARPA*) MARC EXTRACTS DEPENDING ON THE EXTRACTION METHOD

**Ance Dandena**<sup>1,2</sup>, **Līga Žūka**<sup>2</sup>, **Maria Kostova**<sup>3</sup>

<sup>1</sup> Faculty of Food Technology, Latvia University of Agriculture, 2 Liela Street, Jelgava, Latvia

<sup>2</sup> Silvanols Ltd., 2 a Kurbada Street, Riga, Latvia

<sup>3</sup> Medical University–Sofia, Boulevard Akademik Ivan Evstratiev Geshov 15, Sofia, Bulgaria

The aim of this study was to find out the optimal conditions for extraction of natural antioxidants of grinded black chokeberry marc. The marc was extracted using microwave and ultrasound-assisted extraction methods for 15-30 minutes in water/ethanol solutions with different degrees of concentration and using different particle sizes of the marc. Total content of polyphenols and anthocyanins was determined by spectrophotometry. The highest amount of total polyphenols was found in the extracts obtained using the ultrasound method, a 50% ethanol/water solution and a 2 mm diameter particle size extracted for 30 minutes. The microwave method presented the highest amount of anthocyanins in black chokeberry marc extract, using a 70% ethanol/water solution, a 2 mm diameter particles and 20-minute extraction time. It is necessary to find the most effective extraction method in order to develop a production technology for black chokeberry marc extracts rich in natural antioxidants.

**Keywords:** black chokeberry, natural antioxidants, polyphenols, anthocyanins.

For further information please contact: [dandena@inbox.lv](mailto:dandena@inbox.lv)

## EFFECT OF SUPPLEMENTARY SHORT-TERM RED LEDS LIGHT EXPOSURE ON ANTIOXIDANT CAPACITY OF *BETA VULGARIS* MICROGREENS

**Viktorija Vaštakaite<sup>1</sup>, Aušra Brazaitytė<sup>1</sup>, Akvilė Viršilė<sup>1</sup>, Julė Jankauskienė<sup>1</sup>,  
Giedrė Samuolienė<sup>1</sup>, Sandra Sakalauskienė<sup>1</sup>, Algirdas Novičkovas<sup>2</sup>,  
Ramūnas Sirtautas<sup>1</sup>, Jurga Miliauskienė<sup>1</sup>, Pavelas Duchovskis<sup>1</sup>**

<sup>1</sup> Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kaunas str. 30, LT- 54333 Babtai, Kaunas distr., Lithuania

<sup>2</sup> Institute of Applied Research, Vilnius University, Saulėtekio al. 9-III, LT-10222, Vilnius, Lithuania

The aim of our study was to determine and compare the impact of supplemental short – term red light emitting diodes (LEDs) lighting on the antioxidant properties of beet (*Beta vulgaris* L., ‘Bulls Blood’) and chard (*Beta vulgaris* L., ‘Red Chard’) microgreens. *Beta vulgaris* L. were grown within a greenhouse (19-22°C/15-18°C) of Institute of Horticulture, Lithuanian Research Centre of Agricultural and Forestry, in a peat substrate (Profi 1, Durpeta, Lithuania) under daylight with supplementary lighting provided by standard high pressure sodium lamps (HPS) (“Philips”, SON – T Agro) (16 h). The generated photosynthetic photon flux density (PPFD) of HPS lamps was maintained at 90  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Three days before harvest, the HPS lamps were supplemented by red 638 nm LEDs PPFD of 210  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Microgreens under HPS PPFD of 300  $\mu\text{mol m}^{-2} \text{s}^{-1}$  was used as the control level. To determine effect of short – term supplemental 638 nm red light to antioxidant activity, the contents of total phenols, anthocyanins, ascorbic acid and relative DPPH’ radical scavenging capacity were evaluated. The results indicated that the impact of supplementary red LED lighting on antioxidant properties was dependent on *Beta vulgaris* L. microgreens species. The pre-harvest treatment significantly ( $p < 0.05$ ) increased phenolic compounds contents but decreased DPPH’ free scavenging activity in beet fresh weight (FW). Moreover, the exposure of 638 nm red light also contributed to higher levels of anthocyanins and ascorbic acid in table beets. Otherwise, supplementary red light irradiance treatment decreased antioxidant compounds contents in chard microgreens FW.

**Keywords:** antioxidants, *Beta vulgaris* L., microgreens, pre – harvest, red light emitting diodes.

**Acknowledgement.** This research was funded by a grant (No. SVE-03/2010) from the Research Council of Lithuania.

For further information please contact: [v.vastakaite@lsdi.lt](mailto:v.vastakaite@lsdi.lt)

## COMPOSITION OF FLAVONOIDS AND PHENOLIC ACIDS IN LEAVES OF GENUS *SORBUS* L.

**Kristina Gaivelyte, Valdas Jakstas, Valdimaras Janulis**

Department of Pharmacognosy, Faculty of Pharmacy, Lithuanian University of Health Sciences, Eiveniu str. 4, LT-50161, Kaunas, Lithuania

*Sorbus* L. genus is one of the most numerous genera of the *Rosaceae* family. Species of *Sorbus* might be a relevant source of biologically active phytoconstituents. Besides, various *Sorbus* species are used for food worldwide, and therefore could be a promising source of functional food.

Our research aim was to investigate quantitative composition of phenolic acids (neochlorogenic acid, chlorogenic acid) and flavonoids (rutin, hyperoside and isoquercitrin) in leaves of introduced *Sorbus* plants using a HPLC method.

Phytochemical composition of the tested samples was very heterogeneous (contents of identified compounds differed up to 664 times). Comparison of raw plant material samples of *Sorbus* species according to quantitative composition of identified phenolic compounds using cluster analysis revealed an exceptional position of *S. commixta* Hedl. leaf samples. The samples comprised the highest contents of chlorogenic acid, hyperoside and isoquercitrin, but also the lowest contents of neochlorogenic acid and rutin. The highest contents of neochlorogenic acid were recorded in *S. lancifolia* Hedl. leaves, and those of rutin – in *S. anglica* Hedl. leaves.

In conclusion, leaf raw plant material of *Sorbus* plants could be the source of raw plant material rich in phenolic compounds, promising the acquisition of phytotherapeutic agents with specific effects. The analyzed phenolic compounds are characterized by diverse significant biological activity and therefore they could be targeted as analytical bioactive markers of *Sorbus* raw plant material and the final manufactured products.

**Keywords:** *Sorbus*, flavonoids, chlorogenic acid, neochlorogenic acid, HPLC.

For further information please contact: [kristigai@gmail.com](mailto:kristigai@gmail.com)



## DETERMINATION OF CHLOROGENIC ACID AND FLAVONOIDS OF SELECTED APPLE CULTIVARS GROWN IN LITHUANIA

Mindaugas Liaudanskas<sup>1</sup>, Pranas Viškelis<sup>2</sup>, Darius Kviklys<sup>2</sup>, Raimondas Raudonis<sup>1</sup>,  
Juozas Lanauskas<sup>2</sup>, Jonas Viškelis<sup>2</sup>, Valdimaras Janulis<sup>1</sup>

<sup>1</sup> Department of Pharmacognosy, Faculty of Pharmacy, Lithuanian University of Health Sciences, Eivenių 4, Kaunas, Lithuania

<sup>2</sup> Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kauno 30, Babtai, Kaunas region, Lithuania

The aim of this research was to determine the qualitative and quantitative content of phenolic compounds in the ethanol extracts of apple fruits harvested from the cultivars 'Aldas', 'Auksis', 'Ligol', and 'Lodel' grown under Lithuanian climatic conditions.

The ethanol extracts of apple fruits were analyzed by the HPLC method. Chlorogenic acid was found to be a predominant component in the apple fruits of all the cultivars, except the cultivar 'Ligol'. (–)-Epicatechin was the major compound in the ethanol extracts of apple fruits obtained from all the cultivars, while the amount of (+)-catechin was lower. The following quercetin glycosides were identified and quantified: hyperoside, isoquercitrin, avicularin, rutin, and quercitrin. Hyperoside was the major quercetin glycoside in apple fruits. The amount of procyanidin B2 was higher than that of procyanidin B1; the apple fruits of the cultivar 'Lodel' contained the greatest amount of procyanidin B2.

The results obtained in this study give new actual information about composition of phenolic compounds in tested apple cultivars which will be used to identify promising apple cultivars grown under Lithuanian climatic conditions, the fruits of which accumulate large amounts of phenolic compounds and are valuable for the consumption and production of juice and other foods.

**Keywords:** apple, HPLC, chlorogenic acid, quercetin glycosides, procyanidins.

**Acknowledgement:** This study was supported by the Foundation of Lithuanian University of Health Sciences and a grant from the Research Council of Lithuania (No. SVE-02/2011).

For further information please contact: [m.liudanskas@yahoo.com](mailto:m.liudanskas@yahoo.com)

## THE CONTENT OF REDUCED GLUTATHIONE IN THE YEAST *SACCHAROMYCES CEREVISIAE* UNDER COLD STORAGE

Natalia Skvortsova, [Aleksandr Shleikin](#)

Department of Chemistry and Molecular Biology, Institute of Refrigeration and Biotechnologies, ITMO University, Lomonosov Str., 9, St. Petersburg, Russia

Yeast *Saccharomyces cerevisiae* serve as source of protein and low molecular weight biologically active substances, which are widely used in various areas of the biotechnology, and especially in the food industry. Major natural antioxidant synthesized by yeast is glutathione. It neutralizes free radicals, prevents lipid peroxidation, protects cells from oxidative stress and stimulates the growth of yeast cells. Last time yeast is used as biosensors of different damage factors and in model researches of cellular aging. The purpose of this study is to determine the amount of reduced glutathione in *S. cerevisiae* during storage at low temperature. It was developed evaluation of total sulfhydryl groups' content by iodide titration method in the pressed yeast and the quantity of reduced glutathione was calculated. In result, it was established that under storage at -18 °C for 14 days analytically significant changes of glutathione content weren't found. In the range between 14 and 28 days the level of reduced glutathione is increased 5 times, and between 28 and 42 days of storage the content of glutathione is raised on approximately 13%. The possible biological reasons and technological value of these data are discussed.

**Keywords:** *S. cerevisiae*, cold storage, glutathione.

For further information please contact: [shleikin@vandex.ru](mailto:shleikin@vandex.ru)

## COMPARISON OF THREE DIFFERENT TECHNIQUES FOR EXTRACTION OF VOLATILES FROM PISTACHIO NUTS

**Perihan Kendirci, Tomris Altug Onogur**

Food Engineering Department, Engineering Faculty, Ege University, Izmir, Turkey

Pistachio nut (*Pistaciavera* L.) is one of the popular tree nuts of the world and is widely cultivated in saline, dry and hot areas of the Middle East, Mediterranean countries and United States. Iran, USA, Syria and Turkey are the main producer countries of this product. Pistachio nut is widely consumed as a raw or roasted ingredient of many desserts, ice cream, cake, pastry and in the production of some sausages.

The aim of the present study was to determine the appropriate technique for extraction of volatiles from pistachio nuts. Uzun variety which is cultivated in the South-East Region of Turkey was used as the material of the study. Volatiles were extracted with three different extraction techniques; Liquid-Liquid Solvent Extraction (LLSE) at  $85\pm 2^\circ\text{C}$  / 6 h by using ethanol and hexane as solvents, Headspace extraction (HS) at  $100^\circ\text{C}$  / 1 h and Solid Phase Micro Extraction (SPME) at  $100^\circ\text{C}$  / 1 h by using DVB/Car/PDMS fiber. Obtained extracts were analyzed by Gas Chromatography/Mass Spectrometer (GC/MS) device. The total number of volatiles extracted by LLSE, HS and SPME techniques were detected to be 34, 41, 25; and the percentage of volatiles identified by these techniques were found to be 67.36%, 72.04%, 92.91%, respectively. Since more than 90% of volatiles could be identified by SPME which also showed high repeatability, it could be recommended as the most appropriate technique for extraction of volatiles from pistachio nuts.

**Keywords:** pistachio nut, extraction of volatile components, GC/MS analysis.

For further information please contact: [pkendirci@hotmail.com](mailto:pkendirci@hotmail.com)

## INVESTIGATIONS OF THE CASEIN LEVEL AND SOMATIC CELLS COUNT DEPENDENCE IN COW'S MILK

**Kristina Musayeva, Antanas Sederevičius, Danuta Beliavska-Aleksiejūnė**

Department of Anatomy and Physiology, Faculty of Veterinary Medicine, Veterinary Academy  
Lithuanian University of Health Science, Tilzes st. 18, LT – 47181 Kaunas, Lithuania

The aim of this study was to investigate the impact of somatic cells count (SCC) on the content of milk casein as a percentage of true protein (C%TP) and to compare the casein level obtained with two different methods. Data array of the livestock control was used for situation analysis for the estimation of C%TP variation by SCC limits in milk. Milk samples (MS) were tested by infrared spectrophotometry. Total data sample record of the livestock control in Lithuania consisted of 22.6%. MS were classified according to the SCC level into 13 groups where SCC vary from 40 000 cells ml<sup>-1</sup> to 5 010 000 cells ml<sup>-1</sup>. The average percentage of C%TP ranged 79.5–81.1%. The present analysis shows only slight notable changes in casein of controlled cow's milk by somatic cells count limits.

Eighteen sorted dairy samples have been investigated for C%TP ratio in milk with reference (Kjeldahl) and infrared spectrophotometry methods. C%TP estimated with the reference method, was by 2–5% higher than casein percentage tested with the infrared spectrophotometry method when SCC was low and ranged from 33 to 293 000 cell ml<sup>-1</sup>. Though, when SCC was high and ranged from 2 203 000 cell ml<sup>-1</sup> to 5 395 000 cell ml<sup>-1</sup> casein percentage decreased to 5%, in comparison to casein level estimated by the infrared spectrophotometry method. Evaluated results obtained by the least squares method, linear approximation of variation indicators presented noticeable decline in casein percent - 0.27, when SCC was increasing by 80 000 cell ml<sup>-1</sup>, but only when the studies was made with reference LST EN ISO 8968-2:2002 method. Results where statistically significant when R<sup>2</sup>(R square) was not less than 0.25.

**Key words:** milk casein, somatic cell count, reference method, cow.

For further information please contact: [musayeva@lva.lt](mailto:musayeva@lva.lt)

## ANTIMICROBIAL RESISTANCE OF COAGULASE-NEGATIVE STAPHYLOCOCCI ISOLATED FROM BOVINE MILK IN LITHUANIA

Modestas Ružauskas, Irena Klimienė, Rita Šiugždinienė, Marius Virgailis, Lina Vaškevičiūtė, Raimundas Mockeliūnas, Rita Plančiūnienė, Alvydas Pavilionis

Microbiology and Virology Institute, Lithuanian University of Health Sciences, Tilzes 18, Kaunas, Lithuania

The aim of this study was to examine antimicrobial resistance of coagulase-negative staphylococci (CNS) isolated from milk samples obtained from cows with subclinical mastitis. Seventy nine CNS strains were obtained from the enterprise “Pieno Tyrimai” and tested at Microbiology and Virology Institute, Lithuania.

Species identification was performed using biochemical tests. In complicated cases PCR using thermonuclease genes as well as sequencing of 16S RNA genes was performed. Minimal inhibitory concentrations were determined for susceptibility testing using CLSI standard interpretation. PCR was used for investigation of genes encoding resistance.

The most common resistance was detected toward penicillin G (78.5%), tetracycline (21.5%), oxacillin (21.5%), erythromycin (12.7%) and gentamicin (10.1%). 32.9% of the isolates were resistant to at least three antibiotics of different classes. All oxacillin-resistant isolates harboured the *mecA* gene while the *mecC* gene was not detected. The other detected genes included *blaZ*, associated with resistance to Penicillin G, *tetK*, associated with resistance to tetracyclines, whereas *ermC* was responsible for resistance to erythromycin. All strains were susceptible to vancomycin, daptomycin and streptogramins.

This is the first report about resistance genes of CNS isolated from milk in Lithuania. According to the results obtained it could be outlined that situation on antimicrobial resistance in CNS isolated from milk is still favourable however, multiresistant strains to classical and old antibiotics are prevalent. Such isolates might be a reservoir of antimicrobial resistance genes and could be important for antimicrobial resistance transfer to other bacteria including human microbiota.

**Keywords:** mastitis, genes, antimicrobials, CNS.

For further information please contact: [ruzauskas@lva.lt](mailto:ruzauskas@lva.lt)

## THE INFLUENCE OF BAKING TEMPERATURE ON THE QUALITY OF TRITICALE BREAD

**Martins Sabovics, Evita Straumite, Ruta Galoburda**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela street 2, Jelgava, Latvia

The baking temperature affects the quality of bread. During the baking, there occur different changes in dough depending on time and temperature - starch gelatinization, protein denaturation, enzyme inactivation, gas expansion, evaporation of moisture from the crumb and crust. Varying the baking time and temperature the bread physico-chemical parameters and volatile compounds profile changes significantly. The research was accomplished on triticale flour blend, which was made from whole grain triticale, rye, hull-less barley flour and rice, maize flour. The aim of the research was to evaluate physico-chemical properties and volatile compounds profile of triticale bread. Triticale bread was baked 45 minutes at  $160\pm 10$  °C,  $200\pm 10$  °C and  $240\pm 10$  °C temperature. In triticale bread crumb using standard methods there were evaluated hardness, stickiness, colour ( $L^* a^* b^*$ ), moisture, water activity, pH and titrable acidity, but in bread crust there was evaluated only colour ( $L^* a^* b^*$ ). The volatile compounds profile was identified in both samples – bread crumb and crust. During research it was established that increasing baking temperature the bread crumb moisture, water activity, stickiness and pH decreased, but hardness and acidity increased. Variation of the baking temperature has significant influence ( $p=0.02$ ) on bread crumb and crust colour. In the bread crumb and crust totally 26 volatile compounds were detected. There were identified 13 volatile compounds – common in all bread crumb and crust samples. All 26 volatile compounds belong to alcohols, aldehydes, acids, terpens and ketons. The baking temperature has significant influence ( $p<0.05$ ) on the quality of triticale bread.

**Keywords:** triticale bread, quality, volatile compounds.

For further information please contact: [martins.sabovics@inbox.lv](mailto:martins.sabovics@inbox.lv)

## COMPOSITION AND PROPERTIES OF FORGOTTEN AROMATIC PLANTS AND MUSHROOMS GROWN IN LATVIA AND MIDI-PYRENEES

**Zanda Kruma<sup>1</sup>, Thierry Talou<sup>2</sup>, Ruta Galoburda<sup>1</sup>, Lina Smolskaite<sup>2</sup>, Lolita Tomsone<sup>1</sup>, Ina Alsina<sup>3</sup>, Ruta Paulovica<sup>1</sup>**

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

<sup>2</sup> Laboratoire de Chimie Agro-industrielle, INPT-ENSIACET, Université de Toulouse, 4 Allée Emile Monso, 31432, Toulouse, France

<sup>3</sup> Institute of Soil and Plant Sciences, Faculty of Agriculture, Latvia University of Agriculture, Liela iela 2, Jelgava, Latvia

For centuries, herbs and mushrooms have been an important food source due to Compounds present in plants and mushrooms, which have beneficial effect on human health, and possess antioxidant and antimicrobial activity. Some valuable properties of plants are characterised in ancient publications, but today these plants or mushrooms are not so popular, probably due to palatability, the change of traditions etc. The aim of current research was to perform comparative evaluation of composition and properties of forgotten aromatic plants and mushrooms of Latvia and Midi-Pyrenees. The research was carried out within the framework of the 'Osmose' project between France and Latvia. Project was implemented in period from 2012 till 2013 and two scientists from France and four scientists from Latvia were involved. The first stage of research was selection of plants and mushrooms based on bibliography research, taking into account chemical composition and agrotechnical conditions. Plant material was collected both in Latvia and in France. From plant materials horseradish and lovage, but from mushrooms 34 species were selected for further analysis. In the following stages was performed evaluation of extraction method of bioactive compounds from plants and investigation of plant extracts' antioxidant and antimicrobial activity. The results of these investigations confirm the great potential of forgotten plants and mushrooms as antimicrobial and antioxidant agents. 'Osmose' project is the basis for development of research network for further studies of aromatic plants in France and Baltic states.

**Keywords:** mushrooms, aromatic plants, antioxidant, antimicrobial.

For further information please contact: [zanda.kruma@llu.lv](mailto:zanda.kruma@llu.lv)

## INVESTIGATION OF YIELD AND QUALITY PARAMETERS FOR OAT CULTIVARS

Linda Brunava<sup>1,2</sup>, Ina Alsiņa<sup>1</sup>, Sanita Zute<sup>2</sup>, Vita Sterna<sup>2</sup>, Zaiga Vicupe<sup>2</sup>

<sup>1</sup> Institute of Soil and Plant Sciences, Faculty of Agriculture, Latvian University of Agriculture

<sup>2</sup> State Stende Cereals Breeding Institute

Oat (*Avena sativa* L.) is one of the cereal crops cultivated in temperate climate zones. It is well known as a healthy food in the world, because of its unique biochemical structure. Nowadays the quality of grain for consumers has become important especially in terms of lipids and  $\beta$ -glucan content. The aim of this study was to characterize the yield, test weight, 1000 kernel weight, husk content and grain distribution in different fractions for two naked and three husked oat cultivars. In laboratory there were performed analysis of quality determining protein, starch, lipids and  $\beta$ -glucan content. Investigations were carried out at the State Stende Cereal Breeding Institute in 2012 and 2013. The obtained results showed significant differences among naked and husked oat cultivars in all tested parameters for example lipid content for husked oat cultivars varied from 5.8–6.7 g kg<sup>-1</sup>, but for naked oat 9.5–10.4 g kg<sup>-1</sup> in 2012.  $\beta$ -glucan content among husked oat cultivars varied from 3.8–3.95 mg 100 g<sup>-1</sup>, but naked oat breeding line '33793' reached 7.3 mg 100 g<sup>-1</sup> in 2012. Little variation between years was detected as well. Research showed that naked oat characterized with better quality and no husk content, what is preferable for processing comparing with husked oat cultivars. Overall naked oat could be better for food production.

**Keywords:** naked oat, husked oat, cereal quality.

For further information please contact: [brunava.linda@inbox.lv](mailto:brunava.linda@inbox.lv)



## LIPID COMPOSITION OF OAT GRAIN GROWN IN LATVIA

**Vita Sterna<sup>1</sup>, Sanita Zute<sup>2</sup>, Linda Brunava<sup>1</sup>, Zaiga Vicupe<sup>2</sup>**

<sup>1</sup> Department of Agro-ecological Research, State Stende Cereals Breeding Institute, „Dizzemes”, Dizstende, Libagi parish, Talsi County, Latvia

<sup>2</sup> Department of Cereal Breeding, State Stende Cereals Breeding Institute, „Dizzemes”, Dizstende, Libagi parish, Talsi County, Latvia

Oat (*Avena sativa* L.) is a well known annual crop in temperate climates. It is recognised as a healthy food containing significant amounts of fat-soluble vitamin E and polyunsaturated fatty acids in the world. There are few investigations of lipid composition in connection with human health in Latvia. Therefore the aim of this study was to characterize the composition of lipids of same oat varieties to grown in Latvian condition. Investigations were performed at the State Stende Cereal Breeding Institute. In the studied samples content of fat, composition of fatty acids and vitamin E ( $\alpha$ -tocopherol) were determined, same as ratio most significant for human health like P/S and  $\omega$ -3/ $\omega$ -6 were calculate. The total fat was made by Soxlet method, fatty acids by LVS CEN ISO/TS 17764-1:2007 and content  $\alpha$ -tocopherol determination was made using high-performance liquid-chromatography. The high concentration was determined as mg kg dry matter. The obtained results showed a wide range of fat content among varieties, it varied from 4.9 to 10.5 g 100 g<sup>-1</sup>. The content of  $\alpha$ -tocopherol in oat grain was determined 8.5–12.3 mg kg<sup>-1</sup>, and the sum of polyunsaturated fatty acids accounted 78–80% of total fatty acids content. The ratio P/S varied from 4.1 to 4.5. Result of evaluation leads to conclusion that lipid of oat grain are rich with biologically significant substances.

**Keywords:** oat for human health, fat content, fatty acids, vitamin E.

For further information please contact: [vitasterna@inbox.lv](mailto:vitasterna@inbox.lv)

## THE EFFECT OF PLANT EXTRACTS AND PHYTOCHEMICAL COMPOUNDS ON THE FORMATION OF MAILLARD REACTION PRODUCTS IN MODEL SYSTEM

**Ieva Raudoniūtė<sup>1</sup>, Audrius Pukalskas<sup>1</sup>, Petras Rimantas Venskutonis<sup>1</sup>, Vincenzo Fogliano<sup>2,3</sup>**

<sup>1</sup> Department of Food Science and Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilėnų Pl. 19, Kaunas, Lithuania

<sup>2</sup> Food Quality Design group, Wageningen University, 6700 EV Wageningen, The Netherlands

<sup>3</sup> Department of Agricultural and Food Science, University of Naples "Federico II", Parco Gussone Ed. 84, Portici, Naples, Italy

The industrial production of dairy products requires thermal processing of ingredients, in order to produce safe and long-term products. Heat treatment of milk results in the development of deleterious Maillard reaction products (MRPs), called advanced glycation end products (AGEs), and in the decreased nutritional value of proteins.

Abilities of several plant extracts to inhibit the glycation and thus the formation of AGEs compounds have been investigated. Their inhibitory effects were mainly contributed by the variety of phenolic antioxidants they contain. Therefore, this study was aimed to determine in vitro the effect of red beetroots (*Beta vulgaris*) juice, lingonberry leaves (*Vaccinium vitis-idaea* L.) extract and some phytochemical compounds on the formation of heat induced Maillard reaction products possessing sensory, health and nutritional implications in the model system. The effect of additives on the formation of MRPs such as furosine (early stage MRP) and N<sup>ε</sup>-(carboxymethyl) lysine (CML, advanced stage MRP) in a milk model system was determined using different concentrations and heat treatment intensities. The beetroot juice was more effective in reducing the formation of MRPs in early stage than in advanced stage of Maillard reaction. Lingonberry leaves water extract was more effective in reducing the formation of advanced stage than early stage MRPs. The most effective in reducing MR products formation were pure phytochemicals – quinic acid and catechin. These results may be useful for the industry creating novel source of functional ingredients possessing anti-carcinogenic and antiglycation activities.

**Keywords:** Maillard reaction, CML, AGEs, *Beta vulgaris*, Lingonberry.

For further information please contact: [ieva.raudoniute@gmail.com](mailto:ieva.raudoniute@gmail.com)

## DETERMINATION OF MAJOR SUGARS IN FRESH AND DRIED SPICES AND VEGETABLES USING HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

**Līga Priecina, Daina Karklina**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

Carbohydrates are one of the most important energy sources in plants synthesized during photosynthesis. They are important for plants to grow and produce. Polysaccharide content changes dependent from plant type, where they grew and weather in that year. The highest content differs in roots and leaves – photosynthesis starts in leaves, but to grow and produce mostly carbohydrates are localized in roots. Therefore it is important to follow up differences between sugars changes in leaves and root. The aim of this research was to determine major sugars in nine spices and vegetables as celery (*Apium graveolens*), parsley (*Petroselinum crispum*), dill (*Anethum graveolens*), leek (*Allium ampeloprasum* L.), garlic (*Allium sativum* L.), onion (*Allium cepa*), celery root (*Apium graveolens* var. *rapaceum*), pumpkin (*Curcubica maxima*), and carrot (*Daucus carota*) harvested in Latvia at 2013. Analyses were made in Latvia University of Agriculture, at laboratories of Faculty of Food Technology for fresh samples and dried samples in convective dryer at  $45\pm 1$  °C temperature. Using standard methods quality parameters as a content of fructose, glucose, sucrose and maltose (high performance liquid chromatography), and moisture content (oven-drying) in each sample were determined. Results were expressed as g 100 g<sup>-1</sup> dry weight (DW). During experiments it was found, that highest total sugar content was in fresh and dried vegetables roots (carrot), lowest – in spices leaves. Using drying process in most cases individual sugar content decreases significantly in analysed samples. During drying process sugars are reducing, which indicates active possible Maillard reaction, because convective drying accrue at temperature  $45\pm 1$  °C from 12 till 48 hours.

**Keywords:** spices, vegetables, drying, sugars, HPLC.

For further information please contact: [liga.priecina@gmail.com](mailto:liga.priecina@gmail.com)

## EXTRACTION OF ICE STRUCTURING PROTEINS FROM WINTER RYE AND WINTER WHEAT AND ASSESSMENT OF ACTIVITY

Aleksei Kaleda<sup>1,2</sup>, Laura Taal<sup>1</sup>, Katrin Laos<sup>1,2</sup>

<sup>1</sup> Department of Food Processing, Faculty of Chemical and Materials Technology, University of Technology, Ehitajate tee 5, Tallinn, Estonia

<sup>2</sup> Competence Centre of Food and Fermentation Technologies, Akadeemia tee 15a, Tallinn, Estonia

Ice structuring proteins (ISP) are proteins that bind to ice thus inhibiting ice crystal growth and recrystallization. It is known that winter wheat (*Triticum aestivum*) and winter rye (*Secale cereale*) produce ISPs to survive freezing. ISPs can be used in ice-cream to inhibit ice recrystallization, improve texture and increase shelf life. The aim of this research was to collect winter wheat and winter rye leaves from open fields during winter, extract ISPs, determine crude extract efficiency in inhibiting ice recrystallization and compare it to commercially available fish ISPs. An accelerated method for ISP activity assessment was developed, image analysis and data processing were automated using custom-made Fiji and MS Excel macros. Winter wheat ISP extract at low concentrations showed higher ice recrystallization inhibition efficiency compared to winter rye extract. Winter wheat ISP extract slowed down recrystallization by 60% at around 4 times lower concentration. In comparison with purified fish ISPs crude plant extract has around 100 times lower activity, however protein content of extracts is less than 1%, so recalculated activity of purified plant ISPs is comparable to fish ISPs. Winter wheat and winter rye are perspective local ISP sources that can be used for ice cream production.

**Keywords:** ice structuring proteins, winter wheat, winter rye.

For further information please contact: [aleksei@tftak.eu](mailto:aleksei@tftak.eu)

## EXTRACTION OF BIOACTIVE COMPOUNDS FROM RYE BRAN USING DIFFERENT EXTRACTION TECHNIQUES

**Darius Povilaitis, Petras Rimantas Venskutonis**

Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania

There is a growing demand for healthy food products. Cereal brans are often discarded during flour milling and used for animal feed, while this by-product contains valuable compounds, mainly alkylresorcinols and it could be used to enrich food products with bioactive ingredients.

Traditional extraction techniques are long and require large amounts of solvent. It is possible to increase extraction efficiency by using novel extraction methods at higher pressure and temperature. Optimum conditions for the extraction of rye bran oleoresin using supercritical CO<sub>2</sub> extraction system were determined. Central composite design with three independent variables (pressure, temperature, dynamic extraction time) was used to determine preferable extraction conditions. All tested parameters had significant influence on the extraction yield and by their importance they could be arranged in the following order: temperature, pressure, dynamic extraction time. The highest yield (2.5%) was obtained at 55 MPa pressure, 70 °C temperature and 120 min dynamic extraction time. These results are in agreement with previously reported when the yield of extract was proportional to pressure and temperature. The residue after supercritical fluid extraction was used in pressurized liquid extraction system to extract remaining valuable substance. All the extracts obtained were evaluated.

It is demonstrated that evaluation of interactions between different parameters enables selecting preferable extraction conditions while combination of few sequential extraction techniques results in higher total extract yields and more exhaustive isolation of valuable constituents.

**Keywords:** rye bran, response surface optimization, supercritical carbon dioxide extraction, pressurized liquid extraction.

For further information please contact: [dareuspo@yahoo.com](mailto:dareuspo@yahoo.com)

## TLC BIOAUTOGRAPHY-GUIDED DETECTION OF ANTIOXIDANTS IN MUSHROOM EXTRACTS

Ruta Paulovica<sup>1</sup>, Lina Smolskaite<sup>2</sup>, Thierry Talou<sup>2</sup>, Zanda Kruma<sup>1</sup>

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

<sup>2</sup> Laboratoire de Chimie Agro-industrielle, INPT-ENSIACET, Université de Toulouse, 4 Allée Emile Monso, 31432 Toulouse, France

Mushrooms have been appreciated for their flavor and texture. Also they are recognized as a nutritious food as well as an important source of biologically active compounds with medical value. The aim of current research was to evaluate antioxidants extracted from mushrooms detected using thin layer chromatography (TLC) bioautography. In this study following wild mushroom species were investigated: *Gyroporus castraneus*, *Boletus edulis*, *Chantarellus cibarius*, *Tuber brumale*, *Suillus variegatus*, *Inonotus hispidus*, *Polyporus schweinitzii*, *Tricholoma columbetta*, *Tricholoma caligatum*, *Boletus chrysenteron*, *Hydnum ferruginum*, *Agaricus bisporus*, *Pleurotus ostreatus*. The TLC bioautography was used to separate and localize the active compounds on TLC plates, giving quick access to detection of antioxidants using stable 1,1-diphenyl-2-picrylhydrazyl (DPPH•) free radical. The reaction with DPPH• is very time-unstable and densitometric processing of such plates is not suitable. There have been proposed to use photo documentation and image processing programs for detection and quantification of the radical scavenging capacity of extracts. In current study photos of TLC plates were processed using free access program *ImageJ*. To find the best way of interpretation, images were processed with different tools. All samples were compared to Trolox (0.5%) and expressed as %, of Trolox activity. Results showed that TLC bioautography coupled with *ImageJ* is successful tool for analyses of antioxidants in mushroom extracts. Most of analyzed mushroom (*Gyroporus castaneus* 2011, *Suillus variegatus*, *Black chantharellus*, *Boletus edulis*) extracts have higher radical scavenging capacity compared to Trolox – 101–159%.

Part of the research was carried out within the OSMOSE project "Comparison of composition and properties of forgotten aromatic plants and fungi of Latvia and Midi-Pyrenees".

**Keywords:** mushrooms, antioxidants, TLC, ImageJ.

For further information please contact: [rutapau@gmail.com](mailto:rutapau@gmail.com)

## INFLUENCE OF *OENOCOCCUS OENI* AND OAK CHIPS ON THE CHEMICAL COMPOSITION AND SENSORY PROPERTIES OF CIDER

Rita Riekstina-Dolge<sup>1</sup>, Zanda Kruma<sup>1</sup>, Ingmars Cinkmanis<sup>2</sup>, Evita Straumite<sup>1</sup>,  
Martins Sabovics<sup>1</sup>, Lolita Tomsone<sup>2</sup>

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

<sup>2</sup> Department of Chemistry, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

Cider quality is influenced by several factors, namely, apple variety, yeast strains, fermentation and maturation conditions. The aim of current research was to evaluate influence of lactic acid bacteria *Oenococcus oeni* and oak chips on the quality of apple cider. After main fermentation lactic acid bacteria *Oenococcus oeni* (LA) and two types of oak chips: unroasted oak chips (UOC) and roasted oak chips (ROC) were added to cider and samples were matured for four weeks. For matured ciders total phenolic compounds (TPC) were determined spectrophotometrically, individual phenolic compounds by HPLC, volatile compounds by SPME followed by GC/MS and sensory properties using line scale and ranking test. The TPC in ciders ranged from 1028 mg L<sup>-1</sup> in cider LA to 1526 mg L<sup>-1</sup> in cider ROC. Among analysed phenolics chlorogenic acid dominated in all samples. In cider ROC comparing with control sample higher content of caffeic acid, epicatechin, ferulic acid and vanillin was determined. The highest total peak area was determined in cider UOC. Principal component analysis showed that profile of volatile compounds can be explained by three factors, the first two represent 81% of the total variances. The characteristic volatiles of cider LA were acetic acid, ethyl-9-decanoate, etildecanoate, octanoic acid, and ethylhexanoate, in cider ROC 3-methyl-1-butanol acetate, butyl acetate and ethyl acetate, whereas in cider UOC 3-methyl-1-butanol and phenylalcohol. Preference ranking test results showed that the assessors preferred cider LA. Addition of *Oenococcus oeni*, unroasted and roasted chips during maturation influence chemical composition and sensory properties intensity of cider.

**Keywords:** *Oenococcus oeni*, oak chips, maturation, cider.

**Acknowledgement:** State Research Programme NatRes (2010-2013) Project no. 3. „Sustainable use of local agricultural resources for development of high nutritive value food products (Food)” and ESF project “Support for the implementation of LLU doctoral studies” contract No. 2009/0180/1DP/1.1.2.1.2/09/IPIA/VIAA/017. The authors also acknowledge the Latvia State Institute of Fruit Growing for supplying us with apples.

For further information please contact: [rita.riekstina@llu.lv](mailto:rita.riekstina@llu.lv)

**PREVALENCE AND ANTIMICROBIAL SUSCEPTIBILITY OF  
METHICILLIN-RESISTANT *STAPHYLOCOCCUS* SPP.  
ISOLATED FROM POULTRY PRODUCTS**

**Modestas Ružauskas, Lina Vaškevičiūtė, Rita Siugždinienė, Irena Klimienė,  
Marius Virgailis, Rita Planciūnienė, Raimundas Mockeliūnas, Alvydas Pavilonis**

Microbiology and Virology Institute, Lithuanian University of Health Sciences, Tilzes 18, Kaunas, Lithuania

The aim of this study was to investigate the prevalence of staphylococci in raw poultry products intended for human consumption and to determine antimicrobial susceptibility, particularly of methicillin-resistant isolates.

Poultry (chicken and turkey) liver as representative samples were randomly selected in different retail markets. Isolation of staphylococci was performed using general and selective nutrient media including Mannitol Salt Agar supplemented with cefoxitin as well as Brilliance MRSA2 Agar (Thermo Fisher). Antimicrobial susceptibility was performed using "Sensititre" (Thermo Fisher) plates for determination of minimal inhibitory concentrations. Interpretation of results was performed according to CLSI standard. Polymerase chain reaction was used for determination of *mecA* gene.

Fifty samples from 70 tested were positive for *Staphylococcus* spp. (71%). In 30% of samples tested, the growth of staphylococci was observed on selective media with cefoxitin as well as on MRSA2 Agar. The isolates from those samples were resistant to oxacillin (MIC $\geq$ 0,5mg/ml) however, the only one isolate harboured the *mecA* gene. All of the isolates with phenotypic resistance to oxacillin were susceptible to vancomycin, gentamicin and quinupristin/dalfopristin. The resistances of those isolates were observed to tetracycline (60%), erythromycin (40%), and fluoroquinolones (40%). The species of oxacillin-resistant staphylococci included *S. hyicus* (6), *S. hominis* (4), *S. haemolyticus* (1), *S. cohnii* (1), *S. lentus* (1), *S. warneri* (1) and *S. intermedius* (1). Methicillin resistant *Staphylococcus aureus* was not found. The obtained results demonstrated low correlation between phenotypic resistance to oxacillin and the presence of *mecA* gene in staphylococcal isolates from poultry products. Further studies need to be performed for investigation of this unusual finding.

**Keywords:** *Staphylococcus*, methicillin, resistance, antimicrobials, poultry.

For further information please contact: [ruzauskas@lva.lt](mailto:ruzauskas@lva.lt)



## PHYSICAL AND CHEMICAL PARAMETERS OF STRAWBERRY PUREE

**Ruta Galoburda<sup>1</sup>, Sigita Boca<sup>2</sup>, Imants Skrupskis<sup>2</sup>, Dalija Seglina<sup>3</sup>**

<sup>1</sup> Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, 2 Liela Street, Jelgava, Latvia

<sup>2</sup> Department of Nutrition, Faculty of Food Technology, Latvia University of Agriculture, 2 Liela Street, Jelgava, Latvia

<sup>3</sup> Latvia State Institute of Fruit Growing, 1 Graudu stret, Dobele, LV 3701, Latvia

Practice of the world shows, that more and more often a consumer chooses products, which can be used in nutrition without spending much time for their preparation. Use of fruit desserts in nutrition is one of the ways how to consume vitamins and minerals. The aim was to investigate physical and chemical parameters of strawberry puree from different cultivars and effect of freezing on its quality. The strawberries of cultivars - 'Polka', 'Honeoye', and 'Senga Sengana' were processed in a blender until obtaining a homogenous mass. The strawberry mass was analyzed fresh and after storage at -18 °C. Content of sugars (sucrose, glucose, and fructose) was evaluated by high performance liquid chromatography. Content of total acids was explicit as citric acid. Content of soluble solids was determined according to ISO 2173:2003 using digital refractometer; content of total phenols by spectrophotometer method. Content of anthocyanins was evaluated by spectrophotometer method pH was measured according to LVS 1132:2001, content of vitamin C - AOAC Official Method 967.21. Colour was measured in CIE L\* a\* b\* system.

Content of vitamin C in strawberry puree essentially differs ( $p < 0.01$ ) among the researched cultivars and among the types of thermal treatment. Content of vitamin C in strawberry puree has a close correlation with content of total sugars. Close correlation of a\* and b\* with content of total sugars was established. This could be explained with the changes of the content of anthocyanins in strawberry puree. Content of total acids in fresh strawberry puree from the researched cultivars was from  $0.85 \pm 0.03$  to  $0.87 \pm 0.03$  mg  $100$  g<sup>-1</sup>, which increases in average for 4.4% as a result of freezing. The highest content of anthocyanins was in fresh strawberry puree from the cultivar 'Polka', whereas the lowest – from the cultivar 'Honeoye'.

**Keywords:** strawberry puree, freezing, anthocyanins, sugars, vitamin C.

For further information please contact: [ruta.galoburda@llu.lv](mailto:ruta.galoburda@llu.lv)

## BIOCHEMICAL COMPOSITION AND ANTIOXIDANT ACTIVITY OF JAPANESE QUINCE FRUITS AND THEIR SYRUP AND CANDIED FRUIT SLICES

Marina Rubinskiėnė<sup>1</sup>, Pranas Viškelis<sup>1</sup>, Jonas Viškelis<sup>1</sup>, Ramunė Bobinaitė<sup>2</sup>,  
Maryna Shalkevich<sup>3</sup>, Dalia Urbonavičienė<sup>1</sup>

<sup>1</sup> Biochemistry and technology laboratory, Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Kauno st. 30, Babtai, Kaunas distr., LT-54333, Lithuania

<sup>2</sup> Faculty of Natural Sciences, Vytautas Magnus University K., Donelaičio st. 58, Kaunas, Lithuania

<sup>3</sup> Institute for fruit growing – Belsad, Koroliovo st. 2, Samokhvalovichy, Minsk distr., Belarus

The aim of this study was to evaluate biochemical composition and antioxidant activity of Japanese quince fruits and their products as a potential source of biological active compounds.

Fresh Japanese quince fruits and their products (syrup and candied fruit slices) were investigated. Dry soluble solids, ascorbic acid and total phenolics content of fresh fruits, freeze-dried products and sugar syrups were analyzed. The antioxidant activity of the samples was tested using the DPPH radical scavenging assay. Surface colour of Japanese quince fruits and their products was measured with a spectrophotometer. Japanese quince accumulated high amounts of ascorbic acid, 55 mg 100 g<sup>-1</sup> in C-47 and 106 mg 100 g<sup>-1</sup> in cv. 'Lichtar'. Higher content of phenolic compounds (422.6 mg 100 g<sup>-1</sup>) and stronger antiradical activity (12.35 μmol TE g<sup>-1</sup>) had fruits of Japanese quince cv. 'Lichtar'. Sugar syrup produced from the hybrid clone C-47 fruits had higher concentration of ascorbic acid (56.4 mg in 100 g of syrup). The content of organic acids in syrups was 3.09–3.18%. The content of ascorbic acid in candied quince slices was 116–124 mg 100 g<sup>-1</sup> of product. Higher amount of ascorbic acid was retained in candied slices of cv. 'Lichtar'. Candied slices of hybrid C-47 fruits had higher content of phenolic compounds (917 mg 100 g<sup>-1</sup>) and stronger antiradical activity – 30.89 μmol TE g<sup>-1</sup>.

Colour value a\* and colour tone h° of quince fruits and products varied most of all. Among all tested products quince syrups were distinguished for the high lightness (L\*) values.

**Keywords:** chemical composition, fruits, Japanese quince, products.

**Acknowledgement.** This work was supported by a grant from the Research Council of Lithuania, No. VPI-3.1-ŠMM-10-V02-021.

For further information please contact: [biochem@lsdi.lt](mailto:biochem@lsdi.lt)

**FOOD MATERIAL / PACKAGING  
INTERACTION**

## CEREAL MUESLI WITH SEEDS QUALITY CHANGES DURING STORAGE

**Santa Senhofa, Evita Straumite, Dace Klava**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture, Liela street 2, Jelgava, Latvia

Cereals play a vital role in diet because they not only provide humans with essential macronutrients such as protein, fat and carbohydrate for growth and maintenance but also supply with vitamins, minerals, and micronutrients for optimal health. In recent years the activities of human consumption “clean” products, with no extra added sugars, food additives and preservatives increases. The aim of this study was to evaluate cereal muesli with seeds quality changes during storage. Samples of muesli with seeds (linseeds, pumpkins seeds, almond slices) were packaged in 3 different packages –paper bag, paper tubes and Doypack (standup pouches) and stored for 6 months (at  $20\pm 2$  °C temperature and air humidity –  $50\pm 5\%$ ). During the storage moisture content, water activity, and microbiological safety were evaluated.

After 6 months storage of muesli with seeds, the moisture content in samples packaged in the paper tube decreases by 13.57%, in Doypack – 7.14% and in paper bag by 33.63%. The lowest moisture content was determined for muesli samples storage in the paper package – 6.00%. Water activity compared to the fresh prepared musli ( $a_w=0.56$ ) decreased, in paper tube it was 0.33, in paper bag – 0.16 and in Doypack – 0.47. As more unsuitable for cereal muesli with seeds packaging paper bags was detected, because of essential quality changes of samples during storage. After 6 months storage total count of micoorganisms and moulds increase, but remained within the normal range. Therefore, the shelf-life of cereal muesli with seeds packaged in paper tube or Doypack 6 months could be recommendable.

**Keywords:** cereals, muesli, packaging, storage time.

For further information please contact: [shenhofa@inbox.lv](mailto:shenhofa@inbox.lv)

## INTERACTION OF SUGAR CONFECTIONARY SHERBET QUALITY PARAMETERS DURING STORAGE TIME IN DIFFERENT PACKAGING MATERIALS

**Lija Dukalska, Eva Ungure, Sandra Muižniece-Brasava**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela street 2, Jelgava, Latvia

Essential importance for milk pomade confectionary quality assurance during storage time is alternate design of appropriate packaging technologies and materials. In order to substantiate scientifically the optional shelf life of sherbet, different packaging materials in air ambience, modified atmosphere (MAP), and active packaging with oxygen absorbers were used in this research to approve their conformity for providing the main physical parameters and microbiological security during long term storage of investigated sugar confectionary. Shelf life can be extended significantly in conventional polymer packaging with high barrier properties: to 10–12 weeks in air ambience OPP and Multibarrier 60 HFP material; to 16 weeks in MAP 100% CO<sub>2</sub> and Multibarrier 60 HFP, metallised BOPET/PE and Aluthen material, exceeding neither experts' accepted hardness of 300 N nor permissible total plate count of microorganisms' level (TPC g<sup>-1</sup> ≤ 10<sup>4</sup>). The sherbet hardness in active packaging after 16 weeks of storage in Multibarrier 60 HFP is 261.18 ± 8.32 N, in comparison with MAP 100% CO<sub>2</sub> environment, it is by 11.5% lower, which is valued as positive.

**Keywords:** confectionery, sherbet, quality, packaging.

For further information please contact: [lija.dukalska@llu.lv](mailto:lija.dukalska@llu.lv)

## PROPERTIES OF HAZELNUT AS INFLUENCED BY PACKAGING AND STORAGE

**Raquel P. F. Guiné<sup>1,2</sup>, Cátia F. F. Almeida<sup>1</sup>, Paula M. R. Correia<sup>1,2</sup>**

<sup>1</sup> Department Food Industry, ESAV, Quinta da Alagoa, Ranhados, 3500-606Viseu, Portugal

<sup>2</sup> CI&DETS – Polytechnic Institute of Viseu, Campus Politécnico, Repeses, 3504-510 Viseu, Portugal

Food quality is a concept that has unquestionable interest to Industries and consumers, hence the concern to preserve the products under appropriate conditions, avoiding physical and chemical changes that jeopardize the integrity of the foods. In this context, evaluation of some physical and chemical properties was done in order to investigate the effects of storage on hazelnuts, under certain conditions of temperature, relative humidity and packaging.

The hazelnut samples used were original from Spain, Portugal and Turkey. The storage of the nuts lasted for a month and a half, and the conditions tested were: at room temperature; at 30 and 50 °C without control over relative humidity of the air; 30 and 50 °C with relative humidity of 90%, refrigeration and freezing. The two types of plastic package tested were low density polyethylene (LDPE) and linear low density polyethylene (LLDPE). The water activity was measured by a hygrometer; moisture by oven drying until constant weight, colour with a colorimeter and texture with a texturometer. The textural attributes measured were hardness and friability.

From the results obtained it was concluded that for a good preservation of the hazelnuts it must be chosen the LDPE type of package and with respect to storage conditions it should be done at room temperature, or alternatively under refrigeration or frozen. High relative humidity conditions jeopardize the quality of the hazelnuts.

**Keywords:** colour, hazelnut, moisture content, texture, water activity.

For further information please contact: [raquelguine@esav.ipv.pt](mailto:raquelguine@esav.ipv.pt)

**SUSTAINABLE PROCESSING  
AND PACKAGING**

## EFFICIENCY OF THE ADDITIONAL FERTILIZATION WITH NITROGEN FERTILIZERS GROWING CARROT OF EXCEPTIONAL QUALITY AND ITS INFLUENCE ON PRODUCTION STORAGE

**Ona Bundiniene, Vytautas Zalatorius, Danguolė Kavaliauskaitė, Roma Starkutė**

LRCAF Institute of Horticulture, Babtai, Kaunas distr, LT-54333, Lithuania

Plant nutrition, among other agro-technical measures most influences yield, quality and production storability. The aim of investigations – instilling new progressive technology of the growing of root-crop vegetables of exceptional quality to choose for the additional fertilization the most suitable nitrogen fertilizer and its rate in order the soil, environment was polluted as little as possible and the qualitative production was obtained. There was grown carrot ‘Nerac’ F<sub>1</sub> and ‘Tito’. There was investigated the influence of nitrogen fertilizer used for additional fertilization (ammonium nitrate and calcium nitrate) and their rates (N<sub>30</sub> and N<sub>15</sub>) on carrot yield, and its impact on production storage. Additional fertilizations were carried out at 2–4 carrot leaves stage. Carrot were grown on profiled surface, sowing scheme 62±8, there were sown 1mln. unt. ha<sup>-1</sup> germinable seeds. Before sowing the field was fertilized with complex fertilizers. Carrots during vegetation period were additionally fertilized through leaves for three times applying soluble complex fertilizers. Experiments were carried out in calcareous epihypogleyic luvisol (IDg8-k), *Calc(ar)i-Epihypogleyic Luvisol (LVg-p-w-cc)*. Data of investigations showed that carrot hybrid was more productive than cultivar. Calcium nitrate was more effective both to hybrid and cultivar. Vegetables fertilized with it was preserved better than these fertilized with ammonium nitrate.

**Keywords:** nitrogen fertilizer, exceptional quality.

For further information please contact: [o.bundiniene@lsdi.lt](mailto:o.bundiniene@lsdi.lt)



## EFFECT OF PORK BACKFAT SUBSTITUTION WITH RAPESEED OIL IN WATER EMULSIONS ON THE PHYSICO CHEMICAL PROPERTIES OF MODEL MEAT SYSTEMS

**Vilma Speičienė<sup>1</sup>, Dovilė Grauzdytė<sup>2</sup>, Daiva Leskauskaitė<sup>2</sup>**

<sup>1</sup> Food Institute, Kaunas University of Technology, Taikos av. 92, Kaunas, Lithuania

<sup>2</sup> Department of Food Technology, Faculty of Chemical Technology, Kaunas University of technology, Radvilėnų Rd. 19, Kaunas, Lithuania

The effect of pork backfat (0, 25 and 50%) substitution with concentrated rapeseed oil (40%) in water emulsions stabilized by whey proteins and chitosan on the physicochemical properties (pH, water holding capacity, water and fat release, colour characteristics, cooking loss) of meat batters and model meat products (heat-treated in the convection oven) was investigated. Emulsions frozen at different temperatures (-8 and -18 °C) that determine difference in free oil content after thawing were used for pork backfat substitution.

The increase in pork backfat replacing emulsions content from 0 to 50% resulted in pH values and slight water holding capacity decrease in meat batters and products. Nevertheless there was significant decrease in evaluated meat batter stability with increase in pork backfat substituting emulsion content that was expressed by increase in total fluid (water and fat) release there was no significant increase in cooking loss of final product with 25% of emulsions and only slight increase in products with 50% of emulsions. Replacement of pork backfat had no significant effect on lightness (L\*) and yellowness (b\*) and reduced redness (a\*) in the meat product.

Comparison of meat batters and products prepared with emulsions stored at different frizzling temperatures showed that there were no significant differences in their evaluated properties, except the cooking loss, which was slightly higher in products with 50% of emulsion frozen at -18 °C.

Partial replacement of animal fat presented in meat products with rapeseed oil in water emulsions can be used for presumably healthier products with improved fatty acid profile.

**Keywords:** meat, backfat, rapeseed oil, emulsion.

For further information please contact: [vilma.speiciene@ktu.lt](mailto:vilma.speiciene@ktu.lt)

## THE EFFECT OF SPRAY DRYING PROCESSING CONDITIONS ON PHYSICAL PROPERTIES OF SPRAY DRIED MALTODEXTRIN

**Banu Koc<sup>1</sup>, Figen Kaymak-Ertekin<sup>2</sup>**

<sup>1</sup> Gaziantep University, NaciTopçuoğlu Vocational School, Gaziantep, Turkey

<sup>2</sup> Ege University, Faculty of Engineering, Food Engineering Department, Bornova, Izmir, Turkey

Maltodextrins have wide applications particularly in the food industry. They have many functionalities including use as wall material, dispersing aid, flavour carrier, bulking agent, viscosifier or fat re-placer, and they exhibit only a slightly sweet taste. For this reason, spray drying conditions and physical properties of maltodextrin should be determined. Maltodextrin was subjected to spray drying to determine the effect of spray drying conditions on moisture content, water activity, particle properties (particle size distribution and particle density) and bulk properties (bulk and tapped densities, porosity, flowability) of the powder product. Experiments have been performed in a lab scale spray-dryer (BüchiLabortechnik AG, Flawil, Switzerland) using a full-factorial design to provide data and correlations that predict the powder properties as a function of the main operational variables of the spray-dryer. The inlet (140 and 200°C) and feed temperatures (10 and 50 °C), feed flow rate (2.1E-0.4 and 9.6E-0.4 kg s<sup>-1</sup>) and atomizing air flow (0.473 and 0.670 m<sup>3</sup> h<sup>-1</sup>) were investigated as spray drying process variables. The effect of spray drying conditions on physical properties of powders was expressed with three dimensional response surface and perturbation graphs. Perturbation and 3-D graphs revealed that feed low rate and atomizing air flow had more effect than inlet air and feed temperatures, on the physical properties of maltodextrin powder. The results showed that the Sauter mean diameter ( $D_{3,2}$ ) was between 3.503 and 6.045 µm for maltodextrin powders. Maltodextrin powders had bad flowability due to their small particle size.

**Keywords:** maltodextrin, spray drying, particle and bulk properties, particle size distribution.

For further information please contact: [kocbanu@gmail.com](mailto:kocbanu@gmail.com)

**CONSUMER BEHAVIOR AND  
SENSORY ISSUES**

# FOODBALT 2014

## THE USE OF FACE READING TECHNOLOGY TO PREDICT CONSUMER ACCEPTANCE OF SUGAR CONFECTIONARY PRODUCTS

Grazina Juodeikiene<sup>1</sup>, Loreta Basinskiene<sup>1</sup>, Daiva Vidmantiene<sup>1</sup>, Dovile Klupsaite<sup>1</sup>,  
Elena Bartkiene<sup>2</sup>

<sup>1</sup> Department of Food Science and Technology, Faculty of Chemical Technology, Kaunas University of Technology, Radvilėnų Rd. 19, Kaunas, Lithuania

<sup>2</sup> Department of Food Safety and Quality, Faculty of Veterinary Academy, Lithuanian University of Health Sciences, Tilzes 18, Kaunas, Lithuania

Traditional sensory and consumer tests predict consumer acceptance of new products rather poorly, as evidenced by the high their failure rates in the market. These tests typical reflect conscious processes whereas consumer acceptance may also be based on unconscious processes.

The aims of this work were to examine whether facial expressions measured with the Noldus FaceReader technology can be used for differentiating between differing sugar confectionary products (various types of sweets and chocolates), and to investigate whether facial reactions are able to explain liking ratings on hedonic scales.

Naive consumers (mean age 22 years) were recruited at the Kaunas University of Technology. They were asked to rate the sample with an intentional facial expression, which was recorded and then characterized by FaceReader program (Noldus Information Technology, Wageningen, The Netherlands). The measurements showed significant differences between facial expressions elicited by the different samples of tested products and reflected the introspective liking ratings well. The positive correlations of facial expression pattern “happy”, and negative correlations of “sad” expression intensity against self-reported liking ratings suggest that these may be the most valuable descriptors for explaining the self-reported hedonic quality of sweets and chocolates. It can be concluded that Noldus FaceReader technology is sufficiently accurate for differentiating between sugar confectionary products and can deliver additional information to conventional acceptance tests.

**Keywords:** sugar confectionary products, facial expressions, hedonic liking.

**Acknowledgement.** The research was funded by a grant (EUREKA ITEA 2 project 11005 Empathic) from Lithuanian Agency for Science, Innovation and Technology.

For further information please contact: [loreta.basinskiene@ktu.lt](mailto:loreta.basinskiene@ktu.lt)

## CURRENT EATING PATTERNS AND LIFE STYLE ON THE HEALTH OF NAMIK KEMAL UNIVERSITY STUDENTS

**Emine Yilmaz, Yasemin Oraman, Gokhan Unakitan, Burcin Basaran**

Department of Agricultural Economics, Agricultural Faculty, NKU, Tekirdag, Turkey

Eating habits result from the variety and complexity of influences on university students lifestyles and consequently on their eating behavior. Highlights of a few of these influences and the adolescent eating patterns of particular concern to nutrition educators and health professionals are discussed.

This research was conducted to determine the students' current eating patterns and life style on the health and the correlation of these factors to the health condition of the students surveyed. A self-reported questionnaire was administered to 618 students. Students from Namik Kemal University in Turkey participated in this study. The parametric variables were analyzed using the t-test. Chi-square analyses were conducted for non-parametric variables.

Our findings suggest the need for strategies designed to improve competence in the area of nutrition, especially with respect to information relating to sources of nutrition and healthy weight management. Descriptive statistics of some of the results obtained from the survey study are as follows: 37.9% of consumers are female; the average age of consumers is 20.5 years. The life style practices were compared by gender. Significant differences between genders were determined by chi-square analyses ( $p < 0.05$ ). Furthermore, public demand for health and nutritional information should be taken into consideration when implementing strategies aimed at improving the nutritional well-being of individuals.

**Keywords:** eating pattern, life style on the health, student.

For further information please contact: [emineyilmaz@nku.edu.tr](mailto:emineyilmaz@nku.edu.tr)

## AN ANALYTIC STUDY OF UNIVERSITY STUDENTS'S NUTRITIONAL HABITS AND ATTITUDES AS A PART OF SOCIETY IN TURKEY

**Yasemin Oraman, Emine Yilmaz, Gokhan Unakitan, Burcin Basaran**

Department of Agricultural Economics, Agricultural Faculty, NKU, Tekirdag, Turkey

The importance of proper nutrition as one of the enhancing the nutrition attitudes, knowledge and important aspects of lifestyle were emphasized in the practices of students has high importance, because recent years and the trend toward healthier diets have this subsequently will lead to more food-conscious increased.

The aim of research carried out is to understanding the nutrition knowledge, attitude and food habits of students at higher education programmes. This study has been carried out using subjects of 618 students consisting of 237 female and 381 male students attend 15 departments at Namik Kemal University. A Likert type scale was used to evaluate each of the questions. The collected data was analyzed by t-test, one-way ANOVA and Pearson correlation coefficient ( $P < 0.05$ ). In addition, this result supported by principal component analysis (PCA), descriptive statistical analysis which students' attitudes on nutritional habits.

Using the one-way ANOVA, it transpired that there was a significant differences in the knowledge level between students of different departments ( $F=3.06$ ;  $p < 0.001$ ). Principal component analysis was used to identify four main dietary patterns, and analysis of variance employed to examine the characteristics associated with them. Factor analysis reduced the 15 independent variables into four factor groups. This paper provides a unique insight into a wide range of Turkey young's' nutritional habits (e.g. vegetables, fast foods, milk products etc.-related) and Turkey policy makers' responses to such food habits.

**Keywords:** young's' nutritional habits, proper nutrition, attitudes, factor analysis.

For further information please contact: [yoraman@nku.edu.tr](mailto:yoraman@nku.edu.tr)

## ANALYSIS OF NUTRITIONAL INFORMATION SHOWN ON THE LABELS OF BREAD PRODUCED IN LATVIA

**Irisa Mūrniece, Līga Everosne**

Department of Food Technology, Faculty of Food Technology, Latvia University of Agriculture,  
Liela Street 2, Jelgava, Latvia

The information on the products' nutritional values is becoming more and more topical also in the field of food products' packaging, paying more attention to the uniqueness of a food product, showing both health and nutritional information. Therefore different kinds of analytical research are being carried out on the consumers' attitude towards nutritional labelling issues. The aim of research was to evaluate the consumers' understanding of nutritional labelling and analyse the nutritional information shown on the label of bread packages. By experimental method 214 bread label samples were analysed. In the questionnaire on the consumers' (n=146) understanding of and attitude towards the nutritional issues which are directly or indirectly related to the indication of the nutritional information of food products on the labels, contradiction was stated in the respondents' answers: 1) 86% (n=126) of the respondents indicated that they very seldom, sometimes or never pay attention to the nutritional information; 2) 81% of the respondents (n=118) answered that they are satisfied with the information on bread labels. Consequently, not paying attention to the nutritional information of a product, or paying attention to it very seldom, the nutritional information shown on the label satisfies the consumer. From the evaluated bread labels (n=214) the calculation of energy value (calories) was shown accurately on 2.8% (n=6) of bread packaging labels.

**Keywords:** food labelling, bread, nutrition, Latvia.

For further information please contact: [irisa.murniece@llu.lv](mailto:irisa.murniece@llu.lv)



## A PORTUGUESE SURVEY ABOUT THE KNOWLEDGE AND ATTITUDES OF THE POPULATION REGARDING DIETARY FIBRES

Maria João Barroca<sup>1</sup>, Célia A. C. Martinho<sup>2</sup>, Raquel P. F. Guiné<sup>3</sup>

<sup>1</sup> Department of Biological and Chemical Engineering - Coimbra Institute of Engineering, Coimbra, Portugal

<sup>2</sup> Department of Food Industry, ESAV, Polytechnic Institute of Viseu, Viseu, Portugal

<sup>3</sup> CI&DETS – Polytechnic Institute of Viseu, Viseu, Portugal

Dietary fibres assume an important role on today's diet, and the consumption of dietary fibre in food such as fruits, vegetables, whole grains, and legumes is critical for fighting the epidemic of obesity in developed countries. Given this importance, the knowledge, attitudes and perceptions of the Portuguese regarding dietary fibre were investigated by undertaking a consumer survey by means of questionnaire.

The questionnaire was administered by e-mail among the adult population and a total of 182 validated answers were obtained. Regarding the sample, 54.4% were female and 45.6% were male; the great majority had a university degree, 127 people, representing almost 70% of the sample; over 74% lived in urban areas, whereas about 26% lived in rural areas.

A factor analysis was done to group the knowledge about food fibres, and it revealed that the most appropriate solution involved three factors (health effect, food and fibres, general knowledge), explaining 71% of the variance in the original data.

A cluster analysis was done for the segmentation of the sample population, and it lead to the identification of 3 clusters: people in cluster 1 can be considered as practising a healthy diet, in cluster 2 those who eat out, and in cluster 3 those who do not concern about these matters.

**Keywords:** dietary fibre, diet, health, cluster analysis, factor analysis.

For further information please contact: [mjbarroca@gmail.com](mailto:mjbarroca@gmail.com)

## CAN FOOD / FLAVOR PAIRING BE AN USUABLE TOOL FOR FLAVORINGS FORMULATION?

Alexandra Vinozzi<sup>1</sup>, Nolwenn Divanach<sup>1</sup>, Thierry Talou<sup>1,2</sup>

<sup>1</sup> Laboratoire de Chimie Agro-industrielle, INPT-ENSIACET, Université de Toulouse, 4 Allée Emile Monso, 31432 Toulouse, France

<sup>2</sup> MIPAROME SARL, 25 cours de la Chartreuse 46000 Cahors, France

A new approach for combining foods was recently developed by a senior-flavor chemist and a 3 Michelin stars chef: the so-called "Food Pairing theory". It is based on the principle that foods can be combined when they share major flavor components. For example, unconventional combination of strawberry and coriander, sharing at least one key odorant, (Z)-3-hexenal, was reported as incredibly tasty. According to this method, once the flavor components of a particular food have been analyzed, they are compared to a database of several hundreds of other food products. Products which have flavor components in common with the selected ingredient are retained. Dedicated algorithm allows establishing foodpairing tree which is an interactive visualization that indicates which ingredients match from a flavor perspective. In the foodpairing tree, the chosen food is placed at the center of the tree and surrounded by possible combinations. The shorter the branch, the better the match to the central ingredient.

The transfer of this concept in aromatic industry generates the "Flavor Pairing concept" which had as objective to set up a methodological approach for developing novel flavorings based on best associations of natural extracts of herbs and spices. In the framework of the project ESS+ (innovative flavored vegetal oils design), flavor pairing was applied to select the better combinations of 2 herbs and spices essential oils among 30 different ones. Among the 900 possible combinations, 50 are reported as flavor compatible according to their flavor pairing trees. If half of proposed combinations appeared as logical due to the common high amount of a flavor compound e.g. limonene (lemon-orange), 1-8 cineole (laurel-cardamon), linalool (coriander-lemon mint), methyl chavicol (basil-tarragon), half of them remained unexplicated, e.g. cumin-nutmeg, thyme-rosemary, citronella-bergamot, basil-turmeric etc., despite their high ranking in sensory analysis tests.

**Keywords:** food-flavor pairing, flavorings, formulation tool.

For further information please contact: [thierry.talou@ensiacet.fr](mailto:thierry.talou@ensiacet.fr)

**FOOD CHAIN MANAGEMENT**

## FOODBALT 2014

## PIKE-PERCH FARMING IN RECIRCULATING AQUACULTURE SYSTEMS (RAS) IN THE KALININGRAD REGION

**Dmitry Pyanov, Artem Delmukhametov, Evgeny Khrustalev**

Department of Aquaculture, Faculty of Bioresources and Nature Management, Kaliningrad State Technical University, 1 Sovietskyy prospect, Kaliningrad, Russia

Pike-perch (*Sander Lucioperca*) is considered as one of the most valuable food fishes native to Europe. Low fat content (1–2%), highly assimilable protein and a delicate flavor makes pike-perch meat is highly valued by dietitians. Currently, pike-perch available on the market are usually caught by fishers, mainly from Eastern Europe. However, breeding technology is still low, only a few countries (such as Denmark and the Netherlands) have established production. According to predictions of increasing consumption and environmental degradation it'll be necessary to develop reliable technology of pike-perch reproduction as a potential for aquaculture development.

Nowadays, in the EU is actively developing aquaculture in fully "recirculating" systems where water is largely reused. It is known as Recirculating Aquaculture Systems (RAS). In the EU, only the fish which is reared in the RAS may be considered as an eco-friendly product. And food safety concerns are led to the fact that some consumers are willing to pay a premium prices for safe and eco-friendly products, making such cultivation technology more profitable.

The objective of this article is to provide an overview of the current status of pike-perch farming in the Russian Federation with a focus on quality of fish, which is produced in environmentally friendly way by using the RAS technology. We researched the growth features of various pike-perch generations reared experimentally in a local fish hatchery and established the possibility of introducing this species to the market in the Kaliningrad Region.

**Keywords:** pike-perch, RAS, weight gain.

For further information please contact: [dmpjanov@gmail.com](mailto:dmpjanov@gmail.com)

**PREVALENCE OF *CLOSTRIDIUM BOTULINUM*  
IN THE GULF OF RIGA**

**Inga Eizenberga<sup>1,2</sup>, Yağmur Derman<sup>3</sup>, Miia Lindström<sup>3</sup>, Hannu Korkeala<sup>3</sup>,  
Aivars Bērziņš<sup>1,2</sup>**

<sup>1</sup> Institute of Food Safety, Animal Health and Environment - "BIOR," Latvia

<sup>2</sup> Faculty of Veterinary Medicine, Latvia University of Agriculture, Latvia

<sup>3</sup> Department of Food Hygiene and Environmental Health, Faculty of Veterinary Medicine, University of Helsinki, Finland

*Clostridium botulinum* is a spore forming, neurotoxin producing anaerobic bacteria. There are 8 serotypes (A to H) of botulinum neurotoxins.

Human botulism is caused mostly by toxin types A, B, E, and (rarely) F. *Clostridium botulinum* spores can be found in terrestrial and aquatic environments. Prevalence of *C. botulinum* serotypes varies in different regions of the world. Type E is the most commonly found in the northern subarctic and temperate zone water sediments. A high prevalence was reported in the Baltic Sea sediments and fish, however data is not available on distribution of *C. botulinum* in the ecosystems of the Gulf of Riga. The aim of this study was to determine the occurrence and prevalence of the *C. botulinum* in the Gulf of Riga. Sediment samples were collected from the Gulf of Riga between November 2009 and October 2012. In the present study five samples (71%) were positive for *C. botulinum* type E, while type A, B and F were not detected. Our results indicate that the Gulf of Riga could be a source of pathogenic *C. botulinum* which may lead to subsequent contamination of fish and other sea products in food chain.

**Keywords:** *C. botulinum* type E, marine sediments.

For further information please contact: [inga.eizenberga@bior.gov.lv](mailto:inga.eizenberga@bior.gov.lv)

**IMPACT OF STUNNING ON CARP BREAM MEAT QUALITY**

**Viktoras Liorančas, Orestas Levuškinas**

Food technology, Faculty of Technologies, Klaipeda's State College, Bijunu Str. 10, Klaipeda, Lithuania

Animal welfare and product quality are linked aspects. The aim of this study was to investigate how stunning methods influence the flesh quality in carp bream (*Abramis brama*). For quality measurements a total of 60 fish were caught by fishing vessel in Coronian Lagoon. In this study after the removal from ledger tackle, carp bream was stunned manually, with electricity and third (control) group was left to die due to oxygen deficiency (as in traditional fishing way). Excitation and mucus secretion as well as the time taken for the fish to be anaesthetized were recorded. With manual and electrical stunning, all fish were anaesthetized almost immediately, while in control group 6.5 min on average. After slaughter and after 1 and 5 days of storage on ice, the fish meat quality parameters, i.e. pH value and rigor mortis, were measured. Control group gave rise to the lowest pH values and *Rigor mortis* in carp bream. No significant differences, either in development of pH or *Rigor mortis*, were seen between fish that were stunned with electricity or by percussion. Testing of prepared fish was performed by a panel assessing organoleptic properties. Fish anaesthetized manually were ranked to be better than those in the other groups.

**Keywords:** stunning; substantial quality, organoleptic properties.

For further information please contact: [viktoras@lva.lt](mailto:viktoras@lva.lt)

## LITHUANIAN EXPERIENCE ON THE ASSESSMENT OF POULTRY WELFARE IN ORGANIC AND CONVENCIONAL FARMS

**Ina Stuoğė, Vytautas Ribikauskas, Robertas Juodka, Gintautas Švirnickas**

Institute of Animal Sciences of Lithuanian University of Health Sciences,  
R. Žebenkos Street 12, LT-82317 Baisogala, Radviliškis district, Lithuania

The adoption of organic farming is important because this method of farming creates potential possibilities to solve the issues of competitiveness of poultry production, employment and additional income in the rural areas of Lithuania. Besides it helps to reduce the negative effects on the environment of Lithuania and supplies the consumer with healthier food products.

The welfare of animals concerns not simply stress, experienced by an animal, but its ability to manage stress.

The aim of the study was to analyze and evaluate the environment and welfare of poultry in Lithuanian organic farms compared with conventional poultry farms. The studies were conducted on six laying hens' farms located in different regions of the country and at the Department of Ecology at the Institute of Animal Sciences of Lithuanian University of Health Sciences.

Laying hens' welfare and health studies were carried out on the basis of ANI 35 L/2000 system. The following criteria were evaluated: 1) possession of relevant qualifications by the staff maintaining poultry farms; 2) regular inspection of poultry; 3) health of laying hens; 4) freedom of poultry movement; 5) buildings and premises; 6) feeding, feeding quality, watering and water quality; 7) evidence of technological mutilations; 8) breeding and reproduction. Organic housing was evaluated more favourably in comparison with conventional housing on the laying hens, barns. The estimation of barns with organic laying hens housing was average 29.0 points or "very suitable" versus. 23.4 points or "suitable" for laying hens housing in traditional poultry farms. Correspondingly, laying hens welfare was evaluated as "excellent" and "very good".

The microenvironment of barns, cleanliness of equipment, laying hens health of organic and conventional farms were similar in evaluation.

**Keywords:** organic and conventional farming, animal welfare, assessment, laying hens.

For further information please contact: [ina.stuoge@gmail.com](mailto:ina.stuoge@gmail.com)



## AUTHORS LIST

- Abaravičius A. 75  
 Acar B. 22; 58  
 Alenčikiene G. 75  
 Almeida C. F. F. 28; 142  
 Alsina I. 35; 61; 127; 128  
 Aluc M. 71  
 Andrade S. C. 46  
 Andriulionyte D. 80  
 Antonenko K. 81  
 Arneborg N. 53  
 Augspole I. 70  
 Auzina L. 93  
 Aydogdu A. 89  
 Balubash V. 113  
 Balžekas J. 115  
 Barroca M. J. 30; 153  
 Bartkevičs V. 79  
 Bartkiene E. 68; 108; 149  
 Basaran B. 150; 151  
 Basinskiene L. 149  
 Batu A. 83  
 Beitane I. 66; 88  
 Beliakova S. 45  
 Beliavska-Aleksiejūnė D. 124  
 Bērziņš A. 158  
 Bobinaitė R. 38, 138  
 Boca S. 137  
 Brazaitytė A. 119  
 Bredie W. L. P. 24  
 Brites C. 105  
 Brunava L. 128; 129  
 Budreckiene R. 100  
 Būdinienė O. 144  
 Čakste I. 102; 109  
 Campanella O. H. 90  
 Carballido J. R. 117  
 Čeksterytė V. 115  
 Ciekure E. 52  
 Çınar F. 47  
 Cinkmanis I. 102; 135  
 Ciprovica I. 33; 114  
 Coelho J. 29  
 Correia P. M. R. 28; 29; 30; 105; 142  
 Dandena A. 118  
 Degola L. 64  
 Delmukhametov A. 157  
 Denina I. 93; 94  
 Derman Y. 158  
 Dimiņš F. 70; 106  
 Divanach N. 154  
 Dizgalve A. 116  
 Dubova L. 61  
 Duchovskis P. 119  
 Dukaļska L. 50; 141  
 Dūma M. 23; 61  
 Eglīte A. 48  
 Eisinaite V. 39  
 Eizenberga I. 158  
 Elyıldırım F. 83  
 Erol T. 22; 58  
 Everosne L. 152  
 Feldmane J. 33  
 Ferrari G. 38  
 Fogliano V. 130  
 Gaivelyte K. 120  
 Galoburda R. 109; 126; 127; 137  
 Garipoğlu H. 72  
 Gedrovica I. 114  
 Giacinti G. 41  
 Gil H. 29  
 Gonçalves S. 29  
 Gramatina I. 26; 97  
 Grauzdytė D. 145  
 Gūvendi Ö. 25  
 Guiné R P. F. 28; 30; 46; 105; 142; 153  
 Hampshire J. 57  
 Hansen Å. S. 24; 53  
 Ikaunieca D. 62; 63  
 Ivanov V. L. 113  
 Jakstas V. 120

## FOODBALT 2014

- Jankauskienė J. 119  
Janulis V. 59; 120; 121  
Jasinauskienė D. 84  
Jasutienė I. 39; 98  
Jaundzeikare L. 66  
Jefimovs A. 96  
Jefremovs A. N. 106  
Jemeljanovs A. 62; 63  
Jonkuvienė D. 76; 84  
Juhņeviča-Radenkova K. 73  
Juodeikiene G. 68; 108; 149  
Juodka R. 160  
Jure M. 40  
Kajava K. 20  
Kaleda A. 132  
Kalnina S. 26  
Kaminskas A. 75  
Kampuse S. 65; 96  
Kampuss K. 110; 116  
Kantautaitė J. 108  
Kara O. O. 36  
Karacabey E. 36; 47; 82  
Karklina D. 34; 43; 131  
Kasnauskytė N. 84  
Kasparaviciute E. 42  
Kavaliauskaitė D. 144  
Kaymak-Ertekin F. 87; 146  
Kazernavičiūtė R. 115  
Kendirci P. 123  
Keršienė M. 98  
Khrustalev E. 157  
Kirse A. 34; 43  
Kitrytė V. 27  
Kivima E. 21  
Klava D. 37; 140  
Klimaviciute R. 98  
Klimienė I. 125; 136  
Klupsaitė D. 149  
Koç B. 146  
Koç M. 87  
Korkeala H. 158  
Koscelkovskienė I. 111  
Kostova M. 118  
Kovalcuks A. 23  
Krasnikova L. 45; 78  
Krasnova I. 37  
Kraujalienė V. 51  
Kraujutienė I. 74  
Kreicbergs V. 81  
Kruke A. 57  
Kruma Z. 70; 107; 127; 134; 135  
Krumina-Zemture G. 88  
Krunģleviciute V. 108  
Küçüköner E. 36; 47; 82  
Kūka M. 109  
Kūka P. 106  
Kunkulberga D. 26; 81; 104; 114  
Kurtinaitienė B. 115  
Kutaceva A. 65  
Kviklys D. 121  
Lamanauskas N. 38  
Lanauskas J. 121  
Laos K. 132  
Lauber N. 57  
Lazdins M. 44  
Lemos D. 105  
Lepeskaite E. 68  
Lepse L. 61  
Leskauskaitė D. 39; 145  
Levuškinas O. 95; 159  
Liaudanskas M. 121  
Lidums I. 34  
Linde R. 33; 93  
Lindhauer M. G. 17  
Lindström M. 158  
Linina A. 81; 104  
Liorančas V. 95; 159  
Liutkevičius A. 75  
Lücke F.-K. 49  
Lukosiunaite G. 42  
Mačionienė I. 76  
Martinho C. A. C. 153  
Maruska A. 68  
Melngaile A. 52; 79  
Mert I. D. 90  
Mierina I. 40

## FOODBALT 2014

- Mieželienė A. 75  
Miķelsons V. 106  
Milliauskienė J. 119  
Mockeliūnas R. 125; 136  
Moreno I. J. 117  
Müller M. 57  
Muižniece-Brasava S. 35; 50; 141  
Muratova E. 60; 91  
Mūrniece I. 88; 103; 152  
Musayeva K. 124  
Nazarova V. 113  
Nguyen Q. H. 99  
Novičkovas A. 119  
Nuobariene L. 53  
Olšteine A. 73  
Onoğur T. A. 58; 123  
Orman Y. 150; 151  
Ötleş S. 87  
Özdestan Ö. 22; 58  
Ozola L. 44  
Ozolina V. 114  
Page L. 57  
Pataro G. 38  
Patetko A. 93; 94  
Paulovica R. 127; 134  
Pavilonis A. 125; 136  
Plančiūnienė R. 125; 136  
Povilaitis D. 133  
Priecina L. 131  
Pugajeva I. 79  
Pukalskas A. 130  
Pyanov D. 157  
Radenkovs V. 37  
Ragazinskiene O. 68  
Rakcejeva T. 36; 31; 35; 70;  
96; 97; 104  
Raudonė L. 59  
Raudonis R. 59; 121  
Raudoniūtė I. 130  
Raynaud C. 41  
Ribikauskas V. 160  
Riekstina-Dolge R. 135  
Rokaitytė A. 77  
Roseiro L. C. P. 46  
Rosin V. 57  
Rubinskienė M. 138  
Ruse K. 31  
Rutkaite R. 98  
Ruza A. 104  
Ruzaike A. 50  
Ružauskas M. 125; 136  
Šabovics M. 109; 126; 135  
Šaduikis A. 27  
Sahin S. 89; 90  
Sakalauskienė S. 119  
Šalaševičienė A. 111  
Šalomskienė J. 76  
Samuolienė G. 119  
Santos T. 105  
Šarkinas A. 84  
Šatkauskas S. 38  
Sausserde R. 110; 116  
Scherbaka R. 93  
Schreiber S. 49  
Sederevičius A. 124  
Segliņa D. 73; 137  
Seifert A. 57  
Seisonen S. 21  
Sekmokienė D. 92  
Semjonovs P. 33; 93; 94  
Senhofa S. 140  
Šeputis I. 95  
Sério S. A. 30  
Shalkevich M. 138  
Shatalov I. 54  
Shatalova A. 54  
Shleikin A. 54; 122  
Silina L. 97  
Siliņš I. 69  
Simon V. 41  
Simonavičienė I. 80  
Simoneliene A. 42  
Sirtautas R. 119  
Šiugždinienė R. 125; 136  
Skabeikyte E. 68  
Skrabule I. 103

## FOODBALT 2014

- Skrīvele M. 73  
Skrupskis I. 137  
Skudra L. 73; 97  
Skvortsova N. 122  
Slapkauskaite J. 92  
Smolikhina P. 60; 91  
Smolskaite L. 127; 134  
Speičienė V. 75; 145  
Starkutė R. 144  
Starr G. 24  
Steponavičienė A. 74  
Sterna V. 62; 63; 114; 128; 129  
Stimbirys A. 80  
Straumite E. 44; 126; 135; 140  
Strauta L. 35  
Strazdina V. 62; 63  
Strēle M. 40  
Struzeckiene A. 100  
Stuogė I. 160  
Sturmovica E. 112  
Šulniūtė V. 117  
Sumnu G. 89; 90  
Švirmickas G. 160  
Taal L. 132  
Talou T. 99; 127; 134; 154  
Tcoi D. 78  
Tokareva T. 48  
Tomsone L. 103; 107; 112; 127; 135  
Treciokiene E. 42  
Tuorila H. 18  
Turgut S. S. 82  
Unakitan G. 150; 151  
Ungure E. 141  
Upite D. 93  
Urbonavičienė D. 32; 138  
Vaičiulytė-Funk L. 111  
Vaivode A. 103  
Valciņa O. 52  
Vasiliauskienė N. 74  
Vaškevičiūtė L. 125; 136  
Vaštakaitė V. 119  
Vene K. 20; 21  
Venskutonis P. R. 19; 27; 51; 115;  
117; 130; 133  
Vicupe Z. 128; 129  
Vidmantienė D. 68; 149  
Vidžiūnaitė I. 98  
Vinauskiene R. 39  
Vinozzi A. 154  
Virgailis M. 125; 136  
Viršilė A. 119  
Viškėlis J. 121; 138  
Viškėlis P. 32; 38; 59; 121; 138  
Vojevodova A. 40  
Vucāne S. 102  
Vysniauskas G. 42  
Wagner C. 57  
Wagner S. 57  
Winkler L. 57  
Yalçin B. 87  
Yalçin E. 25  
Yilmaz E. 151  
Yilmaz I. 71; 72; 150  
Zaboraite J. 92  
Zaborskienė G. 77  
Zalatorius V. 144  
Zeberga S. 40  
Zeipiņa S. 61  
Zhao T. M. 99  
Žūka L. 118  
Žumbure L. 79  
Zungur A. 87  
Zute S. 128; 129