



Latvia University of Agriculture  
Faculty of Food Technology

# 6th Baltic Conference on Food Science and Technology

## “Innovations for Food Science and Production”

### **FOODBALT-2011**

#### Abstract Book

Jelgava  
May 5-6, 2011

# FOODBALT-2011

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**6th Baltic Conference on Food Science and Technology**  
**“Innovations for food science and production”**  
**FOODBALT-2011**

**Jelgava, Latvia May 5-6, 2011**  
**Programme**

**May 5, 2011**

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 Rivza, Dean of the Faculty of Food Technology Inga Ciprovica, Professor Petras Rimantas Venskutonis, ESF project leader Evita Straumite)

**Session I**

**Moderator: Inga Ciprovica**, Latvia University of Agriculture, Latvia

10<sup>15</sup>-10<sup>55</sup> **KEY LECTURE *Indrikis Muiznieks***, *Vice rector, Latvia University, Latvia* **GMO in food – real or imaginary threat?**

10<sup>55</sup>-11<sup>10</sup> **O1 – A. Novoslavskij**, H. Korkeala, M. Malakauskas *Prevalence and genetic diversity of enteropathogenic Yersinia in pigs and possible relations to farming factors in Lithuania*

11<sup>10</sup>-11<sup>25</sup> **O2 – V. Ozolina**, D. Kunkulberga, F. Dimins *Formation of 5-hydroxymethylfuraldehyde in Latvian whole meal rye bread during baking*

11<sup>25</sup>-11<sup>40</sup> **O3 – V. Kitryte**, A. Adams, R. Venskutonis, N. De Kimpe *Effect of the lipid oxidation-derived aldehydes on the antioxidant properties of the Maillard reaction products*

11<sup>40</sup>-11<sup>55</sup> **O4 – L. Smolskaite**, T. Talou, N. Fabre, R. Venskutonis *Valorization of saffron industry by-products: bioactive compounds from leaves*

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

# FOODBALT-2011

## Session II

**Moderator: Petras Rimantas Venskutonis**, Kaunas University of Technology, Lithuania

12<sup>45</sup>-13<sup>25</sup> **KEY LECTURE Huub Lelieveld**, *European Hygienic Engineering and Design Group (EHEDG)* **The design of factories to produce safe and wholesome food products**

13<sup>25</sup>-13<sup>40</sup> **O5 – N. Petrova**, Z. Gudieva, V. Hovhannisyan *Light beer formulation using buckwheat as an adjunct*

13<sup>40</sup>-13<sup>55</sup> **O6 – I. Beitane**, I. Ciprovica *The study of carbohydrates fermentation ability of B.lactis in milk*

13<sup>55</sup>-14<sup>10</sup> **O7 – D. Urbonaviciene**, E. Bartkiene, P. Viskelis, G. Juodeikiene, R. Tusiene *Possibilities to enrich meat products with lycopene from tomato*

14<sup>10</sup>-14<sup>25</sup> **O8 – A. Mikelsona**, I. Ciprovica *The study of attenuated starters in Holandes cheese ripening*

14<sup>25</sup>-14<sup>40</sup> **O9 – I. Mazuknaite**, D. Leskauskaite, R. Vinauskiene, S. Pukinskyte, R. Vinauskaite *Properties of whey protein edible films and their impact on the shelf life of Turkey meat*

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

## Session III

**Moderator: Thierry Talou**, Universite de Toulouse, France

15<sup>10</sup>-15<sup>25</sup> **O10 – I. Alsina**, G. Petrova, L. Dubova *The effect of colored plastic films on the yield quality of basil*

15<sup>25</sup>-15<sup>40</sup> **O11 – I. Kalnina**, S. Strautina, I. Krasnova, A. Olsteina *Correlation between organoleptic values and chemical composition of new strawberry cultivars*

15<sup>40</sup>-15<sup>55</sup> **O12 – D. Dobravalskyte**, T. Talou, R. Venskutonis *Activity of natural antioxidants extracted from greater calamint, sweet cicely and coltsfoot cultivated in Lithuania and in France*

## FOODBALT-2011

15<sup>55</sup>-16<sup>10</sup> **O13** – **P. Kraujalis**, R. Venskutonis, O. Ragažinskienė *Antioxidant activities and phenolic composition of extracts from Nepeta plant species*

16<sup>10</sup>-16<sup>25</sup> **O14** – **E. Malinauskyte**, D. Leskauskaite *Stability and digestibility of O/W emulsions stabilized by whey protein and carboxymethylcellulose*

16<sup>25</sup>-16<sup>40</sup> **O15** – **I. Gedrovica**, D. Karklina *Influence of Jerusalem artichoke powder on dough rheological properties*

16<sup>40</sup>-16<sup>55</sup> **O16** – **S. Dzene**, O. Yorulmaz *Consumer behaviour towards sustainable food consumption in Europe*

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

**May 6, 2011**

### Session IV

**Moderator: Huub Lelieveld**, European Hygienic Engineering and Design Group (EHEDG)

9<sup>00</sup>-9<sup>40</sup> **KEY LECTURE Johanna Buchert**, Vice President, VTT, Finland, Finland  
**Enzymes in food processing and by-product valorization**

9<sup>40</sup>-9<sup>55</sup> **O17** – **V. Kraujalyte**, R. Venskutonis, M. Andjelkovic, R. Verhe *Determination of volatiles, tocopherols and colour changes in aromatized oils with marjoram (*Origanum majorana*)*

9<sup>55</sup>-10<sup>10</sup> **O18** – **A. Ennigrou**, K. Hosni, H. Casabianca, E. Vulliet, S. Smiti *Leaf volatile oil constituents of Schinus terebinthifolius Raddi and Schinus molle L. from Tunisia*

10<sup>10</sup>-10<sup>25</sup> **O19** – **T. Talou**, C. El Kalamouni, D. Dobravalskyte, L. Smolskaite, C. Raynaud, R. Venskutonis *“From the field to the fork”: Development of headspace concentrators for native flavor analysis*

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

# FOODBALT-2011

## Session V

**Moderator: Tatjana Rakcejeva** Latvia University of Agriculture, Latvia

11<sup>00</sup>-11<sup>15</sup> **O20** – **K. Dorofejeva**, T. Rakcejeva, J. Kviesis, L. Skudra *Composition of vitamins and amino acid in Latvian cranberries*

11<sup>15</sup>-11<sup>30</sup> **O21** – R. Tandlich, **D. Smogrovicova**, K.-A. Frith, B. S. Wilhelmi, J. L. Limson *Chemical, microbiological and antioxidant properties of selected honey varieties from South Africa*

11<sup>30</sup>-11<sup>45</sup> **O22** – **D. Urbonaviciene**, E. Bartkiene, G. Juodeikiene, P. Viskelis, V. Luzaitė *Lycopene and  $\beta$ -carotene content of fermented tomato products*

11<sup>45</sup>-12<sup>00</sup> **O23** – **S. Muizniece-Brasava**, L. Dukalska, I. Kantike *Consumers knowledge and attitude to Traditional and environmentally friendly FOOD packaging materials in market of Latvia*

12<sup>00</sup>-12<sup>10</sup> ESF project “Formation of the Research Group in Food Science”

12<sup>10</sup>-13<sup>00</sup> **LUNCH**

## Session VI

**Moderator: Ruta Galoburda** Latvia University of Agriculture, Latvia

13<sup>00</sup>-13<sup>40</sup> **KEY LECTURE Louisa Page**, *Sensory Laboratory, University of Applied Sciences Fulda, Germany* **New developments in Sensory Science**

13<sup>40</sup>-13<sup>55</sup> **O24** – E. Bartkiene, **E. Drungilas**, G. Juodeikiene *The use of *Lactobacillus sakei* in yoghurt production*

13<sup>55</sup>-14<sup>10</sup> **O25** – E. Bartkiene, **A. Sanikovas**, G. Juodeikiene *The use of *Pediococcus acidilactici* in yoghurt production*

14<sup>10</sup>-14<sup>25</sup> **O26** – K. Juhnevica, S. Ruisa, **D. Seglina**, I. Krasnova *Evaluation of sour cherry cultivars grown in Latvia for production of candied fruits*

14<sup>25</sup>-14<sup>40</sup> **O27** – **E. Berna**, S. Kampuse, L. Dukalska, I. Murniece, *The chemical and physical properties of sweet rowanberries in powder sugar*

14<sup>40</sup>-15<sup>00</sup> **CLOSING OF CONFERENCE**

# FOODBALT-2011

## Poster Programme

May 5–6, 2011

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Poster No.	Author, Title of Poster
<i>Food chain management (raw materials, logistics, consumers, economics, information systems, etc.)</i>	
P1	I. Skudra, A. Linina <b>The influence of meteorological conditions and nitrogen fertilizer on winter wheat grain yield and quality</b>
P2	I. Skudra, D. Kunkulberga, A. Linina <b>Baking quality of winter wheat grain varieties</b>
P3	A. Linina <b>Influence of agroecological conditions on winter wheat grain protein content</b>
P4	A. Pogulis <b>Buckwheat grain quality indices</b>
P5	H. G. M. Geweife, A. H. Bassiouny <b>Improving bread wheat productivity in newly reclaimed sandy soil in Egypt</b>
P6	V. Kalvaityte, L. Basinskiene, G. Juodeikiene, J. Ceseviciene <b>Comparison of the enzyme activity of different cereals grown using organic and conventional agricultural practices</b>
P7	M. Sabovics, E. Straumite, R. Galoburda <b>Assessment of the rheological properties of flour using the Mixolab</b>
P8	M. Duma, I. Alsina, L. Dubova, L. Stroksa, Z. Smiltina <b>The effect of sodium selenite and selenate on the quality of leaf vegetables</b>
P9	J. Zagorska, I. Eihvalde, I. Gramatina, S. Sarvi <b>Evaluation of colostrum quality and new possibilities for its application</b>
p10	U. Antone, V. Sterna, J. Zagorska <b>Potential to increase the stability of milk riboflavin against photo-oxidative degradation</b>
P11	A. Eglite <b>Dairy consumption and production trends</b>
P12	T. Talou, B. Pichetto, J. Massip <b>“Chromagustology concept”: Application for designing 27 European flags with local food</b>

# FOODBALT-2011

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<b>Poster No.</b>	<b>Author, Title of Poster</b>
<b><i>New product development and innovation in food processing</i></b>	
P13	M. Kobakhidze, N. Seididshvili <b>Granular green tea</b>
P14	S. Boca, J. Predajs, U. Gross, I. Skrupskis <b>Quality investigation of whipped redcurrant and blackcurrant mass</b>
P15	R. Bobinaite, P. Viskelis, P. R. Venskutonis <b>Enrichment of fruit puree with raspberry marc extract bioactive constituents</b>
P16	S. M. Banu, P. H. Hemaprabha, P. J. Lovelin, P. Sudha, Sreelakshmi, A. Reni, P. Suganya, Ramani <b>Incorporation of mushroom powder in extruded products</b>
P17	S. M. Banu, P. H. Hemaprabha, P. J. Lovelin, P. Sudha, Sreelakshmi, A. Reni, P. Suganya, Ramani <b>Value addition of processed mushroom by extrusion technique</b>
P18	A. Shleikin, G. Ternovskoy, N. Danilov <b>Enzyme technologies development in food industry</b>
P19	E. Bartkiene, E. Zokaityte, G. Juodeikiene, L. Basinskiene <b>The using of enzymes for wheat bread quality and safety</b>
P20	L. Ozola, E. Straumite, D. Klava <b>Extruded corn flour effect on the quality of gluten-free bread</b>
P21	M. Kronberga, D. Karklina, I. Murniece, Z. Kruma <b>Changes of agar-agar gel properties after replacing sucrose by inulin syrup</b>
P22	T. Makaravicius, L. Basinskiene, G. Juodeikiene, M. Tenkanen <b>Non-alcoholic cereal-based beverages with increased oligosaccharides content</b>
<b><i>Sustainable products and processes</i></b>	
P23	S. Orehova, U. Nechiporenko, I. Vasilieva, A. Nechiporenko <b>Electronic spectrum of pork and beef muscle tissue surface samples subjected to electronic-irradiation processing</b>
P24	B. Gingule, M. Rucins, V. Rozenbergs <b>Blast chilling method for meat dishes cooking</b>



## FOODBALT-2011

<b>Poster No.</b>	<b>Author, Title of Poster</b>
P25	A. Pastukhov, V. Danin <b>Model development for fresh baked bread natural and forced cooling</b>
P26	R. Riekstina-Dolge, Z. Kruma, R. Galoburda, D. Karklina, D. Seglina <b>Effect of pasteurization on the quality of fermented apple juice</b>
<b><i>Food chemistry, analysis and quality assessment</i></b>	
P27	A. Dandena, I. Leimane <b>Validation of monomeric anthocianin determination method for blueberry juice and pomace extracts</b>
P28	I. Mierina, R. Serzane, M. Strele, J. Moskaluka, D. Seglina, M. Jure <b>Extracts of Japanese quince seeds – potential source of antioxidants</b>
P29	D. Seglina, I. Krasnova, J. Kviesis, L. Ikase <b>The content of polyphenols and tannins of several apple cider varieties grown in Latvia</b>
P30	K. Jonusaite, J. Damasius, P. R. Venskutonis <b>Chemical changes of spice antioxidants during thermal treatment</b>
P31	R. Baranauskiene, P. R. Venskutonis, E. Dambrauskiene, P. Viskelis <b>Influence of harvesting time on the yield and chemical composition of Lithuanian sage (<i>Salvia officinalis</i>)</b>
P32	R. Kazernaviciute, R. Baranauskiene, R. Mazdzieriene, P. R. Venskutonis <b>Essential oil, phenolic compounds and antioxidant activity of Lithuanian cultivated <i>Tanacetum vulgare</i> L.</b>
P33	V. Kreicbergs, F. Dimins, V. Mikelsons, I. Cinkmanis <b>Biologically active compounds in roasted coffee</b>
P34	M. Kuka, I. Cakste <b>Bioactive compounds of Latvian wild edible mushroom <i>Boletus edulis</i></b>
P35	I. Dabina–Bicka, D. Karklina, Z. Kruma <b>Polyphenols and vitamin E as potential antioxidants in barley and malt</b>

# FOODBALT-2011

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Poster No.	Author, Title of Poster
P36	Z. Sabouri, M. Barzegar Bafroei, M. A. Sahari <b><i>Echinacea purpurea</i> extract as a natural preservative in cake</b>
P37	Z. Kruma, T. Talou <b>Characterization of vinegar aroma compounds: comparison of extraction parameters</b>

## ***Food quality and safety***

P38	V. Lioranca, J. Andriejauskiene <b>Amounts of heavy metals in Baltic cod meat</b>
P39	R. Vaitukaityte, G. Januskeviciene, E. Bartkiene, G. Juodeikiene, D. Vidmantiene <b>Deformation diseases of extremities of Turkeys effecting meat quality</b>
P40	J. Buneviciene, E. Kudirkiene, S. Ramonaite, M. Malakauskas <b>Occurrence, numbers and genetic diversity of <i>Campylobacter</i> spp. in retail broiler meat in Lithuania</b>
P41	M. Terentjeva, A. Berzins <b>Prevalence of <i>Yersinia enterocolitica</i> in the environment of slaughterhouse</b>
P42	S. Orehova, U. Nechiporenko, I. Vasilieva, A. Nechiporenko <b>Ethanol effect on the radiolysis of pork tissue</b>
P43	I. Silins, E. Liepins <b>The microbiological quality and physiochemical parameters of cold-smoked sausages during ripening</b>
P44	A. Savickaite, G. Juodeikiene, A. Hansen <b>Screening of Lactic acid bacteria isolated from Danish bread sourdoughs for phytase activity</b>
P45	E. Bartkiene, V. Krungleviciute, T. Rekstyte, G. Juodeikiene, G. Zaborskiene, L. Basinskiene <b>Safety aspects of fermented plant products</b>
P46	D. Eidukonyte, G. Juodeikiene, A. Hansen, L. Nuobariene, F. Vogensen <b>Phytase activity of lactic acid bacteria strains, isolated from Lithuanian sourdoughs</b>

# FOODBALT-2011

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<b>Poster No.</b>	<b>Author, Title of Poster</b>
P47	A. Degutyte, M. Ugintaite, D. Gruzdiene <b>The properties of WHeAt germ and camelina (<i>Camelina sativa</i>) oils, obtained from the Grain and seeds of plants, grown in Lithuania</b>
P48	D. Kunkulberga, E. Murniece <b>Salt levels in bread in Latvia</b>
P49	E. Bartkiene, R. Sikorskyte, G. Juodeikiene <b>Fusel compounds formation in various types of beer</b>
P50	I. Krasnova, D. Karklina, D. Seglina, K. Juhnevica, I. Gailite <b>Effect of different combinations of anti-browning substances on fresh-cut pear slice quality</b>
P51	P. Viskelis, M. Rubinskiene, V. Cesnauskas <b>Quality of various fresh and dried plum cultivar fruits</b>
P52	M. Stankeviciene, J. Buskeviciute, R. Krungleviciene <b>Food safety control Alytus county food processing facilities in 2009</b>
<b><i>Food packaging and storage</i></b>	
P53	S. Muizniece-Brasava, L. Dukalska, I. Murniece, S. Sarvi, I. Dabina- Bicka, E. Kozlinskis <b>Influence of active packaging on the shelf life of soft cheese <i>Kleo</i></b>
P54	E. Ahmadi, M. H. Azizi <b>Effect of ultrasound treatment, thickness and glycerol content on some of methylcellulose films properties and application of optimized film on baguette bread</b>
<b><i>Nutrition and Health</i></b>	
P55	I. Kim, J.-Y. Kim, Y.-J. Hwang, K.-A. Hwang, A.-S. Om, J.-H. Kim, K.-J. Cho <b>Anti-obesity and hypolipidemic effects of aged black garlic in rats fed high-fat diet</b>
P56	G. Ternovskoy <b>Development of technologies for the bakery production of medical-prophylactic purpose</b>
P57	A. Blija, G. Skudra, I. Skrupskis, G. Kaufmane <b>Possibilities to use biological products for children nutrition</b>

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# FOODBALT-2011

Dear participants,

On behalf of Faculty of Food Technology of Latvia University of Agriculture it's my pleasure to welcome you to 6<sup>th</sup> Baltic Conference on Food Science and Technology FOODBALT-2011 "Innovations for Food Science and Production".

The theme – *Innovations for food science and production* – ensures that food researchers, Master and Doctor level students and visitors have opportunity to examine and to discuss relevant and current topics. This Conference gives us all the opportunity to share ideas and to continue to improve the way we do the research in food science.

The Conference Organising Committee has created a programme including 4 key note speeches, 27 oral presentations during 6 sessions and poster sessions. We trust you will find the programme informative, stimulating and an opportunity to create new ideas.

I would like to express my very sincere and personal thanks to the Organising Committee for their hard work and administrative support so necessary to make 6<sup>th</sup> Baltic Conference on Food Science and Technology a great success. In addition I would like to thank all of my colleagues who were involved in the review of papers, again without whom, the review process would have been an absolute impossible. I also wish to thank the ESF project "Formation of the Research Group in Food Science" for financial support of Conference organisation.

I welcome you to Conference and I hope that everything will meet or exceed your expectations and you will enjoy your stay at Jelgava.

Inga Ciprovica

Dean of Faculty of Food Technology

# ORAL PRESENTATIONS

## PREVALENCE AND GENETIC DIVERSITY OF ENTEROPATHOGENIC YERSINIA IN PIGS AND POSSIBLE RELATIONS TO FARMING FACTORS IN LITHUANIA

**Aleksandr Novoslavskij<sup>a</sup>, Hannu Korkeala<sup>b</sup>, Mindaugas Malakauskas<sup>a</sup>**

<sup>a</sup>Department of Food Safety and Animal Hygiene, Faculty of Veterinary Medicine, Veterinary Academy, Lithuanian University of Health Sciences (Kaunas, Lithuania)

<sup>b</sup>Department of Food Hygiene and Environmental Health, Faculty of Veterinary Medicine, University of Helsinki (Helsinki, Finland)

Yersiniosis is one of the three most prevalent foodborne zoonoses in humans in Lithuania and the incidence of 15.9 per 100 000 population was one of the biggest among EU in 2008.

The objective of the study was to determine the prevalence and genetic diversity of enteropathogenic *Yersinia* in pigs at farms and slaughter in relation to farming factors in Lithuania. Altogether 300 of pig fecal, carcass swab and farm environmental samples were tested for presence of *Yersinia* spp. *Yersinia* isolates were biotyped, identified by multiplex PCR, serotyped and genotyped with PFGE including some *Yersinia* spp. isolates from human clinical cases.

Pathogenic *Y. enterocolitica* was found in 64% and *Y. pseudotuberculosis* in 45% of sampled pig farms. *Y. enterocolitica* was more prevalent in carcass swab samples (25%) in comparison to fecal samples collected at slaughterhouses (18%). *Y. pseudotuberculosis* was found in 4% of carcass and 10% of fecal samples collected at slaughterhouses and in 9% of fecal samples collected at farms. All obtained *Y. enterocolitica* and *Y. pseudotuberculosis* isolates belonged to bioserotype 4/O:3 and 2/O:3, respectively. Low biosecurity level and one site production system were found associated with a high prevalence of *Y. enterocolitica* and *Y. pseudotuberculosis* on farms, respectively. Dominant *Y. enterocolitica* genotype found in pigs was identical to genotype of *Y. enterocolitica* found in 9 out of 19 human clinical samples.

The study shows that some farming factors affect prevalence and genetic diversity of enteropathogenic *Yersinia* spp. in pig herds. Moreover, high number of contaminated pig carcasses could be one of the main sources of human yersiniosis in Lithuania.

**Keywords:** *Y. enterocolitica*, *Y. pseudotuberculosis*, pig, PCR, PFGE.

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## FORMATION OF 5-HYDROXYMETHYLFURFURALDEHYDE IN LATVIAN WHOLE MEAL RYE BREAD DURING BAKING

**Vija Ozolina<sup>a</sup>, Daiga Kunkulberga<sup>a</sup>, Fredijs Dimiņš<sup>b</sup>**

<sup>a</sup>Department of Food Technology, <sup>b</sup>Department of Chemistry, Latvia University of Agriculture (Jelgava, Latvia)

During the baking heat exchange process, various chemical transformations take place and form new chemical compounds, and result is the final product-bread. Furans are some of these volatile aromatic compounds. They are formed in the heat exchange processes of food production- baking, heating, roasting. One of these compounds is 5-hydroxy-methylfurfuraldehyde (HMF), which is widely distributed in food products such as bread, coffee, honey, milk products, meat, fish, beer and others. Aromatic volatile compounds endow rye bread with its characteristic aroma and taste. The formation of furan and its derivatives in food products is not clearly understood.

In 2004, the Europe Food Safety Authority started to collect data from EU member states of HMF content in food products. There is no such information available on Latvian Foodstuffs. Specifically, in Latvia, there have been no investigations on HMF formation in rye bread during bake processing to date.

The aim of study was to investigate the dynamic of HMF formation in whole meal rye bread crumb and crust, depending on baking time. The bread was produced in a Latvian commercial bakery.

The content of HMF in whole meal rye bread was determined by using liquid chromatography.

The study showed that Latvian whole meal rye bread at the optimal baking time of 60 minutes contains 320.6 mg kg<sup>-1</sup> HMF. Its content in rye bread crumb reached 22 mg kg<sup>-1</sup>, which is substantially different from the HMF content of bread crust. During the prolonged baking time, the rate of HMF formation increased significantly.

**Keywords:** furan, HMF, rye bread, baking.

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## EFFECT OF THE LIPID OXIDATION-DERIVED ALDEHYDES ON THE ANTIOXIDANT PROPERTIES OF THE MAILLARD REACTION PRODUCTS

**Vaida Kitrytė<sup>a,b</sup>, An Adams<sup>b</sup>, Petras Rimantas Venskutonis<sup>a</sup>, Norbert De Kimpe<sup>b</sup>**

<sup>a</sup>Department of Food Technology, Faculty of Chemical Technology, Kaunas University of Technology (Kaunas, Lithuania)

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The presence of lipid oxidation products in the classical Maillard reaction pathway and vice versa is of particular interest nowadays. Due to the parallel modifications in food colour and flavour, it is expected that the course of both reactions can be modified by the reactants, intermediates and products of the other. Recently, low molecular weight intermediates and final polymeric products from such interactions are reported to comprise a significant part of water-soluble and nonsoluble dietary antioxidant compounds and influence the oxidative stability of thermally processed foods, whether animal or vegetable in origin. Since the safety of many commercially used antioxidants is currently being questioned, Maillard-derived antioxidants are promising in the search for natural food constituents with antioxidant properties.

Melanoidin-like water-soluble reaction products were isolated from model reactions of amino acids (glycine, L(+)-lysine, L(+)-arginine), lipid oxidation products (hexanal, (2E)-hexenal) with or without D(+)-glucose or L(+)-ascorbic acid, under water-free reaction conditions (125 °C for 120 min). Radical scavenging and ferric ion reducing properties of model reaction products before and after dialysis, unheated amino acid/carbonyl compound mixtures, and initial reactants were measured employing the DPPH and FRAP assays. The results obtained were used to evaluate the effect of the lipid oxidation products used on the antioxidant properties of model melanoidins. UV-visible absorbance spectra ( $\lambda = 200\text{--}800$  nm) and values of three colour components ( $L^*$ ,  $a^*$ , and  $b^*$ ) were measured to correlate the development of browning achieved with the antioxidant activity of model reaction products tested.

**Keywords:** Antioxidant activity; Maillard reaction; Lipid oxidation.

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## VALORIZATION OF SAFFRON INDUSTRY BY-PRODUCTS: BIOACTIVE COMPOUNDS FROM LEAVES

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Interest in the development of bioprocesses for the production or extraction of bioactive compounds from natural sources has increased in recent years due to the potential applications of such compounds in food, chemical, and pharmaceutical industries. Plants produce a wide variety of bioactive compounds with significant applications in the health and food areas. In fact, plants are considered to be excellent sources of phenolic compounds with very interesting nutritional and therapeutic applications. *Saffron Crocus sativus* L., is one of the most expensive spice in the world. Obtention of 1 kg of spice from saffron stigmas generates 150 000 blooms and 1 500 kg of leaves, which are presently both considered as waste. But due to the biologically valuable compounds like flavonoids, antioxidants which could be extracted in blossom and leaves of crocus species and could potentially used as functional components for food products and diet supplement.

Analysis were performed on dried leaves of *C. Sativus* collected in different parts of the world, regions and provinces in the framework of the European Program CROCUSBANK. Samples of *C. Sativus* were extracted with a in-house developed micro-extraction technique and extracts analyzed by HPLC-UV, HPLC-MS and spectrophotometry. 8 flavonoids were identified and titrated in *C. sativus* leaves from which 2 (kaempferol-8-C-gluco-6,3-O-diglucoside and kaempferol-8-C-gluco-6-O-glucose) were reported for the first time in saffron. Comparison of flavonoids and antioxidants from samples harvested in different countries states that flavonoid concentrations vary independently of origin, while different cultivation conditions or different picking periods seemed to greatly influence.

**Keywords:** *Crocus sativus*, by-products valorization, bioactive compounds, HPLC-MS.

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### LIGHT BEER FORMULATION USING BUCKWHEAT AS AN ADJUNCT

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Beer has a rather rich chemical composition, including essential microelements and vitamins. In specialty beers the antioxidants' content is known to be more, than in several juices or other products. One can change their quantity using different adjuncts, containing a lot of natural antioxidants.

Today information about using buckwheat as an adjunct has appeared. It has specific chemical composition providing nutritive and biologic value. Buckwheat includes vitamins, minerals, contains malic, oxalic and citric acids. It should be mentioned, that buckwheat contains a rather small percentage of gluten, which is harmful to people with celiac disease, who are gluten-intolerant, and increases the mash lautering time in brewing.

The present work aims at formulating the recipe and the production method of a new sort with improved consumer's properties, namely the improvement of mineral composition, the antioxidants content increase and the gluten percentage reduction. The effect of buckwheat on aroma and flavour of beer must be appreciated, too.

To determine the wort and the finished product qualitative characteristics brewing accepted techniques have been used. The antioxidants' content was determined by coulometric titration with electrogenerated bromine.

Based on researches the following conclusions have been made:

- comparative analyses of pilot wort sample obtained by decoction mashing process using different concentrations of buckwheat as an adjunct (10, 15, 20%) allowed us to chose an optimal one equal to 15%;
- buckwheat usage results in pH and attenuation limit increase as compared with buckwheat-free beer;
- aroma and flavor changes were not substantial;
- antioxidant content has increased 1, 2 times.

**Keywords:** beer, buckwheat, antioxidant.

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## THE STUDY OF CARBOHYDRATES FERMENTATION ABILITY OF *B.LACTIS* IN MILK

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The ability of *Bifidobacterium lactis* (Bb-12) to hydrolyse lactose, lactulose and inulin was studied during milk fermentation. For this purpose, the content of lactose, lactulose and inulin was determined before and after fermentation of milk samples. Pasteurized milk, freeze-dried culture Bb-12 (Chr. Hansen, Denmark), inulin - RAFTILINE®HP (ORAFI, Belgium) with polymerization degree  $\geq 5$  and degree of purity 99,5%, syrup of lactulose (Duphalac®, the Netherland) were used for experiments. The different concentrations (1; 2; 3; 4 and 5%) of lactulose and inulin were used for studying of *B.lactis* ability to assimilate of milk sugar and prebiotics during fermentation. The fermentation process of milk samples enriched with lactulose or inulin was produced at 37 °C for 16 hours. The content of lactose and lactulose was determined by IDF standard 147B:1998, the content of inulin by AOAC Official Method 999.03 and by AACC Official Method 32.32. Results showed that bifidobacteria poorly assimilate lactose presence of prebiotics in milk. The lactose assimilation decreases together with increase of added prebiotics concentration in milk. However bifidobacteria are able to hydrolyse up to 50% of lactulose in the product, except samples with 5% of lactulose. There was a decrease of lactulose by 2/3. The changes of lactulose content are significant ( $p < 0.05$ ). Consequently *B.lactis* possesses ability to assimilate lactulose. Inulin assimilation degree in fermented milk samples was low (10-20%), because it depends on the inulin polymerization degree and the degree of purity. The inulin assimilation decreases together with the increase of inulin polymerization degree and the degree of purity. The obtained results confirm that most suitable substrate for growing of bifidobacteria in milk is lactulose at any analyzed concentration.

**Keywords:** bifidobacteria, prebiotics, lactose, fermented milk.

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## POSSIBILITIES TO ENRICH MEAT PRODUCTS WITH LYCOPENE FROM TOMATO

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In recent years there are demands of healthy meat products with functional value. Meat colour is one of the important attribute for minced meat products quality. The naturally occurring meat colourants are an alternative to nitrite. Tomato and tomato products are rich in natural colorant lycopene. Also lycopene is the antioxidant.

The aim of this study was to evaluate the impact of fermented tomato powder with *Pediococcus pentosaceus* MI807 and *Lactobacillus sakei* on the noisettes colour and carotenoids amount. Noisettes were formulated with fermented tomato powder at 10% and 30% levels in basic formula. Total lycopene and  $\beta$ -carotene content was identified using spectrophotometric method. Lycopene isomers were identified using high pressure liquid chromatography method with an UV detector.

Results of the study show that the noisettes with 10% and 30% fermented tomato powder had significantly ( $p < 0.05$ ) lower values for lightness and hue but values for redness, yellowness and chroma were significantly ( $p < 0.05$ ) higher than noisettes without fermented tomato powder. These products have improved red colour and are more attractive to consumers than the control noisettes. The total lycopene and  $\beta$ -carotene content ( $1.467 \text{ mg } 100 \text{ g}^{-1}$  and  $7.318 \text{ mg } 100 \text{ g}^{-1}$  respectively) was highest in noisettes with *Lactobacillus sakei* at 30% levels at basic formula fermented tomato powder, but the significant differences between *Pediococcus pentosaceus* MI807 and *Lactobacillus sakei* not found. The noisettes with added fermented tomato powder could also be a source of lycopene which acts as a functional additive in human diet.

**Keywords:** fermentation, tomato, lycopene,  $\beta$ -carotene, meat.

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## THE STUDY OF ATTENUATED STARTERS IN HOLANDES CHEESE RIPENING

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Ripening is a slow, and consequently an expensive process. Acceleration of cheese ripening has received considerable attention in the scientific literature (Fox et al., 1996, El Soda et al., 2003, Wilkinson, 1993, Upadhyay and McSweeney, 2003). Certain approaches have been used to accelerate the ripening of cheese, including the use of an elevated ripening temperature, addition of attenuated starters, and use of adjunct cultures.

The aim of the paper is to investigate the role of attenuated starter to formation of Holandes cheese sensory properties.

Holandes cheeses (Edam type cheese) from one manufacturer with/without attenuated starter culture were chosen for experiments. Cheese samples were ripened for 60 days at 6 °C and 12 °C. Cheeses were analyzed during ripening (60 days) for chemical (aroma compounds), physical ( $a_w$ , pH and elasticity) and microbiological (colony forming units of lactic acid bacteria) composition. Mesophilic lactic acid bacteria were enumerated on MRS agar at 37 °C 72 h. Volatiles were detected using solid phase GC/MS, the extraction of components was carried out using of 75 µm CAR-PDMS fibre. pH,  $a_w$  and elasticity of cheese samples were measured using appropriate standards procedures.

Attenuated starter has impact on the sensory properties of Holandes cheese. The starter intensifies the flavour of cheese and accelerates proteolysis without necessarily reducing of ripening time. Modification of the ripening temperature influences the rate of flavour and structure development in Holandes cheeses. In spite of attenuated starter the slow development of flavour are observed in cheeses ripened at 6 °C.

Attenuated starter accelerates ripening, intensifies flavour and controls the growing of non starter lactic acid bacteria in Holandes cheese.

**Keywords:** Holandes cheese, attenuated starter, aroma compounds, ripening conditions

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## PROPERTIES OF WHEY PROTEIN EDIBLE FILMS AND THEIR IMPACT ON THE SHELF LIFE OF TURKEY MEAT

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A study on edible whey protein films made from whey protein isolate and plasticizers (glycerol and sorbitol) is presented. Transparent and flexible films were made from whey protein gels produced under different heating conditions, mixed with different plasticizers and dried afterwards. Whey proteins gels were characterized by measuring particle size and viscoelastic properties of gels (prepared at different heating conditions). The mechanical properties and water vapour permeability (WVP) of films were studied and the dependency of different thermal treatment on the films properties was estimated. Results showed that a higher temperature treatment caused a higher elasticity of the films due to different protein molecular structures. However, the water vapour permeability of films made from whey proteins treated at higher temperatures increased as well. Later, a protective effect of whey protein film on the fresh turkey meat was analyzed. Changes in pH, moisture, and in free volatile fatty acids (FVFA) content were measured in the meat during two days storage at room temperature. Results showed that the whey protein film slowed down the meat spoilage processes with regard to pH and FVFA as compared with the control samples. However, weak WVP resistance of whey protein film was found in this experiment due to the lost moisture content in the samples, which was higher than in the control one.

**Keywords:** whey proteins, temperature influence, edible films properties, water vapour permeability, meat freshness.

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## THE EFFECT OF COLORED PLASTIC FILMS ON THE YIELD QUALITY OF BASIL

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Experiments were carried out to investigate the effect of colored plastic films on the growth, yield formation and yield quality of green and red basil. Red, yellow and blue colored polyethylene plastic films were used. Control was colorless polyethylene film. The transparency of films during vegetation period was detected at the wave length 400–700 nm (photosynthetically active radiation). During vegetation period plastic film transparency and the ratio between red and blue spectrum was changed. Green basil variety 'Large Basil' and red basil variety 'Dark Opal' was used for experiments

Plants were grown in vegetation pots placed in greenhouse covered with plastic film of different color. Plant length, number of leaves and leaves pigment content was determined during plant growth. Chlorophylls and carotenoides content was determined spectrophotometrically in the ethanol extract of plant leaves and fruits. Anthocyanins in the 0.1 M HCl solution. Experiments showed the influence of plastic film color on pigment content in plant leaves. The increase of chlorophyll content as effect of blue and yellow plastic film was observed in the leaves of red basil. Yellow plastic film stimulated accumulation of carotenoides the leaves of both varieties. Increased content of anthocyanins was observed as result of red basil growth under red and blue film. No effect of plastic film color on number of leaves was observed.

**Keywords:** basil, chlorophyll, carotenoides, anthocyanins, plastic films.

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## CORRELATION BETWEEN ORGANOLEPTIC VALUES AND CHEMICAL COMPOSITION OF NEW STRAWBERRY CULTIVARS

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The aim of this research was to test how organoleptic values correlate with the chemical composition. The trial was established at the end of May 2009 and lasted. Ten new cultivars of strawberries – ‘Sonata’, ‘Elegance’, ‘Antea’, ‘Lucy’, ‘Zumba’, ‘Figaro’, ‘Fenella’, ‘Galiaciv’, ‘Dange’, L181, were tested for the suitability to our climate. Strawberries are grown in the open field conditions in sandy loam soil with drip irrigation. Berry organoleptic characteristics - appearance, color uniformity, flavor, acidity, sweetness and chemical composition - soluble solids (%) and acid (%) were evaluated. Dry weight to acid ratio and berry density ( $\text{kg cm}^{-2}$ ) was determined.

The cultivars ‘Sonata’, ‘Figaro’ and ‘Galiaciv’ had the better flavor than the others. The cultivars ‘Elegance’, ‘Antea’, ‘Lucy’ had denser berries, but the cultivars ‘Dange’, ‘Fenella’ and ‘Sonata’ – softer berries. Higher acid content was found in the berries of the cultivars ‘Dange’ and L181, but lower – in the berries of ‘Lucy’ and ‘Antea’.

More homogeneous color uniformity was observed for the cultivars with denser berries ‘Elegance’, ‘Antea’ ( $r=0.6$ ), but acid content lower ( $r=-0.6$ ), and flavor worse ( $r=-0.6$ ). The cultivars with higher acidity (‘Zumba’, ‘Fenella’ and ‘Lucy’) were found as more attractive, however their taste was worse. The cultivars with higher sweetness ( $r=0.7$ ) and less acidity were evaluated as more tasty.

**Keywords:** strawberry, soluble solids, acid, density, organoleptic characteristics.

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## ACTIVITY OF NATURAL ANTIOXIDANTS EXTRACTED FROM GREATER CALAMINT, SWEET CICELY AND COLTSFOOT CULTIVATED IN LITHUANIA AND IN FRANCE

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Agricultural and industrial residues/by-products obtained during processing of raw plants represent potential natural sources for antioxidants that are rarely exploited (wastes could be represent up to 99.5% of the raw material). Taking into account this situation our aims are analysing and evaluating such by-products as possible sources for food antioxidants. The residues obtained after hydrodistillation of three aromatic plants (*Calamintha grandiflora*, *Myrrhis odorata* and *Tussilago farfara*) were separated into solid and liquid fractions. The liquid fraction was dried while the solid fraction was extracted with acetone, methanol or ethanol. Two main types of antioxidant activity tests were employed: i) assays to evaluate oxidation of fats, oils and other fat containing foods (Oxipress); ii) assays to evaluate radical scavenging activity in model systems (DPPH, ABTS, FRAP). The antioxidant activities were expressed as gallic acid equivalents (GAE) to standardize these methods and to allow data comparisons. The three antioxidant assay methods give different antioxidant activity trends. An initial screening of acetone extracts from the three aromatic plants for antioxidant activity in oil reported them as the best. Despite hydrodistillation residues presented strong antioxidant activities, the total phenolics content in acetone extracts was about twice lower than in sage, and lower than in some other herbs having lower antioxidant activities. These results showed that the content of total phenolics in herbs is not the single reliable indicator for evaluation of their antioxidant activity. The structures of the individual constituents need to be elucidated and assessed in order to obtain more precise results.

**Keywords:** Aromatic plants, antioxidant activity, by-products valorization.

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**ANTIOXIDANT ACTIVITIES AND PHENOLIC COMPOSITION  
OF EXTRACTS FROM *NEPETA* PLANT SPECIES****Paulius Kraujalis<sup>a</sup>, Petras Rimantas Venskutonis<sup>a</sup>, Ona Ragažinskienė<sup>b</sup>**<sup>a</sup>Kaunas University of Technology, Department of Food Technology (Kaunas, Lithuania)<sup>b</sup>Kaunas Botanical Garden of Vytautas Magnus University (Kaunas, Lithuania)

Catnips are perennial flowering plants, which have been used as aromatic herbs and for some other purposes. They belong to the genus *Nepeta*, a member of the Mint family, Lamiaceae, comprising about 250 species, which are native in Asia, North Africa and Europe; it is most abundant in the Mediterranean region. Catnip leaves possess pleasant minty or lemony scent which depends on the plant species and variety. Some common species of *Nepeta* genus are *Nepeta cataria* (field balm, true, catnip, catmint), *Nepeta cataria* var. *citriodora* (lemon catnip) and *Nepeta cataria* var. *transcaucasica*. The plant is also interesting because of its behavioral effects on cats; its essential oil is a repellent against insects. Some positive effects on human health of plant preparations were reported as well. The main compound in the plant oil is a terpenoid nepetalactone which may cause hallucinogenic effect for animals. Other constituents include acetic acid,  $\alpha$  and  $\beta$ -nepetalactones, citral, geraniol, dipentene, citronellol, nerol, butyric acid, valeric acid and tannins. The aim of this study was to determine the content of polyphenolics and evaluate the antioxidant activity of the three different *N. cataria* plants using different polarity solvents for their extraction, namely acetone, methanol, ethanol and water. The sub-fractions isolated from the plant material were analysed by HPLC-MS and total phenolic content assay methods; the major phenolic acids were separated and quantitative determined. The antioxidant properties were assessed using free DPPH radical scavenging assay, accelerated oil stability test and peroxide value measurement. Antioxidant activities of the analysed herb extracts were greatly dependent on the extraction solvent. Methanolic extract of *N. cataria* exhibited significantly higher antioxidant capacity comparing to other extracts. Rosmarinic acid was the major component in all extracts, luteolin, caffeic and gallic acids were other constituents found in *N. cataria*, however in considerably lower amounts.

**Keywords:** *Nepeta* plants, antioxidant activity, phenolicsFor further information please contact: [polijus@gmail.com](mailto:polijus@gmail.com)

## STABILITY AND DIGESTIBILITY OF O/W EMULSIONS STABILIZED BY WHEY PROTEIN AND CARBOXYMETHYLCELLULOSE

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Whey proteins are well known to facilitate emulsions formation and improve their stability by reducing the interfacial tension and by forming a protective membrane around fat droplets. Hydrocolloids are often added to the oil-in-water emulsions to create a desirable texture and to stabilize emulsion droplets against gravitational separation. One of the aims of this study was to compare the influence of different technological parameters, such as concentration of carboxymethylcellulose, method of emulsions manufacture and pH, on the properties of O/W emulsions stabilized by whey proteins. The digestibility of O/W emulsions was also in the field of interest of this study. It is well known that hydrocolloids can be used to reduce protein digestibility by modifying bioavailability of amino acids. Food emulsions increasingly are seen as a tool by which lipid uptake may be controlled.

The emulsions were characterized by creaming stability, apparent viscosity, flow behavior and emulsifying activity. The composition and apparent viscosity of serum layer was used to evaluate the proportion of free non-adsorbed proteins and carboxy-methylcellulose. Emulsions were digested using pepsin under simulated gastric conditions (37 °C, pH 1.2 and 34 mM NaCl ionic strength, with continuous shaking at approximately 100 min<sup>-1</sup> for 3 h). Digestibility rate of emulsion was characterized by droplet size distribution, protein hydrolysis rate, rheological characteristics of emulsions and simulated gastric fluids mixture.

It was found that the emulsions stabilized by 0.75% carboxymethylcellulose and made at pH 5 were more stable when whey protein solution was homogenized with carboxymethylcellulose solution. However, different behaviour was determined in analysing neutral emulsions. Better stability properties during storage were shown by emulsions stabilized by 0.75% carboxymethylcellulose which were made at initial mixing of whey protein and carboxymethylcellulose solutions and later homogenizing with rapeseed oil.

**Keywords:** O/W emulsions, stability, digestibility, whey protein, carboxymethylcellulose.

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## INFLUENCE OF JERUSALEM ARTICHOKE POWDER ON DOUGH RHEOLOGICAL PROPERTIES

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Wheat flour products are the most common and traditional foods around the world. Fresh backed products all day long and a wide variety of pastry products with new flavors, shapes, and sizes are some of the consumers' demands. The perennial vegetable plant *Helianthus tuberosus* L. (Jerusalem artichoke) is an interesting plant regarding functional food constituents because it is a rich source for fructooligosaccharides (e.g., inulin), minerals, and vitamins. Jerusalem artichoke powder (JAP) is a valuable product which is convenient in use and its addition to bread and pastry product increases their nutritional values. Quality control equipment Mixolab for flour from French firm Chopin Technologies is a new generation device which allows the complete characterization of the flours in terms of proteins' quality by determining their water absorption, stability, elasticity, and weakening properties; starch behaviour during gelatinization and retrogradation; consistency modification when adding additives and enzymatic activity of the proteases, amylases. Mixolab could play a key role in ensuring flour performance matches customers' expectation in finished product.

The aim of this study was to evaluate how the addition of JAP in different concentration levels influences thermo-mechanical properties of the wheat flours and dough.

Partial replacement of wheat flour with JAP at different levels (10, 20, 30, 40, and 50%) significantly changed the qualitative and quantitative thermo-mechanical properties of enriched dough. Results indicated relationships between the terms - water absorption capacity, mixing time, dough stability, dough resistance to kneading - and JAP concentration.

**Keywords:** Jerusalem artichoke, wheat flour, rheological properties, Mixolab

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## CONSUMER BEHAVIOR TOWARDS SUSTAINABLE FOOD CONSUMPTION IN EUROPE

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Private consumption is shaped by an array of complex and interrelated factors, including demographics; income and prices; trade, globalisation and technologies; supply of goods and services and how they are marketed, as well as social and psychological factors such as habits, culture and taste.

Reducing the environmental impacts related to the consumption of food is a major challenge that requires efforts at all phases of the food value chain. The majority of environmental impacts related to consumption of food are from agricultural activities, including in particular cattle farming; therefore the main focus of the study is directed to meat consumption and to one of the main indicators of sustainable food consumption – organic farming.

The objective of this paper is to analyze the main influencing factors of consumer behavior and their impact on sustainable food choices in Europe.

The research is based on Principle Component Analysis (PCA), what is used to investigate similar European country groups and by mapping them, evaluate, if the classified countries are the same in terms of main influencing factors of consumer behavior. To study the problem elements also are used methods of analysis, synthesis and logical construction.

The research results show, that one of the strongest factors influencing meat consumption is income; however there are found other latent factors.

One of the conclusions of the study states, that excessive meat consumption is unsustainable also in terms of health and has a correlation with obesity.

**Keywords:** sustainable food consumption, consumer behavior, environment.

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**DETERMINATION OF VOLATILES, TOCOPHEROLS  
AND COLOUR CHANGES IN AROMATIZED OILS  
WITH MARJORAM (*ORIGANUM MAJORANA*)**

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Lipid rich food, fats and oils deteriorate during long term storage or heating. Deterioration process proceeds through several degradation reactions. The use of antioxidants is one of the methods to inhibit oxidation. In recent years, there is a worldwide growing interest to use natural additives instead of synthetic in food and cosmetic. Lamiaceae family considers being a source of natural antioxidants; some of this family plant contains high amounts of phenolic and volatile compounds.

In this study, aromatized oils with marjoram were investigated. During aromatization procedure chemicals migrated from herb to the oil. For the detection and identification of volatile compounds in the marjoram and oils headspace gas chromatography was used (SPME-GS-MS). Twenty volatile compounds were identified in dry marjoram herb. The major compounds were  $\gamma$ -terpinene (10.5%),  $\alpha$ -terpinene (8.24%),  $\beta$ -phellandrene (7.99%), sabinene (7.89%) and  $\alpha$ -thujene (5.04%). During the aromatization procedure with marjoram (3%) after storage for 48 hours 8 flavour compounds were detected in the oil, after 1 week and 4 weeks, 9 and 13 compounds respectively. In oil aromatized with marjoram (6 %) after storage for 48 h, 1 week and 4 weeks 12 compounds migrated to the oil in different concentrations. Only  $\alpha$ -tocopherol and  $\gamma$ -tocopherol were identified in aromatized oils. The changes of aromatized oils colour were visible by observation. The impact of aromatization process for oils were carried out using CIELab and colour parameters ( $L^*$ ,  $a^*$ ,  $b^*$ ). The colour of aromatized oils became more intensive with increasing herb concentration and storage time.

**Keywords:** Marjoram; Volatiles; Tocopherols; Calorimetric measurement

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**LEAF VOLATILE OIL CONSTITUENTS OF *SCHINUS*  
*TEREBINTHIFOLIUS* RADDI AND  
*SCHINUS MOLLE* L. FROM TUNISIA**

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**Background:** Members of the genus *Schinus* mainly *S. terebinthifolius* (Brazilian pepper tree) and *S. molle* (Peruvian pepper tree) have long been recognized as a consolidate sources of functional ingredients namely essential oils and phenols. Despite the substantial data on the volatile oil constituents of their fruits, the leaf volatile fraction has not received much interest. Consequently, the aim of the present study is to analyse the chemical composition of the essential oils of the aforementioned species.

**Methods:** Essential oils were extracted from air dried leaves of *S. terebinthifolius* and *S. molle* by hydrodistillation, dried over anhydrous sodium sulphate and analysed by gas chromatography-mass spectrometry.

**Results:** The hydrodistillation of air dried leaves yielded a pale yellowish oil with pungent and pepper like aroma in 0.75 and 1.06% (w/w dw) for *S. terebinthifolius* and *S. molle*, respectively. In both oil samples, monoterpenes hydrocarbons were the most represented class of volatile. Amongst their derivatives,  $\alpha$ -Phellandrene (46.64–22.16%),  $\beta$ -Phellandrene (28.53–6.49%),  $\alpha$ -Pinene (4.94–5.20%), and  $\beta$ -myrcene (5.04–0.84%) were the main components. Even if the oil samples showed the same main constituents, there was a considerable qualitative and quantitative difference.

**Conclusion:** both species could be considered as potential sources of volatile oil because of their higher essential oil yields. Such feature appears to be characteristic of the genus *Schinus*. Moreover, the occurrence of some volatile compounds (e.g  $\alpha$ -Phellandrene,  $\alpha$ -Pinene,  $\beta$ -myrcene and  $\beta$ -caryophyllene) with documented biological activities could justify the traditional uses of these species.

**Keywords:** *Schinus molle* - *Schinus terebinthifolius* – Leaves- essential oil composition- GC-MS.

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**“FROM THE FIELD TO THE FORK”:  
DEVELOPMENT OF HEADSPACE CONCENTRATORS  
FOR NATIVE FLAVOR ANALYSIS**

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A decade ago, several treks (NEBLINA, TASTETREK) were performed by aromatic industry companies both in South-America and West-Africa in order to investigate the aromatic potentialities of rare exotic plants for novel flavors and fragrances formulations. As Midi-Pyrénées region (SouthWest of France) has a rich and unvalored wild vegetal heritage, especially for aromatic and medicinal plants, the MIPAROM Trek was conducted in order to collect and analyze various regional forgotten aromatic plants. These plants, actually harvested and not cultivated, interested local famous cooks for use in French “Nouvelle Cuisine” recipes in fresh, dried or extracts states. In order to study these aromatic plants from “the field to the fork”, various headspace concentrators devices were developed for better characterizing native flavor compounds. In addition to the classical HeadSpace Bell Jar (HSBJ) allowing to collect volatiles emitted by uncrushed living leaves in fields, 2 novel devices were designed in order to analyze native volatile compounds emitted just after crushing of leaves, i.e. Artificial Crushing Finger (ACF) and Flash Aroma Dispenser (FAD) allowing respectively a mechanical and a gas flash pressure crushing. Then in order to study the aromatic impact of such plants or their respective essential oils when they were added to dishes, another device, called HeadsSpaceDome (HSD) was developed in order to collect volatiles emitted by the flavored food directly in the plate. Various experimental sampling parameters (trapping temperature and duration, fibers types, gas types) were optimized.

**Keywords:** Headspace analysis, volatile compounds, native flavor, living plants.

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## COMPOSITION OF VITAMINS AND AMINO ACIDS IN LATVIAN CRANBERRIES

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Berries contain a diverse array of nutrients with recognized biological activities that promote or contribute to health. The content and diversity of vitamins is often the basis for promoting increased daily intake of berries. The current research focuses on the evaluation of vitamins and amino acids content in Latvian wild and cultivated cranberries. The research was accomplished on fresh Latvian wild and cultivated cranberries harvested in Kurzeme region: wild cranberries and cultivated cranberries variety 'Early Black', 'Ben Lear', 'Steven', 'Bergman' and 'Pilgrim'. The following quality parameters of cranberries were controlled using standard methods: vitamin E (AOAC 971.30), vitamin B<sub>1</sub> (AOAC 986.27), vitamin B<sub>2</sub> (AOAC 970.65), vitamin C (LVSEN 14130:2003), amino acid except tryptophan (ion exchange method), tryptophan (spectrophotometric method). Very similar vitamin C content was detected in cultivated cranberries varieties: 'Steven', 'Bergman' and 'Ben Lear'. The lowest vitamin C content was detected in wild cranberries and cultivated cranberries variety 'Early Black', respectively 46.98±3.42 and 47.48±3.42 mg 100 g<sup>-1</sup> (in dry matter). During current research it was found, that the content of vitamin B<sub>1</sub> and B<sub>2</sub> in cranberries was similar. The higher vitamin E content was found in wild and cultivated cranberries variety 'Ben Lear' and 'Pilgrim', ie., 1.56 mg 100 g<sup>-1</sup>, 1.50 mg 100 g<sup>-1</sup> and 1.58 mg 100 g<sup>-1</sup> respectively. Higher irreplaceable amino acid content was found in wild and cultivated cranberries variety 'Bergman', 'Pilgrim' and 'Early Black' 1.94 g 100 g<sup>-1</sup>, 2.06 g 100 g<sup>-1</sup>, 1.83 g 100 g<sup>-1</sup> and 2.23 g 100 g<sup>-1</sup> respectively.

**Keywords:** amino acid, vitamins, cranberries

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**CHEMICAL, MICROBIOLOGICAL AND ANTIOXIDANT PROPERTIES OF SELECTED HONEY VARIETIES FROM SOUTH AFRICA**

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The authors measured chemical properties, antioxidant potentials, and microbial composition in eight commercially available varieties of honey from South Africa. The pH values ranged from  $3.61 \pm 0.03$  to  $6.65 \pm 0.02$ , while the electrical conductivity measurements lied between  $12 \pm 3$  to  $93 \pm 0.4$  mS m<sup>-1</sup>. Concentrations of mesophilic bacteria ranged from  $(2.9 \pm 0.6) \times 10^1$  to  $(1.55 \pm 0.09) \times 10^3$  CFUs g<sup>-1</sup> wet weight of honey, and there was between  $(3.3 \pm 3.2) \times 10^1$  to  $(3.3 \pm 2.3) \times 10^5$  CFUs g<sup>-1</sup> wet weight of honey of mesophilic fungi. No threats to human health would result from the consumption of any of the honey varieties studied as the faecal coliform concentrations, and the concentrations of *Salmonella spp.*, were below the detection limit of 1–9 CFUs/g wet weight. All samples had antioxidant activity as supported by results of the ATBS and DPPH assays. At the same time, the square-wave voltammetry showed that this activity resulted from two compounds at half-position potentials from  $0.207 \pm 0.003$  to  $0.293 \pm 0.003$  V; and from  $0.444 \pm 0.001$  to  $0.524 \pm 0.031$  V. Based on the Kruskal-Wallis analysis at 5 % level of significance, the average values of all but one of the parameters were different among the honeys (all *p*-values < 0.0124). Stratification of mesophilic fungi was observed in all the studied samples which probably resulted in no difference among the fungal concentrations, i.e. *p*-value was equal to 0.0734. Preliminary results of bacterial and fungal species will be presented.

**Keywords:** South Africa, honey, chemical properties, microbial composition, antioxidant properties

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## LYCOPENE AND $\beta$ -CAROTENE CONTENT OF FERMENTED TOMATO PRODUCTS

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The interest of health benefits of lycopene from tomato have increased in recent years. Tomato and related tomato products are the major source of natural antioxidant lycopene. Tomato is an important product of establishing functional food. Probiotication is one of the methods used to produce fermented functional foods.

The aim of this study was to evaluate the impact of fermentation with *Pediococcus pentosaceus* MI807, *Lactobacillus sakei* and spontaneous sourdough on the lycopene and  $\beta$ -carotene content in tomato powder. The products were fermented with *Pediococcus pentosaceus* (+35 °C; 4 days), *Lactobacillus sakei* (+30 °C; 4 days) and spontaneous sourdough (+ 30 °C; 4 days). Total lycopene and  $\beta$ -carotene content was identified using spectrophotometric method. Lycopene isomers were identified using high pressure liquid chromatography method with an UV detector.

Results of the study show that the amount of  $\beta$ -carotene and lycopene in fermented tomato powder with *Pediococcus pentosaceus* MI807, *Lactobacillus sakei* were not significantly different (10.73 mg 100 g<sup>-1</sup> and 86.54 mg 100 g<sup>-1</sup> respectively) ( $p > 0.05$ ). Amount of  $\beta$ -carotene and lycopene in fermented tomato powder with spontaneous sourdough was the 44% lower compared to *Pediococcus pentosaceus* MI807, *Lactobacillus sakei* sourdough. Both *Pediococcus acidilactici* MI807 and *Lactobacillus sakei* may be used in the fermentation of the analysed products.

**Keywords:** tomato, fermentation, lycopene,  $\beta$ -carotene, health

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## CONSUMERS KNOWLEDGE AND ATTITUDE TO TRADITIONAL AND ENVIRONMENTALLY FRIENDLY FOOD PACKAGING MATERIALS IN MARKET OF LATVIA

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The packaging industry is one of the most important industries in the world. The quantity of packaging materials increases annually. Food packaging accounts for almost two-thirds of total packaging waste by volume and approximately 50% by weight of total packaging sales. The aim of food packaging is to contain the food, to protect food products from external influences and damage, to preserve food safety and minimize the environmental impact.

To clear up a situation in the market of Latvia, as well as to study the consumer's awareness problem and attitude to traditional and biodegradable polymer packaging materials and their implementation in the market year of 2010, questionnaire was polled. 1200 respondents (50% female and 50% male) from different regions of Latvia (Kurzeme, Zemgale, Vidzeme, Latgale and Riga) were in reply to 19 different questions: how well-informed they are for traditional and eco-friendly packaging and how much more they are willing to pay for eco-friendly food packaging (biobased, biodegradable, recyclable) compared with conventional polymers. Most of consumer inquired in Latvia thinks that there is too much polymer packaging for food products on the market.

**Keywords:** food packaging, biodegradable, consumers, market.

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## THE USE OF *LACTOBACILLUS SAKEI* IN YOGHURT PRODUCTION

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In this study the possibility of using *Lactobacillus sakei* having functional properties by producing bacteriocins was evaluated to produce yoghurt.

In the experiments two flour substrates were prepared: one with *Lactobacillus sakei* sourdough using extruded rice flour and the second one by using extruded corn flour.

In both cases sourdough pH and the amount of lactic acid bacteria was measured.

Yogurt production was carried out with selected types of milk (from different manufacturers with 3.5% milk fat and samples A, B and C) by inoculation of 5% (v/v) of the prepared sourdough and keeping the samples 19 hours by 30 °C.

Gelatinous textured yoghurt samples were subjected to sensory, physical, chemical and rheological studies.

After sensory analysis of the profile, it was found that the best sample was obtained from A milk with extruded rice and corn flour sourdough. After 19 hours of fermentation A, B and C of the samples prepared with extruded corn flour and *Lactobacillus sakei* sourdough, the pH was, respectively, 5.73, 4.81 and 4.75. After 19 hours of fermentation A, B and C of the sample prepared with extruded rice flour and *Lactobacillus sakei* sourdough, the pH was respectively 5.42, 4.71 and 5.67. The texture analysis showed that the strongest texture was derived from yogurt made from milk B with extruded rice and corn flour sourdough. The microbiological analysis showed that the fermented products are free of *coli form* bacteria, while in non fermented milk  $5.0 \cdot 10^5$  to  $1.0 \cdot 10^9$  cfu ml<sup>-1</sup> was noticed.

**Keywords:** *Lactobacillus sakei*, yogurt, milk, safety.

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## THE USE OF *PEDIOCOCCUS ACIDILACTICI* IN YOGHURT PRODUCTION

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In this study the possibility of using *Pediococcus acidilactici* having functional properties by producing bacteriocins was evaluated to produce yoghurt.

In the experiments two flour substrates were prepared: one with *Pediococcus acidilactici* sourdough using extruded rice flour and the second one by using extruded corn flour.

In both cases sourdough pH and the amount of lactic acid bacteria was measured.

Yogurt production was carried out with selected types of milk (from different manufacturers with 1.0% milk fat and samples A and B) by inoculation of 5% (v/v) of the prepared sourdough and keeping the samples 19 hours by 35 °C.

Gelatinous textured yoghurt samples were subjected to sensory, physical, chemical and rheological studies.

After sensory analysis of the profile, it was found that the best sample was obtained from B milk with extruded corn flour sourdough. After 19 hours of fermentation A and B of the samples prepared with extruded corn flour and *Pediococcus acidilactici* sourdough, the pH was, respectively, 5.10 and 5.38. After 19 hours of fermentation A and B of the sample prepared with extruded rice flour and *Pediococcus acidilactici* sourdough, the pH was respectively 5.39 and 5.40. The texture analysis showed that the strongest texture was derived from yogurt made from milk B with extruded corn flour sourdough (11 TAU).

**Keywords:** *Pediococcus acidilactici*, yoghurt, milk, safety.

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## EVALUATION OF SOUR CHERRY CULTIVARS GROWN IN LATVIA FOR PRODUCTION OF CANDIED FRUITS

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Different sour cherry cultivars are grown in Latvia suitable both for fresh market and for processing. Fresh local sour cherry fruits are available for consumers only in July. Sour cherries are favourite fruits because of pleasant taste, juicy flesh and attractive dark red color. Fruits are rich in natural antioxidants – vitamins and polyphenols, but are low in calories.

One of processing methods preserving valuable nutrients in products in significant quantities is drying. Dried cherry fruits or candied fruits can be used as energetic delicacy and healthy goody. It is a great alternative for people liking sweets and caring for their health. A priority of dried fruits is their long keeping time, as well as their use in preparing other dishes.

The aim of the study was to evaluate suitability of sour cherry cultivars grown in Latvia for production of candied fruits.

Five sour cherry cultivars were chosen: ‘Bulatnikovskaya’, ‘Orlica’, ‘Shokoladnica’, ‘Tamaris’ and ‘Zentenes’.

To evaluate suitability of sour cherry cultivars for drying, candied fruits and syrup, sensory estimation establishing the level of liking was performed and biochemical parameters: content of soluble solids, total acids and phenolic compounds were determined. As a result of the study it was found that higher level of liking had candied fruits and syrup made from the cultivar ‘Shokoladnica’, regardless of their higher acidity. On the other side, the highest content of polyphenols was ascertained in candied fruits of the cultivar ‘Orlica’ and their by-product, while the highest content of soluble solids was found in candied fruits and syrup made from the cultivar ‘Bulatnikovskaya’.

**Keywords:** sour cherries, drying, candied fruits.

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## THE CHEMICAL AND PHYSICAL PROPERTIES OF SWEET ROWANBERRIES IN POWDER SUGAR

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The rowanberries (*Sorbus aucuparia*) are small orange-red “fruits” of a rowan tree. These berries have been described as an important source of flavonoids, and their antioxidant activity affects reactive oxygen species and lipid peroxidation; therefore they are suitable for production of health-food products. The aim of this experiment was to prepare new product – rowanberries in powder sugar, and to determine chemical and physical properties of samples. The experiments were prepared in the Faculty of Food technology of Latvia University of Agriculture and in the Customs laboratory of National Customs Board of State Revenue Service. The berries of cultivars 'Moravica' and 'Michurinskaya Krasnaya', and hybrid of rowanberry × hawthorn 'Granatnaya' were used for investigations. The rowanberries 'Granatnaya' in powder sugar were packed in carton and plastic (biodegradable PLA and conventional PP) boxes and kept three weeks at room temperature. The content of ascorbic acid and total carotenoids, the firmness of experimental products and the weight losses of packed samples were analysed. For determination of the organic acid and ascorbic acid content high performance liquid chromatography was used, and the content of total carotenoids was determined by spectrophotometric method. Texture analyser TA.XT.plus was used for measurement of the firmness of samples. The results showed that sweet rowanberries are good raw material for preparation it's in powder sugar. The analysis of firmness showed that the rowanberries in powder sugar had a fairly hard texture, influenced by the presence of sugar layer. We observed the weight losses during 18 days storage of packed samples in carton boxes.

**Keywords:** rowanberries in powder sugar, firmness, ascorbic acid, total carotenoids.

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**FOOD CHAIN MANAGEMENT:  
RAW MATERIALS, LOGISTICS,  
CONSUMERS, ECONOMICS,  
INFORMATION SYSTEMS**

# FOODBALT-2011

## THE INFLUENCE OF METEOROLOGICAL CONDITIONS AND NITROGEN FERTILIZER ON WINTER WHEAT GRAIN YIELD AND QUALITY

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Technological quality and protein composition of the wheat grain are influenced significantly by the system of growing, by variety, locality, year conditions and growing technology. A field experiment of four winter wheat (*Triticum aestivum* L.) varieties was designed to study the influence of meteorological conditions and the effect of additional top dressing of nitrogen fertiliser rates to different varieties grain yield and bread quality data. Field experiment was carried out on sod calcareous medium loam soil of the Research and Training farm "Peterlauki" of Latvia University of Agriculture. The varieties, which were studied, according to the duration of the vegetation period can be relatively divided in three groups: early varieties, mid-early and mid-late varieties. The meteorological conditions in three year period were different compared to average long – term observations and this difference influenced plant development and yield. Obtained data show that fertilizer influence on winter wheat grain yield was significant. The application of nitrogen increased grain yield of late varieties by 10% as compared to early varieties. Grain crude protein content was affected by fertilizer application and by differences of meteorological conditions - from 93 to 172 g kg<sup>-1</sup>. Significant positive correlation was found among protein content and gluten content ( $r = 0.93$ ) and protein content among Zeleny index ( $r = 0.82$ ). The yield and baking quality parameters are depends on meteorological conditions in the investigated years and individually of varieties.

**Keywords:** wheat, nitrogen, meteorological conditions, grain quality.

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**BAKING QUALITY OF WINTER WHEAT GRAIN VARIETIES****Ilze Skudra, Daiga Kunkulberga, Anda Linīna**

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Obtaining high yield and good seed quality of winter wheat is a main goal of farmers and breeders. The quality mainly depends on genetic properties, environmental conditions and on agrotechnological factors. Winter wheat yield and quality is highly and significantly influenced by varieties specific differences. The objective of this study is to determine effect of different origin varieties on grain flour baking properties. The four winter wheat varieties (Germany origin - 'Bussard', 'Cubus', 'SW Maxi' and Latvia origin - 'Fredis') were studied. There was determined grain protein content, Hagberg falling number, starch, hectolitre mass, thousand kernels mass. Grain crude protein content was from 13.8 to 15.9%, gluten content varied from 28.1 to 35.2%, but hectolitre mass – from 755 to 770 g l<sup>-1</sup>. The higher Zeleny number was obtained of variety 'Bussard' (64.8). The yield and baking quality parameters are depends on meteorological conditions in the investigated year and individually of varieties. Wheat grain samples were determined with Mixolab® (Chopin, France) device. The Mixolab® is able to measure the rheological behaviour of dough while controlling both the speed of mixing and the dough temperature. Mixolab analyses and test baking demonstrated that all wheat samples have a good baking quality. There were no differences found between the wholegrain bread samples made from different varieties.

**Keywords:** winter wheat, quality parameters, wholegrain flour, baking properties.

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## INFLUENCE OF AGROECOLOGICAL CONDITIONS ON WINTER WHEAT GRAIN PROTEIN CONTENT

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High quality wheat grains are required for the milling and baking industries. Protein content is important quality indices for technological processing of wheat.

Our objectives were to determine relative influence of variety, environment and nitrogen fertilizer on variation winter wheat (*Triticum aestivum. L*) of protein content. Field experiments with 8 winter wheat varieties with different origin were conducted on brown lessive soils of the Study and Research farm "Peterlauki" of the Latvia University of Agriculture in 2000, 2001, 2002 and 2004. Split nitrogen fertilization was applied in the following way: early in spring at the beginning of vegetation period, at the end of tillering and at the end of shooting into stems. The N fertilizer amount applied was four nitrogen fertilizer (90, 90+30, 90+60 and 90+30+60 N kg ha<sup>-1</sup>) treatments for all the studied winter wheat varieties. Grain protein content were determined by Kjeldahl (N x 5.7; moisture basis), by Latvian Standard LVS-277-2000. The mathematical analysis of the data was applying the analysis of variance. Variety, environment and nitrogen fertilizer had a significant effect on protein content. Our results show, that protein were mostly influenced by genetic peculiarities of a crop variety, in less extent by meteorological conditions in the growing season and by the rate of split N fertilizer.

**Keywords:** winter wheat, protein content, environment, nitrogen fertilizer.

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## BUCKWHEAT GRAIN QUALITY INDICES

### **Aivars Pogulis**

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Buckwheat grain quality is characterized on the basis of their subsequent use: seeds, food, feed or for processing. Field experiments with buckwheat varieties ('Anita Byelorusskaja', 'Aiva') and methods of cultivation (mineral fertilizers, sowing time) were conducted of the Latvian University of Agriculture Agency of Agriculture Research Institute at Skriveri in 1990 to 2003.

Fallowing buckwheat grain quality indices were obtained: 1000 seed weight, volume weight, grain evens, hulls content, germination and chemical composition. Grain chemical characteristics are important parameters for quality characteristics: crude protein, starch, and sugar. The outcome of groats is a key indicator of buckwheat food processing. This is related to grain hulls content.

Research results indicated that the method of buckwheat cultivation, varieties, fertilizers affect buckwheat quality.

**Keywords:** buckwheat, grain quality.

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## IMPROVING BREAD WHEAT PRODUCTIVITY IN NEWLY RECLAIMED SANDY SOIL IN EGYPT

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Two field experiments were carried out during 2004/05 and 2005/06 seasons under sandy soil conditions at the Agricultural Experimental Station, Faculty of Agriculture, Zagazig University, Egypt to study the effect of five nitrogen levels (72, 144, 216, 288 and 360 kg N ha<sup>-1</sup>) and three seeding rates (120, 168 and 216 kg ha<sup>-1</sup>) on grain yield, yield attributes and yield analysis of bread wheat. Application nitrogen up to only 288 kg N ha<sup>-1</sup> significantly increased number and weight of grains per spike and number of spikes m<sup>-2</sup>. However, 1000-grain weight, straw yield, grain yield ha<sup>-1</sup>, biological yield and harvest index significantly increased up to 360 kg N ha<sup>-1</sup>. Increasing seeding rate from up to 216 kg ha<sup>-1</sup> significantly increased number of spikes m<sup>-2</sup>, straw and biological yields/ha but significantly decreased number of grains per spike and harvest index. The highest number and weight of grains per spike and grain yield ha<sup>-1</sup> were achieved by using 168 kg ha<sup>-1</sup>. Correlation analysis indicated that grain yield ha<sup>-1</sup> was positively and significantly correlated with all yield attributes. Regression analysis revealed that number of spikes m<sup>-2</sup> and number of grains per spike had a quadratic response to N increments up to 360 kg N ha<sup>-1</sup>. However, grain yield ha<sup>-1</sup> and 1000-grain weight showed a positive linear function. Path analysis indicated that number of spikes m<sup>-2</sup> and number of grains per spike and their interaction greatly affected grain yield variation and had 79.56% of the total variation. Seeding with 168 kg ha<sup>-1</sup> and fertilizing with 288 kg N ha<sup>-1</sup> could be recommended for maximizing grain yield of wheat under newly reclaimed sandy soil conditions of Egypt.

**Keywords:** Wheat, N fertilization, seeding rate, yield analysis, sandy soil.

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## COMPARISON OF THE ENZYME ACTIVITY OF DIFFERENT CEREALS GROWN USING ORGANIC AND CONVENTIONAL AGRICULTURAL PRACTICES

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Organic, sustainable and conventional agriculture are the primary cultural practices used in the production of cereals. Factors such as resource availability, soil quality, climate and insects are known to affect levels of nutrients in cereals. However, there is very little information on the impact of various cultural practices on the production of biological active components. To address this issue,  $\alpha$ -amylase, protease and endoxylanase activities of wheat (4 varieties), rye (3 varieties), barley (6 varieties), and oats (3 varieties) grown by organic and conventional cultural practices were measured.  $\alpha$ -Amylase activity was determined using soluble starch as substrate, protease activity – using tyrosine as a standard, and endoxylanase activity – by the dinitrosalicylic acid assay.

The average of  $\alpha$ -amylase activity of conventionally and organically grown wheat, rye, barley and oats were found 1210.4; 1065.6; 953.6; 844.3 U and 1070.4; 866.8; 1003.5; 577.1 units  $g^{-1}$ , respectively, and endoxylanase activity – 0.151; 0.128; 0.128; 0.063 and 0.131; 0.651; 0.220; 0.092 units  $g^{-1}$ , respectively. The data demonstrated that organically grown rye, barley and oats had higher  $\alpha$ -amylase activity in compare with conventional grown cereals. Also organically grown rye, barley and oats distinguished much higher endoxylanase activity than conventionally grown. Contrary tendency was found during investigation of  $\alpha$ -amylase activity in wheat and endoxylanase activity in barley. Comparing protease activity, significant differences have not been found between various agricultural practices. The protease activity of conventionally and organically grown cereals was in the range between 4.8 and 4.9 units  $g^{-1}$ . These data demonstrate that there are inconsistent differences in the enzyme activities of conventionally and organically produced cereals.

**Keywords:** enzyme activity, cereals, organic and conventional agriculture

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## ASSESSMENT OF THE RHEOLOGICAL PROPERTIES OF FLOUR USING THE MIXOLAB

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The rheological properties of dough are important basis for the process of production of quality products (Letang et al., 1999, Moreira et al., 2010). The main techniques used for measuring flour dough's properties are empirical or fundamental. Empirical measurements can be conducted by means of farinograph, Falling Number apparatus, rapid visco analyser, etc., and multifunctional new apparatus like Mixolab (Jansen et al., 1996, Moreira et al., 2010). The aim of research was to evaluate the rheological properties of dough made from different cereal flours and flour blends using Mixolab.

Whole grain flour of triticale, rye, hull-less barley, rice, maize and flour blend were used in this research. Flour blend was made from triticale in a combination with other flours in various proportions. Wheat flour was used as a control. Rheological properties of flour dough were studied using Mixolab (*Chopin Technologies*), which was capable of evaluating rheological properties and enzymatic activity of the flour and flour blends.

In the Mixolab test triticale flour demonstrated equivalent dough properties to wheat flour: formation time, protein weakening and starch gelatinization peak value. But values of amylase activity and starch retrogradation in triticale flour were lower than in wheat flour. Evaluation of the Mixolab test results demonstrated that decrease of triticale flour proportion in flour blend resulted in increase of the dough stability, but did not change substantially dough properties.

**Keywords:** Triticale; Wheat; Hull-less barley; Flour blend; Mixolab

**Acknowledgment:** This research has been prepared within the framework of the ESF project „Formation of the Research Group in Food Science”, Contract Nr. 2009/0232/1DP/1.1.1.2.0/09/APIA/VIAA/122.

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## THE EFFECT OF SODIUM SELENITE AND SELENATE ON THE QUALITY OF LEAF VEGETABLES

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Selenium is essential microelement for humans, animals and some species of microorganisms. In human and animal cells Se incorporates in antioxidative system, but it is toxic at high dietary intake. Selenium enters the food chain through the plants which take it up from soil. Se concentration in plants depends on the chemical form of Se, its concentration and bioavailability in soil and soil microorganisms. The aim of the study was detect the effect of sodium selenite and selenate on growth, yield formation and yield quality of leaf vegetable.

Two varieties of lettuce plants (*Lactuca sativa*): iceberg lettuce 'Tarzan' and lettuce 'Rīga', garden cress (*Lepidium sativum*) and spinach (*Spinacia oleracea*) were grown in 1 L pots with peat substratum. All vegetables during growth season were once treated with 50 mg m<sup>-2</sup>, 100 mg m<sup>-2</sup> or 200 mg m<sup>-2</sup> of sodium selenite or selenate. Control - without treatment. Fresh and dry weight of plants, pigment content in plant leaves, ascorbic acid content and antiradical activity were tested three times during vegetation period.

Plants treated with selenium had higher pigment content in comparison with untreated ones. The correlation between selenium concentration and antiradical activity was observed. Ascorbic acid content depended on vegetable and sampling time. No effect of selenium was observed on plant weight. Accumulation of selenium depended on plant and its variety. Selenium concentration in vegetables correlated with Se dose given to plants. Variants were sodium selenate was used accumulated more Se in comparison with selenite ones.

**Keywords:** vegetable, selenite, selenate.

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## EVALUATION OF COLOSTRUM QUALITY AND NEW POSSIBILITIES FOR ITS APPLICATION

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Colostrum is the secretion from the mammary gland during the first 24 h after calving and is an important source of nutritional, growth, and antimicrobial factors for a newborn calf. Despite the importance of nutrients in colostrum, published data describing bovine colostrum composition in Latvia is extremely limited. Most researches, investigating colostrum, focuses narrowly on the total concentration of immunoglobulins (Ig) and ignores other nutrients, and separate Ig concentrations; therefore the aim of the present study was to evaluate quality of colostrum.

A total 29 samples of colostrum were collected from the conventional farm located in Auce. The experiments were carried out in the Latvia University of Agriculture. The content of protein and fat, and pH detected according to the standard methods. Concentrations of IgA, IgG, IgM were determined by turbodynamic method. The data were processed by using the SPSS software package SPSS 11.0. and MS EXCEL.

Research results show, that the concentration of separate nutrients is significantly different compared with data from literature. Due to high nutritional value, particularly increased concentration of immunoglobulins, colostrum may find beneficial application in new functional food development.

**Keywords:** colostrum, chemical composition, immunoglobulins.

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**POTENTIAL TO INCREASE THE STABILITY OF MILK RIBOFLAVIN  
AGAINST PHOTO-OXIDATIVE DEGRADATION****Unigunde Antone<sup>a\*</sup>, Vita Šterna<sup>a</sup>, Jelena Zagorska<sup>b</sup>**<sup>a</sup>*Agency of the Latvia University of Agriculture 'Research Institute of Biotechnology and Veterinary Medicine 'Sigra' (Sigulda, Latvia)*<sup>b</sup>*Faculty of Food Technology, the Latvia University of Agriculture (Jelgava, Latvia)*

Milk and other dairy foods are excellent natural sources of riboflavin (vitamin B<sub>2</sub>). All the water-soluble vitamins are quite stable to milk processing treatments, although riboflavin is extremely sensitive to degradation by light. Exposure of milk to light can take place at several stages from milking to the consumers, initiating the sensibilization of riboflavin and resulting in the oxidation of milk. Light-activated riboflavin is an agent in the development of sunlight flavor in milk and also catalyzes the photo-oxidative degradation of ascorbic acid. The challenges are not only the losses of nutritional value, but also the strong off-flavours that can make the oxidized milk unacceptable to consumers.

The stability of milk components is dependent of a delicate balance between the anti- and pro-oxidative factors. Carotenoids are known as one of the strongest natural antioxidants. The aim of this study was to compare the influence of cow feed on the milk riboflavin stability against photo-oxidative degradation. In a dairy farm three experimental and one control cow groups were made. Experimental group's feed was supplied with carotenoid sources: carrots, red palm oil and red palm oil concentrate. Milk samples were collected after 6 week long feed supplementation and exposed to direct sunlight for 1.5 and 3 hours. The losses of riboflavin were measured by the fluorometric method. The degradation of vitamin B<sub>2</sub> was significantly lower ( $P < 0.05$ ) in the milk of all the three experimental groups compared to the control (15.66%, 18.95%, 18.64%, and 23.48%, respectively).

**Keywords:** dairy products, light induced deterioration, vitamin B<sub>2</sub>, cow feeding, antioxidants.

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## DAIRY CONSUMPTION AND PRODUCTION TRENDS

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According to the NACE classification, the dairy industry belongs to the processing industry, production of food products, and is one of the most important industries in Latvia's national economy.

The research aim is to identify the newest trends in processing dairy products and in consumer behaviour. To achieve the aim, the following research task is set forth: to analyse the output, import, export, and consumption of dairy products in Latvia in 2005–2010.

The following methods are applied in the research: general research methods: analysis and synthesis, documentary analysis, monographic and graphic methods. Statistical analysis was applied for social and economic studies.

Materials used in the research: data of the Latvian Central Statistical Bureau, the Rural Support Service of the Ministry of Agriculture, and the Latvian Central Union of Dairy Farmers.

The main conclusions:

The dairy industry of Latvia meets the consumption needs of its population.

The export of dairy products exceeds their import.

More and more products of low value added are exported or the proportion of milk as a commodity increases in total milk exports.

**Keywords:** dairy, production, consumption, Latvia.

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**“CHROMAGUSTOLOGY CONCEPT”:  
APPLICATION FOR DESIGNING 27 EUROPEAN FLAGS  
WITH LOCAL FOOD**

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At the eve of the New Millenium, the basics of the chromagustology concept, i.e. recipes conception associating color to food, was created by several french food scientists, designers and photographers, especially Sophie CALLE , as a contribution to the Molecular Cuisine. First, it was applied in 2006 for designing “Chromatic Dinner” e.g. one color dish for each week day (for example, orange for Monday by associating carrots, melon, shrimps,...) and later the corresponding “Chromatic Diet” . Then, during the 2008 french Taste Week, we first used this concept for creating a dish representing Midi-Pyrénées regional flag by associating yellow and red local foods including meats, vegetables and beverages. At 2009 Sydney International Food Festival, the concept was extended for designing a dozen of dishes based on national flags from all around the world. In the framework of the new European program “Youth in the Move”, we launched in 2010 the “Flags'nd Dishes” project focusing on European Union countries flags. First, common rules were defined: only cold foods, ingredients must be available during all the year and must be either locally produced nor identified as local-indigen product and finally dishes could be sweet or salty. Then we performed a survey during 6 months among hosted ERASMUS students and French ones having an European experience (more than 200 persons) for collecting information on potential recipes and the finally selected ones were then set up by 2 professional cooks. The present poster reports the designing of the 27 “Food-Flags” European Union countries.

**Keywords:** Chromagustology, Chromatic dinner, European flags, Local foods.

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**NEW PRODUCT DEVELOPMENT  
AND INNOVATIONS IN FOOD  
PROCESSING**

# FOODBALT-2011



**GRANULAR GREEN TEA****Marina Kobakhidze, Nino Seididshvili**

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It is research objective with the new technology of the granulated green tea with antioxidant properties and its solubility in boiled water.

Object of research is served: fresh shoot of tea, steamed tea shoot (granules received from them).

For purpose achievement used different methods: the different sizes of a matrix for reception of granules. Influence on properties of granules has been established the optimum size of granules by research of a matrix thickness (3, 5 and 10 mm) and the size of diameter of an pori (3, 5 and 7 mm). Four times insisting of granules in boiled water and definition of physical and chemical indicators the received samples: definition extractive substances - tannin method of Vorontsov and catehins method of Bokuchava.

In article results of working out of manufacture of the granulated green tea are yielded. The product is characterized by fast dissolution at insisting to boiled water and this ability considerably to surpass usual tea. This product is rich with catehins which possess antioxidant ability and P vitamin activity.

It is remarkable, that this way is enough simple. Farmers engaged in a tea small-scale business can use it.

The tea world market - the place of a sharp competition today, and is important to enter and develop technology. Our technology satisfies market requirements, and we consider sale possibility in those countries where green products of tea were traditionally popular.

**Keywords:** granular green tea, catehin, antioxidant, tannin.

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**QUALITY INVESTIGATION OF WHIPPED  
REDCURRANT AND BLACKCURRANT MASS**

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Many fruits are frozen to extend their availability throughout the year, and to further shelf life through lengthy distribution. Nutritionists consider freezing as the best kind of preservation, because thus biological value and flavor of berry mass are maintained best of all. In experiments are used chemically formed gradients – gelatin, “GENUGEL carrageen type LC-5” and “KELCOGEL LT100 gellan gum”. The Redcurrant (*Ribes rubrum*) variety ‘Viksnas sarkanas’ and Blackcurrant (*Ribes nigrum*) variety ‘Titania’ were used for the experiment. The research was carried out at the Latvia University of Agriculture. Berries were analyzed after 6 months storage time. The volumetric method was used for whipped berry mass. Changes were determined by laser equipment.

The aim of the research is to compare changes of disperse environment in whipped berry mass depending on kind of berry and the jelling agent added. Fruit maintenance in fresh state for preparation of desserts is troublesome, therefore in the research feasibility of preparing them from frozen berries is considered. Freezing, in comparison to mechanical impact, substantially affects water solutions of stabilizers. Thickeners bind much more stable disperse air phase of berry mass, which afterwards affects greater stability during the following storage. Construction of technological equipment, as well as rates of technological process indicates substantial impact on foam dispersion. Therefore, while whipping berry mass, their disperse composition was investigated by the help of microphotography. The results of the research indicate that concentration of thickener’s content influences the texture of the ready-made product. The foam volume and ageing of whipped berry mass depend on the jelling agent added.

**Keywords:** berry mass, whipped, texture, freezing.

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## ENRICHMENT OF FRUIT PUREE WITH RASPBERRY MARC EXTRACT BIOACTIVE CONSTITUENTS

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Berries are important sources of valuable bioactive constituents, particularly vitamins and antioxidants. However, after extracting juice remarkable part of berries, consisting of seeds and skins, is removed as a waste material which may contain valuable bioactive substances. For instance, major polyphenolic compounds of raspberries ellagitannins, are mainly concentrated in their seeds. Therefore, antioxidant rich raspberry marc extract could be a promising ingredient in the production of functional foods, nutraceuticals and food additives.

The aim of this study was to assess the possibility to enrich fruit puree with the raspberry marc extract constituents. For this purpose 0, 0.5, 0.7, 0.9, 1.0, 1.5 and 2.0% of raspberry marc extract were added to two types of fruit purees consisting of (1) apples, red currants and cherries and (2) pears, yellow cherry plums and sea buckthorn. The extract and the products were analyzed for the content of total phenolics, total anthocyanins, ellagic acid and DPPH radical scavenging activity. Sensory properties and colour of fortified purees were also evaluated. It was found that recoveries of phenolic compounds added to the purees with raspberry marc extract were not significantly affected by the product thermal treatment. Radical scavenging activity of fruit purees with 2% of marc extract additive was almost four times higher than that of the purees without additive. Sensory quality of purees containing 0.5, 0.7 and 0.9% marc extract additive were evaluated as similar or even better than the purees without additive. However, higher than 0.9% extract concentrations, resulted in the increased bitterness and astringency of the product.

**Keywords:** fruit puree, raspberry marc, phenolics, sensory properties.

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**INCORPORATION OF MUSHROOM POWDER  
IN EXTRUDED PRODUCTS**

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Extrusion process has been a versatile technique to produce a variety of food products. These foods are readily accepted by all age groups globally. Processing innovations in such types of foods would not only increase the demand and fetch a good market potential for the processors but also contribute towards the overall nutritive value of the food. One such attempt was done by incorporating mushroom powder in different amounts during the production of extruded products like vermicelli and pasta. The main objective of this study was to enhance the nutritive value of extruded foods using a valuable protein source. Mushroom which provides a good quality protein was chosen as a novel source of protein, since consumption of mushroom was widely accepted in the Indian menu. The methodology encompassed a pretreatment and slicing of mushroom to various dimensions. This was followed by drying the optimized sliced mushroom in a tray drier. Dried mushroom was powdered in a ball mill. Mushroom powder was then incorporated at various levels to the basic dough prepared for extrusion of vermicelli and pasta. The physicochemical and sensory characteristic of this new food product was evaluated.

**Keywords:** Extrusion, Pasta, Mushroom powder, Processing, Nutritive Value.

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## VALUE ADDITION OF PROCESSED MUSHROOM BY EXTRUSION TECHNIQUE

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Edible mushroom are a considered a rich source of protein and a delicacy in the Indian menu. Processing of mushroom into value added products would fetch a good business potential as well as add variety to the diet. Innovative methods of food processing techniques such as extrusion lend a large number of diversified products from mushroom after appropriate pre treatments. It would not only also increase the demand for the processors but also contribute towards the nutritive value of the foods. In this line, an innovative study was conducted by incorporating mushroom powder in optimized amounts during the extrusion of products such as vermicelli and pasta. The methodology comprises of slicing the mushroom to various dimensions, followed by drying the optimal size mushroom slices in a tray drier. Dried mushroom was powdered and then this was incorporated at various levels to basic dough prepared for extrusion of pasta products. The physiochemical and sensory characteristics of this new food product was evaluated.

**Keywords:** mushroom, extrusion, pasta, drying characteristics, evaluation.

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**ENZYME TECHNOLOGIES DEVELOPMENT IN FOOD INDUSTRY****Alexander Shleikin, Grigoriy Ternovskoy, Nikolay Danilov**

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The splitting enzymes are used usually in food technologies. A new direction of food enzymology is treatment of raw materials by binding enzymes. We have investigated the action of transglutaminase (TG), [EC 2.3.2.13] as regards technological and functional properties of bread, milk and combined products. TG catalyzes acyl transfer reaction between Glu  $\gamma$ -amine group of the first substrate and  $\epsilon$ -NH<sub>2</sub>-group belonging to Lys of second substrate. TG isoforms are widely distributed in living nature and take part of important physiological functions, including apoptosis, blood clotting, wound healing. Here was used preparation of microbial TG (Activa<sup>®</sup>), derived by Ajinomoto Co. It was established TG in concentrations 0.025–0.3% improves physical and textural properties of dough and quality of bakery foods, explaining by generation of proteinase resistant isopeptide bonds in gluten proteins. The conditions of milk serum proteins binding by TG were studied and was obtained curds enriched with serum proteins. It is known defect of gliadin digestion leading to autoimmune intestines damage – celiac disease; to reduce immune affinity of gliadin it was connected to milk serum proteins by TG. The lowering of immune activity of gliadin combined with milk proteins opens a new possibility for manufacturing of gliadin contained products for nutrition of celiac disease patients.

**Keywords:** transglutaminase, gliadin, milk serum proteins.For further information please contact: [shleikin@vandex.ru](mailto:shleikin@vandex.ru),

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## THE USING OF ENZYMES FOR WHEAT BREAD QUALITY AND SAFETY

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This study is focused on the investigation of the possibilities of wheat bread production with two types of enzymes: Pentopan - 1,4 beta xylanase and Novamyl - maltogenic amylase. The control bread samples 1 have been prepared without enzymes.

The bread samples 2; 3 and 4 have been prepared by using 0.0002; 0.0004 and 0.0006% Pentopan; the bread samples 5; 6 and 7 have been prepared by using 0.0002; 0.0004 and 0.0006% Novamyl; the bread sample 8 have been prepared by using 0.0002% Pentopan and 0.0002% Novamyl. The following characteristics of wheat bread samples have been measured: moisture, specific volume, porosity, sensory properties and staling.

The results of the baking tests showed that the biggest specific volume ( $3.82 \text{ cm}^3 \text{ g}^{-1}$ ) was bread sample 6 baked with 0.0004% Novamyl, i. e. 1,5 times bigger than the control sample. Also bigger than the control sample was sample 4 (with 0.0006% Pentopan). The specific volumes of the other samples varied from 2.57 till  $2.3 \text{ cm}^3 \text{ g}^{-1}$ . The most acceptable for the consumers was sample 8 (with 0.0002 % Pentopan and 0.0002% Novamyl) – 129.6 mm, and the worst sample was 4 (with 0.0006% Pentopan) – 77.6 mm. Sample 6 had the best rheological properties (with 0.0004% Novamyl), and the worst sample was with 0.0003 g Pentopan (4 samples).

The results of the baking tests showed that the addition of 0.0004% Novamyl (based on the amount of flour) gave the best results quality improving results for wheat bread.

**Keywords:** wheat bread, enzymes, quality, safety

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## EXTRUDED CORN FLOUR EFFECT ON THE QUALITY OF GLUTEN-FREE BREAD

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Celiac disease is a common complex disease caused by a dietary intolerance to gluten proteins found in all wheat types and closely related cereals such as barley and rye (Heap, van Heel, 2009). The only effective treatment is a strict gluten-free diet throughout life (Gobbetti *et al.*, 2003). Gluten-free breads often have poor crust and crumb characteristics, low quality, exhibit poor mouth feel and flavour (Katina *et al.*, 2005, Gallagher *et al.*, 2003).

The aim of this research was to investigate the effects of extruded corn flour addition on quality of gluten-free bread.

Four flour types (buckwheat, corn, rice, extruded corn) and six types of gluten-free breads made from buckwheat, corn, rice with or without extruded corn flour in various proportions were studied.

The main quality parameters of gluten-free flour and breads were determined using the following methods: hardness with *Texture analyser TA.XT. plus*, moisture content with *Precisa XM 120* at temperature 110 °C, microstructure was observed using *Zeiss „Axioskop 40”* microscope and *Axioskop 4.7* software.

Results showed that extrusion of corn flour has an effect on the size of starch granules, bread moisture, hardness and pore diameter. After partial flour replacement with extruded corn flour, it is possible to obtain gluten-free bread with more regular, stabile and porous texture.

**Keywords:** Gluten-free bread, extruded flour, quality.

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## CHANGES OF AGAR-AGAR GEL PROPERTIES AFTER REPLACING SUCROSE BY INULIN SYRUP

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A lot of research has been carried out to substitute the sugar in food products by other sweeteners since sugar consumption is directly related to diabetes and other illnesses such as obesity. Inulin is more commonly known as a prebiotic, soluble dietary fiber. In literature there is comparatively little information about inulin as a sweetener. Inulin syrup used in the research was obtained from the Jerusalem artichoke (*Helianthus tuberosus* L.) tubers. Therefore the aim of the research work was to evaluate properties of agar-agar gel when sucrose was replaced by inulin syrup. Agar-agar gel samples were prepared with different concentrations of inulin syrup to replace sucrose: 0%, 20%, 40%, 60%, 80% and 100%. Gel samples were prepared by adding inulin syrup at specific temperatures: 65 °C and 105 °C. To analyse the texture of the gel samples the Texture Analyser Model TA.XT Plus was used by slicing samples with a wire cutter (A/BC) while the colour was determined in the system of CIE L\* a\* b\* by using the Colour Tec-PCM, and for pH measurements – a pH-metre Jenway 3510 with a combined glass electrode was used.

The results of texture analysis show that strength (hardness) of the gel is influenced by the temperature as well as the concentration of the inulin syrup added to the gel samples. In the structure analysis the strength of the gel samples ranges from 7.40±0.66 N to 10.00±0.73 N and the strength increases in samples when a higher concentration of inulin syrup is added at a temperature of 65 °C, but an opposite situation is observed in the gel samples when prepared at a temperature of 105 °C. The colour parameter L\*, which describes lightness of the sample, ranges from 20.92 (20% of inulin) to 18.11 (100% of inulin) while pH of the gel samples ranges from 3.29 (20% of inulin) to 4.18 (100% of inulin).

**Keywords:** inulin syrup, agar-agar, gels

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Non-alcoholic CEREAL-BASED BEVERAGES  
WITH INCREASED oligosaccharides CONTENT

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Oligosaccharides are considered as dietary fibre which enhance growth of bifidobacteria in the large bowel. They may affect the human gastrointestinal tract beneficially and increasingly stand in the spotlight as possible prebiotics. During the past decade, the studies of the possibilities to increase the concentration of oligosaccharides in foods have received more and more attention.

The aim of this study was to develop new processing technology for making traditional Lithuanian non-alcoholic beverage type Gira by extending the spectrum of raw materials such as extruded rye and applying lactic acid bacteria (LAB) instead of baker's yeast to reduce alcohol content in the beverage as well as to find biotechnological means to improve its functional properties by increasing the concentration of oligosaccharides.

The influence of four xylanolytic commercial enzyme preparations Ceremix<sup>®</sup> Plus MG, Pentopan Mono BG, Depol<sup>™</sup> 680, Depol<sup>™</sup> 692 on the degradability of polymers in extruded rye were investigated, and identification and quantification of oligosaccharides formed after enzymatic hydrolysis and fermentation by (LAB) was performed. The changes of oligosaccharides were monitored by GLC, TLC and HPAEC methods.

The highest yield of arabinoxylooligosaccharides ( $0.15 \text{ g kg}^{-1}$ ), xylooligosaccharides ( $24.92 \text{ g kg}^{-1}$ ) and were released in the extruded rye treated with Ceremix<sup>®</sup> Plus MG. In addition to the xylooligosaccharides, a high increase in maltooligosaccharides ( $7.73 \text{ g kg}^{-1}$ ) was obtained by the action of other glycoside hydrolases presented in commercial enzyme preparations. It was noticed that oligosaccharides released after enzymatic hydrolysis were not fermented by LAB, but presented in the samples till the end of the fermentation process. Performed study revealed that the beverages made from extruded cereals hydrolyzed by the properly chosen xylanolytic enzymes can be used as a potential source of prebiotics.

**Keywords:** rye, extrusion, fermentation, beverage, oligosaccharides.

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# **Sustainable products and processes**

# FOODBALT-2011

## ELECTRONIC SPECTRUM OF PORK AND BEEF MUSCLE TISSUE SURFACE SAMPLES SUBJECTED TO ELECTRONIC-IRRADIATION PROCESSING

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All the processes, including pathological, regardless of the origin of solid object, start from its surface. The processes develop in deep and change the structure and properties of the sample in volume, but in this case the surface itself is appropriately transformed. One of the most effective methods for studying solid surfaces is electronic diffuse reflectance spectroscopy (ESDO), along with IR-spectroscopy, Raman and ESR. The ESDO method in the wave length range 200–750 nm was used in this work to study the combined effect of ethanol and irradiation with fast electrons by absorbed doses ranged within 12.5–50.0 kGray on the electronic spectrum of surface of restructured pork and beef muscle tissues and their slices. Ethanol has a preferential effect on different components of biological object depending on the concentration and contact time of full piece sample muscle tissue surface. A definite direction is given to the dominant processes in the subsequent irradiation of samples which are in restructured form depending on the absorbed dose. As a result, a selective medium depending on the absorbed dose is generated in the biological system, which, in turn determine the morphology of microflora forming during sample storage in the postradiation period.

**Keywords:** optical diffuse reflection, muscle tissue, electron-beam irradiation.

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**BLAST CHILLING METHOD FOR MEAT DISHES COOKING****Baiba Gingule, Martins Rucins, Viesturs Rozenbergs**

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In order to ensure hygienic end-product realization, it is necessary as soon as possible to the cooling, using efficient methods, such as the blast chilling equipment. Blast chilling equipment provides food chilling, optimum, 90–120 minutes to +3 °C, reaching an internal temperature of food, especially important to say, the perishable ready-to-eat product groups (first course, main courses and dressings, snacks), including meat dishes, which are used as a reference model in this study. Given the fact that in recent years, technology increasingly refuse from discrete point, switching to the fuzzy temperatures, a study was conducted as a separate meat dishes microbiological indicators, they are not chilling technology to the +3 °C and +7 °C and +11 °C. Research was carried out in *Amica Ltd* professional kitchen, using blast chilling equipment, and *Microbiology Laboratory of Faculty of Food Technology, Latvia University of Agriculture*. The study used two types of *Amica Ltd* catering companies more often used for meat dishes - pork goulash and minced meat sauce. Research results show that, by balancing the food safety standards and cost-efficiency, chilling end temperature of blast chilling in the range of +3–10 °C, followed by further storage in freezer. It was recommended to stop the blast chilling +5–9 °C temperature range, depending on the required shelf life for the finished product. Since the time-temperature relationship is hyperbolic in nature, where the hyperbola is a curve of the function values of +10–60 °C, which is favorable for the development of microorganisms, while the argument value of curvature is between 10–80 minutes, it leaves a significant impact on the production less efficient. It is therefore essential that the limit, to encourage the blast chilling process, reducing the length to be able to optimize the overall process.

**Keywords:** blast chillers, ready-to-eat products.For further information please contact: [martins.rucins@llu.lv](mailto:martins.rucins@llu.lv), +37163005647

## MODEL DEVELOPMENT FOR FRESH BAKED BREAD NATURAL AND FORCED COOLING

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Industrial production of bakery products allows consumers to get fresh bread at any time of the day. However, there are many problems connected with storage and cooling of bread before distributing it to the trading network.

Microbiological safety requirements and marketing necessitates the packaging of bread into films after baking. However, this is only possible when the baked bread has cooled. Rate of cooling is, therefore, very critical parameter. Low cooling rates can limit production capacity in a bakery, while higher cooling rates can lead to higher moisture evaporation rate and result in greater weight loss of the product. The moisture distribution in bread at the end of cooling can also result in water condensation on the film, which can accelerate fungal growth. The principal objective of this work is to study the effect of cooling conditions on heat and mass transfer in bread, and assess their influence on product quality.

Experiments were carried out with white pan bread which was prepared in a laboratory. Cooling was undertaken in ambient environment ( $26\pm 2$  °C, RH 50%) by placing the hot product on a rack, as well as in a climatic cabinet with controlled temperature, humidity and level of convection. A mathematical model based on Fourier's second law for heat transfer and the Fick's second law for the mass transfer was developed to simulate heat and mass transfer processes in the bread during cooling, and validated using experimental data.

The model is able to predict mass and volume changes during the „cooling“ time.

**Keywords:** Bread cooling, model development, heat and mass transfer.

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## EFFECT OF PASTEURIZATION ON COMPOSITION OF VOLATILES IN FERMENTED APPLE JUICE

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Pasteurization is a heat treatment used to destruct spoilage microorganisms and inactivate enzymes, but it can influence quality of the final product. The aim of current research is to evaluate the influence of pasteurization temperature on the volatile compounds of fermented apple juice of the variety 'Kerr'.

For analysis apples of the variety 'Kerr' grown in the Latvia State Institute of Fruit Growing and harvested in October 2010 were used. Juice was obtained by press Voran Basket press 60K. For stabilization of juice Tannisol (Enartis, Italy) was added. Tannisol capsules consist of potassium metabisulphite (95%), ascorbic acid (3%); and tannin (2%). Pasteurisation was carried out in plate heat exchanger FT74X (Armfield, UK) at 70, 80, and 90 °C temperatures. Fermentation was performed using commercial *Saccharomyces bayanus* yeast. Volatile aroma compounds of apple juice, yeast and fermented juices were determined. Extraction of aroma compounds was performed using solid phase microextraction by fibre Car/PDMS. Analysis of volatile aroma compounds was made using a Perkin Elmer Clarus 500 GC/MS.

The data obtained in the present study show the effect of pasteurization on the volatile compound composition in juice and fermented juice. The main group of volatiles in juice was esters, whereas in fermented juices – alcohols. Main components present in unpasteurised juice were hexylacetate, butylbutanoate, propylbutanoate. In pasteurised juice content of butanoates increased, whereas – acetates decreased with increase in pasteurization temperature. The highest total peak area of volatile compounds was detected in unpasteurized juice, and also comparing fermented drinks the highest content of volatile compounds was detected in fermented juice made from unpasteurized juice. Pasteurization has various effects on content of compounds – content of ethyloctanoate decreased by increasing temperature whereas hexyl hexanoate increased.

**Keywords:** apple juice; pasteurization; fermentation, volatile compounds.

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**FOOD CHEMISTRY, ANALYSIS  
AND QUALITY ASSESMENT**

**VALIDATION OF MONOMERIC ANTHOCIANIN  
DETERMINATION METHOD FOR  
BLUEBERRY JUICE AND POMACE EXTRACTS**

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The solid waste generated in industrial berry juice production was considered as a low cost raw material for the extraction of natural antioxidants. Berries contain phenolic compounds with high antioxidant potential, including anthocianin. Quantitative determination method for monomeric anthocianins in blueberry juice and solid residues was validated. An official method from Association of Analytical Communities was used to determine anthocianins in juice and pomace extracts by measuring light absorption for solutions with pH values 1.0 and 4.5 at 520 nm and 700 nm. Results were expressed as cyanidin-3-glucoside equivalent, as it is the most common anthocianin pigment. Calibration curve was obtained, linearity was checked, working interval and accuracy was determined and samples were tested. Mentioned method was evaluated as appropriate for quantitative anthocianin analysis in blueberry juice and pomace. Necessity of calibration curve was approved using extinction coefficient of cyanidin-3-glucoside instead. Method assures adequate precision and accuracy as well.

**Keywords:** natural antioxidants, monomeric anthocianins, blueberry.

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## EXTRACTS OF JAPANESE QUINCE SEEDS – POTENTIAL SOURCE OF ANTIOXIDANTS

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Japanese quince (*Chaenomeles japonica*) is a minor fruit crop in Latvia and Lithuania; it is used for production of juice, aroma and fruit fibers. The seeds are by-products of food processing that could be used further for different purposes.

The seeds of Japanese quince contain about 10 to 20% of oil. The composition of this oil is quite unique: nearly 90% of it is formed by two fatty acids - linoleic (52.4%) and oleic (35.6%). We have also found out that the extracts of Japanese quince seeds can be used to improve stability of vegetable oils; 10% additive of ground seeds to rapeseed oil and 5% additive to hempseed oil can increase the oxidative stability of these oils about 2.0 and 1.6 times, respectively. Unfortunately, the seeds of Japanese quince contain also amygdalin - toxic cyanogenic glycoside. Due to this compound the usage of seeds of Japanese quince are very limited, especially in case of their hydrophilic extracts.

Our research was focused on hydrophilic extracts of seeds in order to find out both the best method to prepare polyphenols rich extracts, as well as to determine the amount of toxic amygdalin in the ethanol/water extracts of seeds and in the extracted seeds. We have found out that the largest amount of total polyphenols can be obtained when whole seeds are extracted with the mixture of ethanol and water under reflux. The antioxidant activity of the prepared hydrophilic extracts were characterized by DPPH test.

**Keywords:** Japanese quince, seeds, antioxidants, polyphenols, amygdalin.

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## THE CONTENT OF POLYPHENOLS AND TANNINS OF SEVERAL APPLE CIDER VARIETIES GROWN IN LATVIA

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Most cider cultivars have substantially greater polyphenol and antioxidant content than dessert apples, which is advantageous both for cider flavour and dietary benefit. For natural cider-making most suitable are bittersweet apple cultivars, to a smaller extent - bittersharp ones. However, excess tannin content is not desirable. To obtain appropriate taste proportions of cider, cultivars are often mixed. There is no cider making tradition in Latvia, cultivars with higher content of tannins are found only in collections. Only a few apple cultivars with high sugar and lower acid content are available for industrial processing.

The aim of the study was to evaluate the content of polyphenols and tannins in cultivars promising for cider production. Eight cultivars - crabapples 'Dzeltenais skābais', 'Hyslop', 'Quaker Beauty', 'Kerr', 'Kuku', 'Riku', 'Ruti' and large-fruited DI-93-4-14 were evaluated in 2009 and 2010.

The total phenolic content varied greatly from 26 to 438 mg 100 g<sup>-1</sup>, significantly depending on year. 'Quaker Beauty', 'Kuku', 'Ruti' and DI-93-4-14 contained polyphenols below 100 mg·100g<sup>-1</sup>, 'Riku' in the range 100–200 mg 100 g<sup>-1</sup>, while 'Dzeltenais skābais' contained more than 300 mg 100 g<sup>-1</sup>. The content of tannins in apple juice significantly depended on the year, the highest content was found in crabapple 'Dzeltenais skābais' juice (average 3.28 mg L<sup>-1</sup>). Two cultivars had low juice yield - 'Quaker Beauty' and 'Dzeltenais skābais', for others it was more than 50%. The highest yield of juice had cultivars 'Kuku' (58%), 'Hyslop' (54%) and 'Kerr' (56%). It can be concluded that in Latvian conditions cider production is possible by mixing different cultivars.

**Keywords:** cider, crabapples, polyphenols, tannins.

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## CHEMICAL CHANGES OF SPICE ANTIOXIDANTS DURING THERMAL TREATMENT

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Spices and aromatic plants are an important source of dietary antioxidants. As a result of this discovery, during the last decade studies of their antioxidative properties have been markedly expanded to develop knowledge and understanding of this important knowledge. The spices are often added to the foods before thermal treatments occur - such as cooking, frying or barbecuing - all of which are performed at differing temperatures. Consequently, the structures and the properties of antioxidants present in such spices may undergo various heat induced changes. This study is aimed at assessing the changes in chemical composition and antioxidant properties of the following herb extracts subsequent to heat treatment; sweet basil (*Ocimum basilicum*), creeping thyme (*Thymus serpyllum*) and winter savory (*Satureja montana*). For this purpose the extracts at the concentration of 0.1% were boiled in the glass vessels on a heating plate with magnetic stirring connected to reflux condensers for a period of 1 hour. The Radical Scavenging Capacity of extracts was measured by a free DPPH<sup>•</sup> Radical Assay method, while their chemical composition was analysed on a high performance liquid chromatograph equipped with mass spectrometric detector (HPLC-MS). Rosmarinic acid, apigenin, luteolin, quercetin and some phenolic glycosides were identified as the main constituents in the basil, thyme and savory extracts. The extracts were notably strong radical scavengers both before and after thermal treatment, however, some changes in their composition as well as antioxidant properties were observed. This has been identified as taking place during thermal treatment.

**Keywords:** spices, antioxidants, thermal treatment, DPPH.

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**INFLUENCE OF HARVESTING TIME  
ON THE YIELD AND CHEMICAL COMPOSITION  
OF LITHUANIAN SAGE (*SALVIA OFFICINALIS* L.)**

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*Salvia officinalis* L. is cultivated mostly for its culinary and medicinal purposes. Essential oils of sage are used for healing of various diseases and, recently, it has been demonstrated that sage essential oil can improve memory, showing promise in the treatment of Alzheimer's disease, and it has also a potential in treating cancer as it shows strong antitumorigenic activities. Also, sage is a natural source of polyphenolic compounds and possesses strong antioxidant and radical-scavenging activities. The influence of harvesting time (seasonal variation) on the yield of crop, as well as production and composition of essential oil and some other chemical characteristic of sage (*Salvia officinalis*) grown in Lithuania was investigated. The yield of crop depends on growing phases of plant vegetation and varied between 3.0–10.0 t ha<sup>-1</sup> and 0.52–2.73 t ha<sup>-1</sup> of fresh and dried sage herb, respectively. *Salvia officinalis* grown in Lithuania is low in essential oil content and at different growing periods it was obtained 0.09–0.18 cm<sup>3</sup> 100 g<sup>-1</sup> (fresh) and 0.36–1.75 cm<sup>3</sup> 100 g<sup>-1</sup> (dried). More than 50 constituents were identified in sage essential oils by capillary GC and GC-MS. It is evident that *Salvia officinalis* grown in Lithuania depends to  $\alpha$ -thujone and camphor chemotype. The amount of *cis*- isomer  $\alpha$ -thujone was 30.3–39.7% (fresh) and 15.2–30.1% (dried); that of its *trans*- isomer  $\beta$ -thujone 5.8–6.1% (fresh) and 5.3–7.9% (dried) in all essential oils of sage aerial part at different growing phases. It is important that these toxic ketones did not exceed the limited amount of the standard ISO 9909 (1999). Other important components were 1,8-cineole, borneol,  $\alpha$ -humulene, viridiflorol and manool. The chemical composition of sage was also investigated and the amount of dry soluble solids, ascorbic acid content, carotenes, nitrates and the amount of total sugars were determined in fresh raw material at different growth stages.

**Keywords:** Sage; *Salvia Officinalis*; Seasonal variation; Chemical composition; Essential oil; Crop; Yield.

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## ESSENTIAL OIL, PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY OF LITHUANIAN CULTIVATED TANACETUM VULGARE L.

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Tansy (*Tanacetum vulgare* L.) is an aromatic plant of the Asteraceae family mainly spread in the northern hemisphere in Europe, Asia and North America. Due to its strong scent characteristic for essential oil, the plants have been used as antiseptic and insecticide. The essential oil (EO) of tansy contains a large number of monoterpene and sesquiterpene structures, sesquiterpene lactones, sterols, phenolics, coumarins, alkaloids, polysaccharides. Herbal preparations of tansy possess strong biological and medical activities. It was also reported that tansy is good source for natural antioxidants and flavonoids. The leaves of tansy can be used as a spice instead of cinnamon and Muscat nuts.

Production of EOs results in a very high content of by-products, which usually remain unused after distillation. Therefore such by-products should be carefully investigated to assess the possibilities of their further processing to various valuable products. The EO was obtained by hydrodistillation of dried tansy herb and analysed by capillary GC and GC-MS. The residues were separated into liquid and solid fractions. The liquid fraction was freeze-dried; the solid fraction was dried and then extracted with acetone with the possible use as source of natural food antioxidants. In the present study an initial screening for radical scavenging activity of hydrodistillation by-products extracts from *Tanacetum vulgare* has been performed using DPPH<sup>•</sup> and ABTS<sup>•+</sup> radical scavenging assays. Total content of phenolic compounds was analysed by UV-spectrophotometry method using Folin-Ciocalteu reagent. Tansy extracts were also tested with an oil oxidation test (analytical oxipres method).

**Keywords:** Tansy; *Tanacetum vulgare*; Essential oil; by-products; yield; antioxidant activity.

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**BIOLOGICALLY ACTIVE COMPOUNDS IN ROASTED COFFEE**

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Coffee is one of the products rich in biologically active compounds. The aim of the research work was to investigate content of total phenols, flavonoids and caffeine in coffee available in local market as well as it changes depending on variety.

Two varieties used in the research were analysed: Arabica (*Coffea arabica* L.) and Robusta (*Coffea canephora* L.). Content of total phenols and total flavonoids were determined spectofotometrically. Content of caffeine and polyphenols (gallic acid, catehin, caffeic acid, vanillin, chlorogenic acid, epicatehin and ferulic acid) were determined by high performance liquid chromatography.

Total phenols in analysed coffee samples ranged from 1300 to 3700 mg gallic acid equivalents (GAE)  $100\text{ g}^{-1}$ , total flavonoids – from 15 to 103 mg quercetin equivalents (QE)  $100\text{ g}^{-1}$  coffee. The content of polyphenols varied in wide range too: gallic acid from 2.5 mg to 80 mg  $100\text{ g}^{-1}$ , catehin from 30 to 80 mg  $100\text{ g}^{-1}$ , caffeic acid from 1200 to 2500 mg  $100\text{ g}^{-1}$ , vanilin from 100 to 150 mg  $100\text{ g}^{-1}$ , chlorogenic acid from 1.4 to 2.8 g  $100\text{ g}^{-1}$ , epicatehin from 11 to 30 mg  $100\text{ g}^{-1}$ , and ferulic acid from 23 till 120 mg  $100\text{ g}^{-1}$  coffee. The content of caffeine ranged from 0.7 till 1.5 g  $100\text{ g}^{-1}$  coffee.

The highest content of caffeine, catehin, caffeic acid and ferulic acid was detected in coffee samples with higher proportion of Robusta coffee variety. Total phenols and total flavonoids content did not vary significantly between coffee varieties.

**Keywords:** coffee variety, caffeine, total phenols, flavonoids.

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## BIOACTIVE COMPOUNDS OF LATVIAN WILD EDIBLE MUSHROOM *BOLETUS EDULIS*

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Considering the interest for mushrooms and the demand to search for natural antioxidants and other sources of bioactive-compounds, the aim of this study was to investigate the bioactive compounds content of two widely used wild edible mushrooms *Boletus edulis f. beticola* and *Boletus edulis f. pinicola* collected at Jelgava and Riga regions in Latvia in late summer 2010.

Ash amount was determined to characterize the mineral content, protein was determined by Lowry method (325–526 mg g<sup>-1</sup> of dried mushrooms). Methanol and hot water extracts of mushrooms were prepared. In water extract titratable acidity was determined (0.22–0.26 mmol of NaOH per g of dried mushrooms) and formol number (0.74–1.40 mmol NaOH per g of dried mushrooms). The total content of phenolic compounds (TP) was determined by using Folin-Ciocalteu assay. TP were higher in the water extracts (11.21–12.52 mg of gallic acid equivalents GAE per 1 g of dried mushrooms) than in methanol extract (7.25–8.04 GAE per 1 g of dried mushrooms). The total content of flavonoids (TF) was determined as described by lia et al. TF were higher in the methanol extracts (0.33–0.37 mg of quercetin equivalents QE per 1 g of dried mushrooms) than in water extract (0.13 QE per 1 g of dried mushrooms). Using HPLC the phenolic compounds like gallic acid, caffeic acid, ferulic acid, catechin, epicatechin and rutin has been detected and quantified.

β-carotene and lycopene was determined as described by Barros et al. DPPH assay was used to evaluate free radical-scavenging capacity.

**Keywords:** wild edible mushrooms, bioactive compounds.

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## POLYPHENOLS AND VITAMIN E AS POTENTIAL ANTIOXIDANTS IN BARLEY AND MALT

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Barley (*Hordeum vulgare L.*) is an ancient and important cereal grain crop. Whole grain products are recommended for healthy diets as being recognized sources of dietary fiber and antioxidant substances – such as polyphenols and vitamin E.

The aim of current research is to compare the content of total phenolic compounds (TPC) and vitamin E of different barley varieties and malt types.

One hulled, typical malting barley variety 'Klass', four hull-less barley lines from Latvia and theirs corresponding malt and for comparison four types of industrial malt – Pilsner, Munich, light, caramel and black malt were used for analyses.

The total phenolic concentration was determined spectrophotometrically according to the Folin-Ciocalteu colorometric method with some modifications. Total phenolics were expressed as gallic acid equivalents ( $\text{mg GAE g}^{-1}$ ) dry weight of samples. During research the vitamin E content was analysed using standard methods AOAC 971.30.

All barley varieties and malt samples exhibited significant content of vitamin E, and contained significant levels of phenolic compounds.

The content of vitamin E in all barley samples was similar and its increase during malting was equate, respectively by 34%. Increase of content of vitamin E during malting could explain by synthesis of vitamin E in germination process of grains. Content of vitamin E in malt is depending of kilning temperature: higher kilning temperature, higher losses of vitamin E.

A significant increase in TPC (2.017 to 3.406  $\text{mg GAE g}^{-1}$  dw) in all malt samples was observed after malting, respectively after steeping, germinating and kilning samples showing greater effect. It increases during malting probably not only by the modification or releasing of phenolic compounds, but also by the formation of new antioxidants, such as Maillard reaction products.

**Keywords:** barley, polyphenols, vitamin E

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## **ECHINACEA PURPUREA EXTRACT AS A NATURAL PRESERVATIVE IN CAKE**

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Oxidation of lipids causes reduction of organoleptic properties and nutritional value of products that contains lipids. Nowadays, there is a growing demand for the natural antioxidants due to the harmful effects of synthetic antioxidants (such as BHA, BHT and TBHQ). Antioxidant and antifungal activity of extract of *Echinacea purpurea* L. were evaluated in cake. It is a valuable medicinal plant that used a lot in treatment of diseases. In this study extract of aerial parts of *Echinacea purpurea* L. apply instead of synthetic antioxidants in cake. The antioxidant activity of the extract (at 1000, 1500 and 2000 ppm) and synthetic antioxidant of BHA (at 100 and 200 ppm) were compared by measuring peroxide and thiobarbituric acid values in different storage times (1,5,8,15,30,45,60 and 75 days). Different levels of extract were able to retard the oxidation rate of cake, extract at 1000 ppm showed the lowest peroxide value, the antioxidant activity of extract was better than BHA 200 ppm ( $p < 0.01$ ). Extract of *Echinacea purpurea* L. have a good antimicrobial effects on cake during storage at room temperature. *Echinacea purpurea* L. extract at 1500 and 2000 ppm showed the best antimicrobial activity ( $p < 0.01$ ). Cakes treated with the extract were well acceptable in terms of sensory parameters during storage period and they were not different from the control ( $p < 0.01$ ). Results showed that extract from *Echinacea purpurea* L. were more effective in controlling growing molds and lipid oxidation during storage.

**Keywords:** *Echinacea purpurea* L.; Extract; Antioxidant activity; Cake.

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**CHARACTERIZATION OF VINEGAR AROMA COMPOUNDS:  
COMPARISON OF EXTRACTION PARAMETERS****Zanda Krūma<sup>a</sup>, Thierry Talou<sup>b</sup>**<sup>a</sup> Latvia University of Agriculture (Jelgava, Latvia),<sup>b</sup> Université de Toulouse/INPT-ENSIACET (Toulouse, France)

Vinegar is a product resulting from the alcoholic and subsequent acetic fermentation of any fermentable starting material rich in carbohydrates. Aroma is one of the most important factors in the determination of vinegar character and quality. The objective of the present study was to characterize volatile compound profile of red wine vinegar and aromatised vinegars depending on extraction parameters by headspace solid-phase microextraction (HS-SPME).

In present study a commercial red wine vinegar and vinegars aromatised with dill and basil were used. Extraction of aroma compounds was performed using solid phase microextraction by Car/PDMS fibre. Influence of three extraction parameters were analysed: temperature (20 and 60 °C), stirring (with and without) and additive incorporation (NaCl). Analysis of volatile aroma compounds was made using a Perkin Elmer Clarus 500 GC/MS.

The main identified compound classes in vinegar were acids forming 77-90% and esters forming 9-16% of total volatile compounds depending on extraction conditions. Acetic acid was identified as the main volatile compounds of red wine vinegar. Extraction conditions significantly changed volatile compound profile. Addition of NaCl promotes release of several compounds as isoamylacetate, ethylacetate. Whereas using extraction at higher temperatures (60 °C) content of both these compounds decreased, whereas content of 2-phenylacetate, benzaldehyde, phenylethylalcohol increased. In aromatised vinegars also extraction conditions influenced headspace composition. Addition of NaCl decreased content of typical dill volatile compounds  $\alpha$ -phellandrene,  $\beta$ - phellandrene, o-cymene, except dill ether. Whereas in vinegar aromatised with basil, NaCl addition accelerated releas of all typical basil volatiles.

**Keywords:** SPME, vinegar, volatile compounds, extraction

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**FOOD QUALITY AND SAFETY**

**AMOUNTS OF HEAVY METALS IN BALTIC COD MEAT****Viktoras Liorančas<sup>a</sup>, Jelena Andriejauskienė<sup>a</sup>**<sup>a</sup>Klaipėda's State College (Klaipėda, Lithuania)

The aim of the study was to analyze the amount heavy metals in Baltic cod meat. Three year averages of Pb, Cd and Hg in cod muscle are reported (the study was conducted in 2008–2010) and data compared with the acts of the Republic of Lithuania and the European Union. The information and research material (data on the amount of heavy metals) were received from the National Laboratory of Veterinary. During the monitoring period amounts of heavy metals Pb, Cd and Hg in cod meat corresponded to the allowable standards and are close to Lithuanian Hygiene Norms MAL. The results of this work obligate to control the amounts of heavy metals fish regularly.

**Keywords:** heavy metals, fish, cod, contamination.

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## DEFORMATION DISEASES OF EXTREMITIES OF TURKEYS EFFECTING MEAT QUALITY

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Leg abnormalities in poultry meat are a very complex problem that can be influenced by many different factors. Intensive growing of turkeys often raised diseases of the extremities, such as pododermatitis, arthritis-tendovaginitis and Valgus-Varus deformation. The aim of this study was to determine whether pathology of legs affects the quality of turkey meat. A for this purpose adapted acoustic method to investigate structural properties of breast and thigh muscles of turkeys have been used. The method was realized by using an acoustic spectrometer. The values of the acoustic signal amplitude were measured in the frequency range of 4.95–35.71 kHz. Prior to the study an optimal acoustic signal of 22.73 kHz frequency was established, which was used in the further studies. Results showed that the turkeys with Valgus-Varus deformation was not significantly different from the muscles structure of the healthy turkeys, whose amplitude value of the acoustic signal were: breast muscles –  $0.4173 \pm 0.23$ ;  $0.4830 \pm 0.07$ , respectively and thigh muscles –  $0.4165 \pm 0.23$ ;  $0.3888 \pm 0.15$ . In compare with the other diseases pododermatitis and arthritis-tendovaginitis by sick turkeys, the amplitude value of the acoustic signal were slightly higher - breast muscles  $0.5026 \pm 0.20$ ;  $0.4909 \pm 0.23$  and thigh muscles  $0.5028 \pm 0.21$ ;  $0.4740 \pm 0.23$  respectively, which is related with the changes of the muscles structure.

Thus, pathology of the extremities, one of the major problems in poultry meat production, could affect the muscles structure of turkey meat.

**Keywords:** diseases of extremities, turkey, meat quality.

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## OCCURRENCE, NUMBERS AND GENETIC DIVERSITY OF *CAMPYLOBACTER* SPP. IN RETAIL BROILER MEAT IN LITHUANIA

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The aim of this study was to examine the occurrence, numbers and genetic diversity of thermophilic *Campylobacter* spp. in raw broiler meat at the retail level in Lithuania.

Direct inoculation on selective medium and selective enrichment in Bolton broth with subsequent plating on mCCDA were used for *Campylobacter* isolation. Appropriate decimal dilutions were made from 0.1 ml of samples rinsate to quantify numbers of *Campylobacter*. Obtained isolates were identified to species level using a multiplex PCR method. Subsequently, 75 isolates of *C. jejuni* and 35 of *C. coli* were getyped using *flaA*- RFLP method. The software SPSS version 9.0 was used for statistical analysis. The Simpson's index (D) was used to determine the genetic diversity of *Campylobacter* isolates.

Out of the 152 broiler wings and 152 broiler drumsticks samples examined 134 were contaminated with campylobacters. The overall mean number of *Campylobacter* detected on wings was 1.55 log<sub>10</sub> CFU/ml and on drumsticks 1.56 log<sub>10</sub> CFU/ml, respectively. Multiplex- PCR has identified *C. jejuni* in 57.46% and *C. coli* in 41.04% of tested samples. The genotypic characterization of 75 isolates of *C. jejuni* revealed 19 different *flaA* genotypes, and 11 genotypes were detected among 35 isolates of *C. coli*. The calculated Simpson's index showed, that *C. jejuni* genetic diversity was higher in comparison to *C. coli*. This study showed a high retail broiler meat contamination with *Campylobacter* spp. in Lithuania. The results indicate the importance of retail broiler meats as potential sources of *Campylobacter* spp. infection for consumers. However, further studies are needed to determine the relationship between *Campylobacter* spp. isolated from broiler meat and clinical cases of human campylobacteriosis. Thus it will allow us to evaluate the risk that broiler meat contaminated with *Campylobacter* spp. cause to consumers in Lithuania.

**Keywords:** *Campylobacter* spp., broiler meat, retail.

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## PREVALENCE OF *YERSINIA ENTEROCOLITICA* IN THE ENVIRONMENT OF SLAUGHTERHOUSE

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A total amount of 64 surface swabs from slaughterhouse rooms and equipment, work tools and clothes were collected in three large scale slaughterhouses between January 2006 and January 2009 at pig slaughter. Samples were tested according to ISO 10273 standard requirements, with subsequent cold enrichment for three weeks in peptone mannitol bile salt broth. Isolated cultures were confirmed with API 20E, after that all *Y. enterocolitica* isolates were biotyped and serotyped. In general, the prevalence of *Y. enterocolitica* in the environment of slaughterhouses was 37% (24/64), where 34% (22/24) and 3% (2/24) comprised *Y. enterocolitica* 1A and *Y. enterocolitica* 4/O:3, accordingly. *Y. enterocolitica* 1A was recovered in slaughterhouses A, B and C with the prevalence 42% (8/19), 33% (9/27) and 28% (5/18) of positive cases, while *Y. enterocolitica* 4/O:3 was observed only in slaughterhouse A with the prevalence 11% (2/19). *Y. enterocolitica* 1A was found on sink (4/4/100%), meat inspection platform (2/4/50%), floor (5/12/42%), table for work equipment (2/3/33%), door (2/3/33%), box for cold storage of products (1/4/25%), apron (1/4/25%), gloves (1/4/25%), work footwear (1/4/25%), work surface (1/5/20%), hook (1/5/20%), box for offals (1/7/14%) samples. *Y. enterocolitica* 4/O:3 was found on work surface (1/5/20%) and floor samples (1/12/8%). No significant differences ( $p > 0.01$ ) were observed in the prevalence of *Y. enterocolitica* in environmental samples between slaughterhouses A, B and C. The presence of *Y. enterocolitica*, especially of pathogenic bioserotype 4/O:3 in environmental samples, indicated that environment of the slaughterhouse can be a cause of contamination of slaughterproducts with yersiniae, and greater efforts should be made to maintain hygiene in slaughterhouse on acceptable level.

**Keywords:** non-pathogenic yersiniae, pathogenic yersiniae, hygiene, pig.

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**ETHANOL EFFECT ON THE RADIOLYSIS OF PORK TISSUE****Svetlana Orehova, Ulyana Nechiporenko, Inna Vasilieva, Alla Nechiporenko**St. Petersburg State University of Low Temperatures and Food Technologies  
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Conventional preservation with the use of ionizing radiation is the most modern and highly economic technology of safe food production. We used pH-metry and microscopy methods to investigate the effect of short-term treatment of full piece sample muscle surface with ethanol on the radiolysis by variable absorbed doses 12.5–50.0 kGray. There were investigated restructured samples of muscle tissue and muscle fiber under these conditions. Autolytic and microbial processes of samples for sealed postradiation period by storage at +4 °C were differentiated on the timeline as a result of ethanol treatment. Overall stabilizing effect of ethanol and electron-beam exposure on the acidity of the restructured muscle tissue samples with preservation of their initial pH level within 3–4 weeks. It was marked this effect is depending on the absorbed dose.

**Keywords:** electron-beam irradiation, muscle tissue, radiolysis.For further information please contact: [shleikin@yandex.ru](mailto:shleikin@yandex.ru),  
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## THE MICROBIOLOGICAL QUALITY AND PHYSIOCHEMICAL PARAMETERS OF COLD-SMOKED SAUSAGES DURING RIPENING

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Many recent studies in food safety have investigated non-thermal processing of ready-to-eat food products, but there is little information about the survival of food pathogens in different ripening stages of cold smoked sausages. Therefore, the microbiological quality (total aerobic count - TAC, *Staphylococcus aureus*, *E. coli*, *Salmonella spp.*, and *Listeria spp.*), water activity ( $a_w$ ), and pH were determined in cold-smoked sausages during the ripening time from days 0 to 21. The temperature in smoke camera was 28 °C for the first 3 days of maturation and  $15 \pm 1$  °C during days 4 to 21. As a result the TAC of starter culture bacteria increased from 5.72 lg cfu g<sup>-1</sup> at the beginning to a maximum of 9.41 lg cfu g<sup>-1</sup>. The count of *S. aureus* increased from 1.38 to 2.68 lg cfu g<sup>-1</sup> and *E. coli* decreased from 2.47 to 0.85 lg cfu g<sup>-1</sup>. *Salmonella spp.* was not detected at any time. *Listeria monocytogenes* was found in one of 5 sausage series, but measured only during the first 5 days when the count decreased from 3.41 to 2.08 lg cfu g<sup>-1</sup>. The mean value of pH decreased from 5.80 to 4.65 in the first 5 days and stabilized. Water activity ( $a_w$ ) decreased slowly and generally correlated with air humidity in the ripening camera and the mean value changed from 0.963 to 0.817  $a_w$ . A significant different correlation between the bacterial count and  $a_w$  values were found. The results indicate that the microbiological safety of cold-smoked sausages depends on the initial contamination level with food pathogens. The analysis was done at the Faculty of Veterinary medicine of the Latvia University of Agriculture and in the sausage manufacturer's laboratory.

**Keywords:** food pathogens, cold-smoked sausage, water activity, pH.

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## SCREENING OF LACTIC ACID BACTERIA ISOLATED FROM DANISH BREAD SOURDOUGHS FOR PHYTASE ACTIVITY

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The nutritional value of bread products is related to the biotechnological means used in the technological process applied. The aim of this study was to determine the phytase activity of lactic acid bacteria (LAB) isolated from Danish bread sourdoughs (wheat and rye). In first stage forty-six strains of LAB were isolated and characterized microbiologically according to their ability to utilize phytic acid from the phosphates medium. The LAB isolates were tested on a micro-titer plate in a liquid phosphates medium as well as on a solid medium. Thereupon the identification of LAB isolates has been carried out. The following species of LAB have been identified: *Lactobacillus pontis*, *L. paralimentarius*, *L. plantarum*, *L. panis*, *L. helveticus*, and *L. pontis* NM100-2. These LAB species have been analysed for extracellular and intracellular phytase activities. The results showed that some LAB isolates such as *Lactobacillus pontis* demonstrated a higher extracellular phytase activity ( $1-6.1 \log_{10} \text{CFU mL}^{-1}$ ), while intracellular activity has been found lower (less than  $0.84 \text{ U mg}^{-1} \text{ proteins}$ ). The identified LAB strains with high phytase activity could be used for the baking industry and especially for the increase of the nutritional value of whole grain bread with a high amount of dietary fibre.

**Keywords:** bread sourdough, lactic acid bacteria, phytase activity.

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**SAFETY ASPECTS OF FERMENTED PLANT PRODUCTS**

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The aim of this study was to evaluate the impact of fermentation with *Pediococcus acidilactici* M1807 and spontaneous sourdough on the formation of biogenic amines in different plant products: defatted flaxseed, yellow lupine (*Lupinus luteus* L.), white lupine (*Lupinus albus* L) and the soya varieties “Rudoji” and “Progress”. The products were fermented with *Pediococcus acidilactici* M1807 and spontaneous sourdough (+30 °C; 4 days). Biogenic amines were identified using high pressure liquid chromatography method with an UV detector.

Results of the study show that the amount of biogenic amines in different plant products depends on the specificity of the product matrix and ranged from 392.4 mg kg<sup>-1</sup> (in *L. luteus*) to 121.8 mg kg<sup>-1</sup> (in the soy seed variety “Progress”). The amount of histamine and tyramine in unprocessed products ranged from 5.4 mg kg<sup>-1</sup> (in defatted soy flour) to 30.5 mg kg<sup>-1</sup> (in the soy seed variety “Rudoji”). When fermented with spontaneous yeast, more histamine and tyramine was formed in the majority of the analysed vegetable products except in the “Progress” soy seed variety where the amount of histamine remained unchanged (5.5 mg kg<sup>-1</sup>); the amount of tyramine increased except for the defatted milled flaxseed where the amount of histamine decreased 2.1 times by fermenting. *Pediococcus acidilactici* M1807 differently influenced the formation of histamine and tyramine in the analysed products. None of the fermented plant products exceeded the recommended concentration levels (of 500 mg kg<sup>-1</sup>), therefore, both spontaneous sourdough and *Pediococcus acidilactici* M1807 may be used in the fermentation of the analysed products.

**Keywords:** biogenic amines, fermentation, plant products.

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**PHYTASE ACTIVITY OF LACTIC ACID BACTERIA STRAINS,  
ISOLATED FROM LITHUANIAN SOURDOUGHS**

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Phytate is the major storage form of phosphorus in cereals. It is a strong chelator of divalent minerals such as  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Fe}^{2+}$  and binds with these minerals herewith decreases their availability for absorption in the humans gut. A reduction of the phytate can be achieved by phytase.

The aim of this work was to isolate lactic acid bacteria (LAB) strains from Lithuanian sourdoughs and to screen them for phytase activity.

To screen LAB for phytase activity three chemically defined medium were used: CDM+Phy (phytate medium), CDM+P (positive control, phosphate containing medium) and CDM-P (negative control, phosphate-free medium). The initial screening of phytase-active LAB was done on solid and in liquid media. Phytase activity was estimated colorimetrically by monitoring the liberated inorganic phosphate from the phytic acid. Most of tested LAB strains grew well on CDM+P and CDM+Phy plates. Slight growth was observed on the CDM-P plates. For most strains grown in liquid CDM+P, optical density values were higher than for those grown in CDM+Phy. Phytase activity show *Pediococcus pentosaceus*, *P. acidilactici*, *Lactobacillus sakei*, *L. frumenti*, *L. reuter* and *L. fermentum*. Fifteen strains were selected for extra- and intracellular phytase activity measurements. *P. pentosaceus* had the highest extracellular phytase activity from all tested strains with value of 23-30 U/10<sup>10</sup> CFU (colony forming units). Intracellular phytase activities were very low for all tested LAB and varied between 0.18 and 1.54 U/10<sup>10</sup> CFU.

**Keywords:** sourdough, lactic acid bacteria, phytase activity

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**THE PROPERTIES OF WHEAT GERM AND CAMELINA  
(*CAMELINA SATIVA*) OILS, OBTAINED FROM THE GRAIN AND  
SEEDS OF PLANTS, GROWN IN LITHUANIA**

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Wheat germ and camelina (*Camelina sativa*) are ancient crops containing oils with a high potential for nutritional, medicinal, pharmaceutical and technical applications. These two oils are most highly valued for unsaturated fatty acid content and natural antioxidants. So, in the present study, we determined fatty acid composition and other identity characteristics of these two oils, obtained from the grain and seeds of plants, grown in Lithuania, and followed total phenol content and oxidative stability using oven test, based on measuring the increase of an oil sample weight due to oxygen binding in the course of lipid oxidation at 60 °C and 40 °C and oxipres methods at 110 °C temperature.

**Keywords:** Wheat germ oil; *Camelina sativa*; Total phenol content; Oven test; Oxipres test

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**SALT LEVELS IN BREAD IN LATVIA****Daiga Kunkulberga, Endija Murniece**

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Scientific researches show that a reduction in salt intake could have a very positive impact on people's health, as salt intake plays a critical role in regulating blood pressure. There has been developed a common EU framework for salt reduction, describing a common vision for a general European approach towards salt reduction. European Commission High Level Group on Nutrition and Physical Activity calls on food manufacturers to reduce the amount of salt added in the process of manufacture. Bread has been identified as an important contributor to the daily salt intake in many countries. On the other hand, salt has important technological functions in bakery products. The aim of this work was to evaluate the amount of salt in Latvian bread and to research the necessity of decreasing the amount of salt in bread. In the research we determined the amount of salt in rye, wheat, sweet-sour bread and grain bread. The salt content is determined by potentiometric titration method. In most of the European countries the traditional level of salt on flour is 2%, which is equal to 1.3% salt in the bread. The majority of Latvian bread contain 1.5 to 1.2% salt on flour, but in some other bread it is even less. The study shows that the salt content of bread is not unduly increased; however, several manufacturers could be able to reduce the amount of salt added. It would be necessary to assess the information about the salt amount in the bread on the label of the product.

**Keywords:** sodium chloride, wheat bread, rye bread.For further information please contact: [daiga.kunkulberga@llu.lv](mailto:daiga.kunkulberga@llu.lv)



## FUSEL COMPOUNDS FORMATION IN VARIOUS TYPES OF BEER

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During preparation of alcohol beverages, when distillation is part of technological process, fusels are removed, although during beer preparation this process of fusels removal is impossible, it causes problems with final product safety. This aspect is very important because beer is described as refreshing beverage and during warm seasons is consumed in large quantities.

The aim of this study was to describe quantities of fusel compounds in various types of beer, sorted into various types of tare. Fusel compounds were examined by gas chromatography method. The research object were 3 types of beer, produced in company „Z“: „A“ beer – light beer (>5.5% alcohol volume); „B“ beer – strong beer (>5.5% alcohol volume), with big amount of carbon dioxide; „C“ beer – strong beer (> 5 % alcohol volume). A, B and C beer has been poured into certain tare: A – glass, plastic, metal; B – glass and plastic; C – metal and glass.

Results of study show that fusel concentration in various samples changed irregularly. The highest fusel concentration has been noticed in A type of beer (metal tare) – 6730.4 mg l<sup>-1</sup>, the least fusel concentration had A type of beer (glass tare) – 864.7 mg l<sup>-1</sup>. Other examined compounds had various fusel concentrations ranging from 5603.5 mg l<sup>-1</sup> (A type of beer in plastic tare) to 2592.1 mg l<sup>-1</sup> (B type of beer in plastic containers). According to these results, A type of beer, poured into glass tare is the safest for consumers.

**Keywords:** fusel compounds, fermentation, beer, tare.

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**EFFECT OF DIFFERENT COMBINATIONS OF ANTI-BROWNING SUBSTANCES ON FRESH-CUT PEAR SLICE QUALITY**

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One of popular fruit crops used in food is pears which contain important biologically active compounds. They are used as an ingredient for making fresh cut fruit salads. To ensure the quality of fresh-cut fruit slices it is necessary to treat them with anti-browning inhibitors.

The aim of the study was to evaluate the effectiveness of inhibitor compositions and their influence on the quality of fresh- cut fruit slices during storage. Slices of pear (*Pyrus communis*) cultivar 'Belorusskaya Pozdnaya' fruits (peeled, cut in pieces of 1–1.5 cm) were treated with inhibitor compositions or control solvents and prepacked in polyethylen bags. Different variants of combinations which consist of sweeteners (15% sugar or fructose syrup) stabilizers of structure (0.5% calcium chloride or calcium lactate), acidifier (0.5% citric acid +1.5% ascorbic acid or 20% cranberry juice) were prepared. 15% sugar or fructose syrup without inhibitors were used as a control. Samples were stored for 12 days at temperature 4±0.5 °C. Physical, biochemical and microbiological analyses were carried out after every 3 days. The highest effectiveness of anti-browning was achieved by using sweeteners, to which ascorbic acid, citric acid and calcium chloride were added. As a result the highest content of vitamin C and phenolic compounds were found in these samples, while color intensity (L\* value) of pieces reduced only by 0.1%. Storage time of fresh cut pear slices during which maximal content of vitamin C and phenolic compounds stayed up and the amount of microorganisms was the lowest, was 5 days.

**Keywords:** Pear salad, Calcium chloride, calcium lactate, vitamin C, polyphenol, storage time.

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## QUALITY OF VARIOUS FRESH AND DRIED PLUM CULTIVAR FRUITS

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The aim of the study was to evaluate chemical composition of fresh plum cultivars and to select the cultivars suitable for drying. Investigations were carried out at the Laboratory of Biochemistry and Technology. There were investigated fruits of nine plum cultivars. There was established the amount of dry soluble solids, sugars, titratable acidity, ascorbic acid and dry matter, in fresh and dried fruits. Plums were dried in convectional drying cupboard. The biggest amount of dry soluble solids (17.06%), sugars (15.78%), organic acids (1.7%) and dry matter (15.8%) was established in fresh fruits of 'Ažano vengrinė'. Plums of 'Gynė' and 'Vangenheimo vengrinė' were distinguished for titratable acidity (1.62%-1.58%). The index of fresh fruit sugars and acids ratio fluctuated between 5.30 ('Kadri') and 16.7 ('Medovka'). The bigger amounts of ascorbic acid among the cultivars were established in the fruits of 'Vangenheimo vengrinė' and 'Gynė'. Fruits of 'Paprastoji vengrinė' and 'Stenli' accumulated a big amount of dry matter (15.85–16.6%). In dried fruits the bigger sugar amounts were established in cultivars 'Paprastoji vengrinė', 'Medovka', 'Stenli' and 'Ažano vengrinė'. The biggest amount of organic acids (5.04%) was found in 'Ažano vengrinė' plums. 'Stenli' and 'Medovka' fruits had the biggest index of sugars and acids ratio. The taste and appearance of 'Stenli', 'Medovka', 'Paprastoji vengrinė', 'Ažano vengrinė' and 'Kauno vengrinė' plums was evaluated best of all (4.5–4.7 points). The ratio of flesh and stone fluctuated in the limits 1.8–3.6, with the exception of cultivar 'Medovka'. The last mentioned cultivar has the biggest index of flesh and stone ratio – 7.4. Plums of 'Paprastoji vengrinė' and 'Stenli' were the most suitable for drying. Fruits of 'Ažano vengrinė', 'Kauno vengrinė', 'Medovka', 'Vangenheimo vengrinė' and 'Gynė' were worse quality, but also suitable for drying.

**Keywords:** cultivar, plum, chemical compounds, drying.

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**FOOD SAFETY CONTROL ALYTUS COUNTY  
FOOD PROCESSING FACILITIES IN 2009****Marija Stankeviciene<sup>a</sup>, Jolita Buskeviciute<sup>a</sup>, Raimunda Krungleviciene<sup>a</sup>**<sup>a</sup>Lithuanian Health Sciences University, Veterinary Academy (Kaunas, Lithuania)<sup>b</sup>Alytus County State Food and Veterinary Authority (Alytus, Lithuania)

The food safety control in food processing facilities based in Alytus was analyzed in this research. Data was taken from 2009 and it was collected in Alytus County State Food and Veterinary Office, which is responsible for food safety control in food processing facilities. Control is carried out according to regulation 882/2004 'state control', 178/2002 'food law', 852/2004 'food hygiene'. All the information collected was analyzed according to those regulations as well. Alytus county's food processing facilities have been divided into two main groups - animal source foods objects and non-animals foods. „MINITAB 14.20” was used for statistical calculation. Data shows, that food safety control were carried out in 771 food processing objects by Alytus County State Food and Veterinary Office. Of these - 178 animal source foods objects, 593 - non-animal food business operators. We found out, that in animal source foods objects situation was getting better, because there were less violations and those violations found were not complex or didn't have an influence on the final product quality. There were no violations in 41% of checks made in 2009. This percentage reflects the growing trend of inspections without violations found. Therefore, we can say that the animal source foods business operators comply with food safety and quality requirements. General hygiene violations (34%) were largest part of the violations of non-animal food production, trade and public catering enterprises accounted for Alytus county. 14% of the violations were found in documents, premises maintenance, waste management, water supply, packing (packaging) materials, vehicles, equipment maintenance, sanitation, product damage. Non-animal food objects were checked 593 times in 2009. 553 checks (94%) were planned and 40 (6%) non-planned. 14% of checks revealed violations, which lead to some kind of sanctions applied. General hygiene violations took the biggest share of violations – 23.5%, labeling and water, used for production, treatment violations – 14.1%.

**Keywords:** food safety control, non-animal food, animal source foods.For further information please contact: [marija@lva.lt](mailto:marija@lva.lt), +37068610217

# **FOOD PACKAGING AND STORAGE**

# FOODBALT-2011

## INFLUENCE OF ACTIVE PACKAGING ON THE SHELF LIFE OF SOFT CHEESE *KLEO*

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The research was carried out at the Faculty of Food Technology of the Latvia University of Agriculture (LLU). Soft cheese *Kleo* produced in Latvia was used for experiments. At present the cheese *Cleo* has been found on the market place in vacuum packaging (VP) and its shelf life is not more than 15 days. For shelf life extension an active packaging in combination with modified atmosphere (MAP) was investigated. Following packaging materials were used: OPP, PE/PA, PE/OPA and Multibarrier 60. An iron based oxygen scavenger sachets of 50 cc obtained from Packaging Solutions OÜ was used. Cheese samples of  $100\pm 10$  g were packaged in polymer pouches (110 x 120 mm). Modified atmospheres consisting of carbon dioxide CO<sub>2</sub> (E 290) 30% and nitrogen N<sub>2</sub> (E 941) 70% was used, while VP was selected as the control packaging. Pouches were hermetically sealed by *MULTIVAC C300* vacuum chamber machine, stored in a Commercial Freezer/Cooler „*Elcold*” at the temperature of  $+4.0\pm 0.5$  °C up to 32 days’ and analysed before packaging and in the 0, 5<sup>th</sup>, 11<sup>th</sup>, 15<sup>th</sup>, 18<sup>th</sup>, 22<sup>nd</sup>, 25<sup>th</sup>, 29<sup>th</sup> and 32<sup>nd</sup> day of storage. Physical and chemical properties: headspace gas composition, pH, acidity, moisture content, and microbial conditions were evaluated. By use of both usual MAP conditions as well as with oxygen scavenger commitment in the pouch the shelf life was extended, good outside appearance and lactic acid aroma was observed.

**Keywords:** soft cheese, modified atmosphere, oxygen scavengers, shelf life.

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**EFFECT OF ULTRASOUND TREATMENT, THICKNESS  
AND GLYCEROL CONTENT ON SOME OF METHYLCELLULOSE  
FILMS PROPERTIES AND APPLICATION OF OPTIMIZED FILM  
ON BAGUETTE BREAD**

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The objective of this study was to investigate the effect of ultrasound treatment (5, 15, 30 and 45 min), different glycerol concentrations (15, 30, 45, 60 and 75% w/w of methylcellulose) and film thickness (15, 30 & 60  $\mu\text{m}$ ) on methylcellulose (MC) films water vapor permeability and mechanical properties. Finally, 15  $\mu\text{m}$  films containing 45% glycerol and treated by ultrasound waves for 5 min (the best conditions) were selected and applied on baguette bread to study its effect on retarding of staling. Results showed the significant effect of glycerol concentration and ultrasound treatment on films water vapor barrier and mechanical properties. Film thickness affected WVP and tensile strength but not elongation at break. Results also indicated on the ability of selected MC films to retard baguette bread staling process.

**Keywords:** Methylcellulose; Thickness; Glycerol concentration; Ultrasound; Baguette

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**NUTRITION AND HEALTH**

**ANTI-OBESITY AND HYPOLIPIDEMIC EFFECTS  
OF AGED BLACK GARLIC IN RATS FED HIGH-FAT DIET**

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The present study was conducted to evaluate the effectiveness of aged black garlic extract (AGE) in alleviating high-fat induced obesity and hyperlipidemia in rats. Six-week old male Sprague-Dawley rats were separately fed for 5 weeks with two kinds of diets; a normal diet (ND) or high-fat diet (HD). Then all rats fed ND and treated with carrier (positive and negative control), AGE (100, 250 and 500 mg kg<sup>-1</sup> bw) or simvastatin (1 mg kg<sup>-1</sup> bw) for another 5 weeks. The body and fat-pad weight, lipid parameter, antioxidant enzyme activity and lipid peroxidation in serum and hepatic was investigated. AGE significantly lowered body and adipose tissue weight. AGE significantly improved lipid profile by decreasing serum triglyceride and hepatic total cholesterol compared with negative control. AGE-treated groups were also observed significant increases glutathione (GSH)/oxidized GSH (GSSG) ratio in serum and hepatic compared with negative control and near to the level of the positive control. Consumption of AGE significantly decreased serum thiobarbituric acid reactive substances (TBARS) level relative to the negative control. Based on these results, we suggest that the administration of AGE improves the body weight gain and dyslipidemia via the suppression of body fat and alteration in lipid profiles and antioxidant defense system.

**Keywords:** aged black garlic extract, antiobesity, hypolipidemic.

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## DEVELOPMENT OF TECHNOLOGIES FOR THE BAKERY PRODUCTION OF MEDICAL-PROPHYLACTIC PURPOSE

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Expansion of assortment of bakery products of medical-prophylactic purpose and the development of new methods for their production are topical directions of food biotechnology. In case of violations of protein metabolism, the basic requirement for food products is declining, deletion or modification of the protein substances. In the diet of Russia and of several other countries population the bread is very useful food product. In the majority of current and emerging new technologies of bakery production apply expedited maintenance of technological processes. Reduced time of processing generates deterioration of flavour and physical-chemical characteristics of bread. We have developed technology of preparation of bread using sourdough, where as a starter cultures are used different symbiotic blends of *Lactobacillus* species such as *L. acidophilus*, *L. brevis*, *L. casei*, *L. fermentum*, *L. helveticus* and *L. rhamnosus*. These were selected by screening of their antagonistic activity against the test bacteria type *Bacillus*, as well as various fungi. To increase the content of vitamins and improve the flavour of bread in sourdough were included also various strains of yeast *Saccharomyces cerevisiae*, that posses high abilities to elaborate vitamins and gases. For preparing dough and cooking bread are used native and processed by extrusion starch and various products elaborated from soy, wheat, rye, rice and corn. Depending on specific disease – gluten enteropathy, phenylketonuria, chronic kidney disease and others, developed a range of products with the inclusion of some raw and sourdough. Introduction of developed technologies in food industry will significantly expand the existing bakery products range of medical-prophylactic purpose and improve their quality.

**Keywords:** Medical-prophylactic bread, *Lactobacillus*, yeasts.

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## POSSIBILITIES TO USE BIOLOGICAL PRODUCTS FOR CHILDREN NUTRITION

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At the time when we turn even more attention to the product origin and want to feed our children with safe and high quality nutrition it is advisable to choose products that do not contain synthetic chemical ingredients. To these products belong ecological-biological agriculture products that are produced in certified Latvian biological agriculture enterprises. The use of biological products in children nutrition reduces for them the possibility to consume the toxic ingredients by nutrition. This possibility exists if in children nutrition we use products that are produced in conventional agriculture.

Usually when child reaches 5–6 months mother's milk can no longer satisfy he's needs for nutrients and mineral substances therefore it is needed to gradually add extra products to basic nutrition. It is recommendable to start the extra product adding with vegetable mashes that have to be half liquid and in homogeny consistence so the child could better swallow it.

Vegetables are accessible for consumers mainly in the seasons of summer and autumn. This accessibility problem is the reason to look for new vegetable storing opportunities at the same time not only to save their biochemical nutrition value but also to better vegetable sensor indicators.

Vegetables for the research were elected from biological farm "Droši vesels". In the process of evaluating the quality and suitability of mashes they were sensory valuated by defining the stage of likeness and defined vegetable physically chemical indicators. Results of the research indicate that the highest likeness stage achieved carrot and pumpkin mashes.

**Keywords:** vegetables, biological products, children nutrition.

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**AUTHORS LIST**

# FOODBALT-2011

## AUTHORS LIST

- Adams A. 16  
Ahmadi E. 104  
Alsina I. 23; 50  
Andjelkovic M. 30  
Andriejauskiene J. 86  
Antone U. 52  
Azizi M.H. 104  
Baranauskiene R. 78; 79  
Bartkiene E. 20; 35; 37; 38; 63; 87;  
93; 97  
Barzegar Bafroei M. 83  
Basinskiene L. 48; 63; 66; 93  
Bassiouny A.H. 47  
Beitane I. 19  
Berna E. 40  
Berzins A. 89  
Blija A. 108  
Bobinaite R. 59  
Boca S. 58  
Buneviciene J. 88  
Buskeviciute J. 100  
Cakste I. 81  
Casabianca H. 31  
Ceseviciene J. 48  
Cesnauskas V. 99  
Cho K.-J. 106  
Cinkmanis I. 80  
Ciprovia I. 19; 21  
Dabina- Bicka I. 82; 103  
Damasius J. 77  
Dambrauskiene E. 78  
Dandena A. 74  
Danilov N. 62  
Danin V. 71  
De Kimpe N. 16  
Degutyte A. 95  
Dimins F. 15; 80  
Dobravalskyte D. 25;32  
Dorofejeva K. 33  
Drungilas E. 37  
Dubova L. 23; 50  
Dukalska L. 36; 40; 103  
Duma M. 50  
Dzene S. 29  
Eglite A. 53  
Eidukonyte D. 94  
Eihvalde I. 51  
El Kalamouni C. 32  
Ennigrou A. 31  
Fabre N. 17  
Frith K.-A. 34  
Gailite I. 98  
Galoburda R. 49; 72  
Gedrovica I. 28  
Geweife H.G.M. 47  
Gingule B. 70  
Gramatina I. 51  
Gross U. 58  
Gruzdiene D. 95  
Gudieva Z. 18  
Hansen A. 92; 94  
Hemaprabha P.H. 60; 61  
Hosni K. 31  
Hovhannisyann V. 18  
Hwang K.-A. 106  
Hwang Y.-J.106  
Ikase L. 76  
Januskeviciene G. 87  
Jonusaite K. 77  
Juhnevica K. 39; 98  
Juodeikiene G. 20; 35; 37; 38; 48;  
63; 66; 87; 92; 93; 94; 97

## FOODBALT-2011

Jure M. 75  
Kalnina I. 24  
Kalvaityte V. 30; 48  
Kampuse S. 40  
Kantike I. 36  
Karklina D. 28; 65; 72; 82; 98  
Kaufmane G. 108  
Kazernaviciute R. 79  
Kim I. 106  
Kim J.-H. 106  
Kim J.-Y. 106  
Kitryte V. 16  
Klava D. 64  
Kobakhidze M. 57  
Korkeala H. 14  
Kozlinskis E. 103  
Krasnova I. 24; 39; 76; 98  
Kraujalis P. 26  
Kraujalyte V. 30  
Kreicbergs V. 80  
Kronberga M. 65  
Kruma Z. 65; 72; 82; 84  
Krungleviciene R. 100  
Krungleviciute V. 93  
Kudirkiene E. 88  
Kuka M. 81  
Kunkulberga D. 15; 44; 96  
Kviesis J. 33; 76  
Leimane I. 74  
Leskauskaite D. 22; 27  
Liepins E. 91  
Limson J. L. 34  
Linina A. 43; 44; 45  
Lioranca V. 86  
Lovelin Jerald P. 60; 61  
Luzaitė V. 35  
Makaravicius T. 66  
Malakauskas M. 14; 88  
Malinauskyte E. 27  
Massip J. 54  
Mazdzeriene R. 79  
Mazuknaite I. 22  
Mierina I. 75  
Mikelsone A. 21  
Mikelsone V. 80  
Moskaluka J. 75  
Muizniece-Brasava S. 36; 103  
Murniece E. 96  
Murniece I. 40; 65; 103  
Nechiporenko A. 69; 90  
Nechiporenko U. 69; 90  
Novoslavskij A. 14  
Nuobariene L. 94  
Olsteina A. 24  
Om A.-S. 106  
Orehova S. 69; 90  
Ozola L. 64  
Ozolina V. 15  
Pastukhov A. 71  
Petrova G. 23  
Petrova N. 18  
Pichetto B. 54  
Pogulis A. 46  
Predajs J. 58  
Pukinskyte S. 22  
Ragazinskiene O. 26  
Rakcejeva T. 33  
Ramonaitė S. 88  
Raynaud C. 32  
Rekstyte T. 93  
Riekstina-Dolge R. 72  
Rozenbergs V. 70  
Rubinskiene M. 39; 99  
Rucins M. 70  
Ruisa S. 39  
Sabouri Z. 83  
Sabovics M. 49  
Sahari M.A. 83

## FOODBALT-2011

Sanikovas A. 38  
Sarvi S. 51; 103  
Savickaite A. 92  
Seglina D. 39; 72; 75; 76; 98  
Seididshvili N. 57  
Serzane R. 75  
Shakila Banu M. 60; 61  
Shleikin A. 62  
Sikorskyte R. 97  
Silins I. 91  
Skrupskis I. 58; 108  
Skudra G. 108  
Skudra I. 43; 44  
Skudra L. 33  
Smiltina Z. 50  
Smiti S. 31  
Smogrovicova D. 34  
Smolskaite L. 17; 32  
Stankeviciene M. 100  
Sterna V. 52  
Straumite E. 49; 64  
Strautina S. 24  
Strele M. 75  
Stroksa L. 50  
Talou T. 17; 25; 32; 54; 84  
Tandlich R. 34  
Tenkanen M. 66  
Terentjeva M. 89  
Ternovskoy G. 62; 107  
Tusiene R. 20  
Ugintaite M. 95  
Urbonaviciene D. 20; 35  
Vaitukaityte R. 87  
Vasilieva I. 69; 90  
Venskutonis P.R. 16; 17; 25; 26;  
30; 32; 59; 77; 78; 79  
Verhe R. 30  
Vidmantiene D. 87  
Vinauskiene R. 22  
Vinauskaite R. 22  
Viskelis P. 20; 35; 59; 78; 99  
Vogensen F. 94  
Vulliet E. 31  
Wilhelmi B. S. 34  
Yorulmaz O. 29  
Zaborskiene G. 93  
Zagorska J. 51; 52  
Zokaityte E. 63