BOOK OF ABSTRACTS

7th-9th November 2022
DUBROVNIK, CROATIA

6th IMEKO FOODS

FOOD ON GLOBAL MARKET

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METRO FOOD
INFRASTRUCTURE FOR PROMOTING METROLOGY IN FOOD AND NUTRITION

BOOK OF ABSTRACTS

6TH INTERNATIONAL CONFERENCE ON METROLOGY IN FOOD AND NUTRITION
7-9 NOVEMBER 2022
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Worldwide Mycotoxin Management via Co-Creation of Innovative Strategies MycoTWIN

Welcome message

The global food market with increasing international food trade and the impact of the Covid-19 pandemic on the global food supply chain brings many challenges. It is yet to be seen whether they are opportunities or threats within the landscape of metrology in food and nutrition. During this 6th international conference of IMEKOFOODS we strive, together with you, to strengthen the links between globalization, metrology, nutrition, food safety and food quality. Therefor we look, with great interest, forward to discuss with you the challenging questions on metrology in Food and Nutrition.

JORIS VAN LOCO
Chair of the organizing committee

Keynote speakers

Dr. sc. Ivana Ljevaković-Musladin, dipl. ing.,
Head of the Food Department and Head of Quality, Institute of Public Health of Dubrovnik-Neretva County, Croatia

Professor dr hab. Ewa Bulska,
University of Warsaw, Biological and Chemical Research Centre, 02-089 Warsaw, ul. Żwirki i Wigury 101, Poland

Dr. Claudia Zoani, PhD.,
ENEA SSPT-BIOAG C.R. Casaccia, Via Anguillarese 301, 00123 Roma Italy

Prof. dr. Nives Ogrinc,
Department of Environmental Sciences , Assistant Head of Department, Head of Research Group, Institut "Jožef Stefan", Jamova cesta 39, 1000 Ljubljana, Slovenija

Prof. Álvaro Silva Ribeiro,
Head of Hydraulics Metrology Laboratory, National Laboratory for Civil Engineering (LNEC), PORTUGAL

Tim Hogg,
co-chair, European Technology Platform on Food for Life, Belgium

Ivan Nastasijević, DVM, MPH, PhD,
Senior Scientist, Food Safety, Department for Scientific-Technical Cooperation, Institute of Meat Hygiene and Technology, Belgrade, Serbia

Ph.D. Darja Sokolić,
director of Croatian Agency for Agriculture and Food (HAPIH), Croatia

Biljana Borzan,
Member of the European Parliament and vice-president of the European Social Democrats

Laura Martin,
Secretary General, EUROLAB, Belgium

Mr Stewart Jones,
Coordinator APFAN (Asia Pacific Food Analysis Network)

Program

Monday, 7th November 2022

08:00 - 09:00	Registration
09:00 - 09:20	**Opening** **Welcome words from IMEKO** MSc Biserka Bajzek Brezak, *Croatian Metrology Society, Croatia* Sandra Šikić, PhD, *Andrija Stampar Teaching Institute of Public Health, Croatia* Mr. Joris van Loco, *Sciensano, Belgium*
Session Chairs:	**Joris van Loco** **Sandra Šikić**
09:30 - 10:10	**Plenary presentation** Residual of pesticides in food: methodology and risk assessments Professor dr hab Ewa Bulska, *University of Warsaw, Poland*
Session:	**Recent trends in food research infrastructures**
10:10 - 10:40	**Key note presentation** Integrated research infrastructures' initiatives in support to the agrifood and the agroecological transition Dr. Claudia Zoani, *ENEA, Italy*
10:40 - 11:00	METROFOOD-RI Service Chart: Service provision via RI for the promotion of metrology in food & nutrition Sharma S., Vandermeiren K., Donard O., Klein M., Castanheira I., Motta C., Vieira L., Zoani C., Van Loco J.
11:00 - 11:30	**Coffee break & Vendor Exhibition**

	Sessions:	**Nutrition and Health**	**Food Safety and Quality**
	Session Chairs:	**Ivan Nastasijević**	**Petru Jitaru** **Maria Fernandes-Whaley**
		Key note presentation	**Key note presentation**
11:30 - 12:00		Are edible insects suitable for people suffering gout? Kouřimská L., Sabolová M., Kulma M., Škvorová P., Veselá K., Kurečka M	Mass tourism – a challenge to food safety Dr.sc. Ivana Ljevaković-Musladin, dipl. ing., *Institute of Public Health of Dubrovnik-Neretva County, Croatia*
12:00 - 12:20		The SOLE project: a plant greenhouse demonstrator for fresh food production in space (VIRTUAL) Garegnani M., Bennici E., Benvenuto E., Crisconio M., Desiderio A., Di Mascio E., Ferranti F., Giuliani L., Nardi L., Pacelli C., Pontetti G., Villani M.E.	METROFOOD-RI physical facilities active in the food safety sector by the end of the preparatory phase of the infrastructure (VIRTUAL) M.Z. Tsimidou, E. Pucci, M. Papadopoulou, N. Nenadis, F.Th. Mantzouridou, S.A. Ordoudi, C. Zoani

12:20 - 12:40	Impact of various fish cooking processes on the fate of Hg and Se species and the Hg-Se antagonism	Comparison of HPLC-FLD and LC-Q-TOF-MS methods for the quantitative determination of aflatoxin B1 and ochratoxin A in raw nuts collected from local markets in Valencia (VIRTUAL)
	Ribeiro M., Leufroy A., Silva J. A. L., Castanheira I., Jitaru P.	Demirtas I., Luz C., Quiles J.M., Meca G., Ozer H.
12:40 - 14:00	**Lunch break**	
Sessions:	**Nutrition and Health**	**Food Safety and Quality**
Session Chairs:	**Ivana Ljevaković-Musladin** **Ivančica Kovaček**	**Joris Van Loco**
14:00 - 14:20	New plant-based food products enhanced by microbial processing	Supporting a safe transition towards sustainable food systems: FoodSafety4EU
	Minna Kahala*, Rina Bragge, Lucia Blasco, Emilie Gullberg Jørgensen, Tove Gulbrandsen Devold, Hilde Marit Østlie, Davide Porcellato, Vesa Joutsjoki, Juha-Matti Pihlava, Markus Nurmi, Xin Huang, Anne Pihlanto	Zoani C., Logrieco A.F., Cito N., Lattanzio V.M.T.
14:20 - 14:40	Safety and quality of the Spirulina nutritional supplements on the Slovenian market (VIRTUAL)	Exposure to lead when manufacturing cookware from scrap metal: A public health threat in the artisanal sector in DR Congo
	Masten Rutar J., Jagodic Hudobivnik M., Nečemer M., Vogel Mikuš K.(3,4), Arčon I., Ogrinc N.	Trésor Carsi Kuhangana; Erik Smolders; Karlien Cheyns; Célestin Banza Lubaba Nkulu; Peter Hoet; Joris Van Loco; Benoit Nemery; Heidi Demaegdt
14:40 - 15:00	The impact of dietary nucleic acids and their components on the growth of human alimentary tract cells in vitro	Accumulation and depuration assessment of microcystin congeners in Basil grown on a hydroculture
	Koziara Z., Bartoszek A.	Wannes H.R. Van Hassel; Maria Gracia Guzman Valesquez; Mohamed F. Abdallah; Bart Cottyn; Elise Tardy;Julien Masquelier1; Mirjana Andjelkovic; Andreja Rajkovic
15:00 - 15:20	Smart nutraceuticals for the prevention of childhood obesity (VIRTUAL)	EPA extraction from microalgae through supercritical carbon dioxide at pilot scale (VIRTUAL)
	Rivas A., Duoandicoechea U., Santamaría A., Alonso M., Alonso R., Izuriaga C., Salman H.	Leone G. P., Marino T., Casella P., Zoani C., Larocca V., Balducchi R. and Molino A.*
16:15	**GROUP PHOTO** **VISIT DUBROVNIK CITY**	

Tuesday, 8th November 2022

08:00 - 08:30	**Registration**
Session Chairs:	**Joris Van Loco** **Sandra Šikić**
08:30 - 09:10	**Plenary presentation - VIRTUAL - Prerecorded** An European food system that contributes to public health and wellbeing from fark to fork Biljana Borzan, *Representative of European Parliament, Member of Internal Market and Consumer Protection Committee*
09:10 - 09:40	**Key note presentation** EUROLAB: developing an international collaboration. Food Fraud and the impact on consumers' safety Laura Martin, *EUROLAB Secretary General, Belgium*
9:40 - 10:20	**Lightning Round - Poster Introductions** Poster presenters
10:20 - 11:00	**Coffee Break, Poster & Vendor Exhibition**
Session:	**Food Authenticity/ Food Fraud**
Session Chairs:	**Adela Krivohlavek** **Andrea Rossi**
	Key note presentation – VIRTUAL
11:00 - 11:30	Metrology in food authenticity and traceability: stable isotope approach Prof. dr.sc. Nives Ogrinc, *Institut "Jožef Stefan", Slovenia*
11:30 - 11:50	Stable isotope ratio of native honey and cheese from the Republic of Croatia Šikić S., Krivohlavek A., Mikulec N., Ivešić M., Barbarić F., Bošnir J.
11:50 - 12:10	Elemental analysis as a simple tool to classify beans according to their geographical origin (VIRTUAL) Veiga M., Valle A., Carrero J. A., Arana G., Donard O. F. X., Juanena A. B., Dolado, C., Molero A., Saiz-Abajo M. J., Perez de Arenaza A., de Diego A.
12:10 - 12:30	Characterization and discrimination of Italian olive cultivars by production area using elemental analysis and LPAS combined with chemometric analysis Pucci E., Palumbo D., Puiu A., Lai A., Fiorani L., Zoani C.
12:30 - 12:50	Elemental analysis combined with pattern recognition as a tool for fraud detection in canned red peppers (VIRTUAL) Veiga M., Valle A., Carrero J. A., Arana G., Juanena A. B., Dolado, C., Molero A., Saiz-Abajo M. J., Donard O. F. X., Perez de Arenaza A., de Diego A.
12:50 – 13:50	**Lunch break**

Sessions:	**Novel analytical methods for food quality/ novel foods**	**Functional foods and food processing**
Session Chairs:	**Severine Goscinny** **Alberto de Diego Rodriguez**	**Minna Kahala**

	Key note presentation	
13:50 - 14:20	Biosensors in the meat chain continuum as a tool for animal health, food safety, food quality and food crime control Ivan Nastasijević, DVM, MPH, PhD, *Institute of Meat Hygiene and Technology, Serbia*	Effects of beneficial microbial consortia and biochar application on rhizosphere biodiversity and maize growth: The SIMBA Project (VIRTUAL) Bevivino A., Fiore A., Hett J., Caldara M., Cangioli L., Maestri E., Aprea G., Ambrico A., Magarelli A., Trupo M. 1, Gullì M., Graziano S. 3, Ercole E., Mengoni A., Daniel Neuhoff D., Marmiroli N., Pihlanto A., Brunori A. (VIRTUAL)
14:20 - 14:40	Raman spectroscopy as a new measurement tool in winemaking Mandrile Luisa, Simone Giacosa, Antonella Bosso, Andrea Mario Rossi	Use of Brewers' Spent Grains as a Potential Functional Ingredient for the Production of Traditional Herzegovinian Product Ćuptern Lalic A., Karlovic A., Maric M.
14:40 - 15:00	Classification of liquid samples with NIR spectroscopy (VIRTUAL) Yoshida, K.	The effect of culinary processing on the microbiological quality of Tenebrio molitor Škvorová P.1, Švejstil R.1, Kouřimská L.1
15:00 - 15:20	Chemometric discrimination of X-ray irradiated mozzarella cheese based on the volatile profile by HS-SPME/GC-MS (VIRTUAL) Zianni R., Mentana A., Campaniello M., Tomauiolo M., Iammarino M., Centonze D., Palermo C.	Chickpea Proteins and Functional Properties (VIRTUAL) Kibar E.A.A.1, Aslan Ö.1
15:20 - 15:40	Fish fraud detection: can Raman spectroscopy be an alternative? Migueis, S. C.; Silva. P. M. T.; Henriques, A. R.; Castaño-Guerreiro, Y.; Moreira, F.	
15:40 -16:00	**Coffee break & Vendor Exhibition**	
Session Chairs	**Sandra Šikić**	**Claudia Zoani**
Sessions:	**Risk assessment,communication and management**	**METROFOOD RI - FoodMetNet Workshop**
16:00 – 16:30	**Key note presentation** Quality and safety systems of agricultural and food products in the Croatian Agency for Agriculture and Food dr. sc. Nataša Pintić Pukec, DVM, *Head of the Sector for Product Quality Control of the Center for Quality Control of Livestock Products of Croatian Agency for Agriculture and Food, Croatia*	16:00 - 16:30 METROFOOD-RI presentation, activities, future challenges Dr. Claudia Zoani, ENEA, Italy
16:30 - 16:50	The Good, the Bad and the Ugly about food additives multi-methods Goscinny S., Detry P., Van Loco J., Van Hoeck E.	16:30 - 17:00 New EMN Food Safety and Sustainability Andrea M. Rossi (INRIM)
16:50 - 17:10	Anisakis in seafood: unwanted guest on a plate Nonković D., Hrabar J.	17:00 - 18:00 Round table discussion

17:10 - 17:30 The influence of lifestyle choices (food, alcohol, smoking) on the blood concentration of Cd, Pb and Hg of newborns, adolescents and adults from Wallonia (VIRTUAL)

Demaegdt H., Ruttens A., Jacques A., Ruthy R., Petit J., Cheyns K., Remy S.

17:30 - 18:30 **IMEKO TC23 meeting**

20:00 **Conference Dinner**

Wednesday, 9th November 2022

08:30 - 09:00 **Registration**

Session: Data and communication platforms

Session Chairs: Claudia Zoani

Key note presentation - VIRTUAL

09:00 - 09:30 Driving pre-competitive research in foods; the role of the European Technology Platform - Food for Life

Prof. Tim Hogg, *European Technology Platform on Food for Life*

09:30 - 09:50 Electronic Core Components of METROFOOD-RI

Żołynia A., Czach J., Presser K.

09:50 - 10:10 A Web Application to provide Food Contamination Data to Consumers

Czach J., Żołynia A., Paschko K., Lindtner O., Presser K.

10:10 - 10:40 **Coffee break & Vendor Exhibition**

Session: Accreditation, PT and CRMs

Session Chair: Laura Martin

Key note presentation - VIRTUAL

10:40 - 11:10 The human factor in the lab of the future

Prof. dr. Álvaro Silva Ribeiro, *National Laboratory for Civil Engineering (LNEC), Portugal*

Key note presentation - VIRTUAL - Prerecorded

11:10 - 11:40 Accreditation, Proficiency Testing and Reference Materials

Stewart Jones

11:40 - 12:00 Creation of a European Metrology Network for Safe and Sustainable Food

Chiara Portesi,a, Milena Quagliab, Nives Ogrinc, Roland Beckerd, Gill Holcombeb, Mojca Milavece, Alexandra Bogožalec Košire, Hayrettin Ozerf, Fatma Akçadagf, Mine Bilself. Elias Kakoulidesg, Silvia Malliah, Gisela Umbrichth, Gavin O'Connori, Andrea Mario Rossia

12:00 - 12:20 Production and Certification of Reference Materials to Prevent Food Adulteration

Şimşek Adnan, İşleyen Alper, Bilsel Mine

12:20 - 12:40 Enabling Chemical Metrology for Food Safety in Africa

Fernandes-Whaley M.

12:40 - 13:10 **Closing Ceremony**

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International Measurement Confederation IMEKO TC-23

EUROLAB

CO-ORGANIZERS:

METROFOOD

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Electrical Engineering Institute Nikola Tesla

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Croatian Metrology Society and Member of IMEKO TC10

MSc Biserka Bajzek Brezak, Croatia,
Member of Board of HMD (Croatian Metrology Society)

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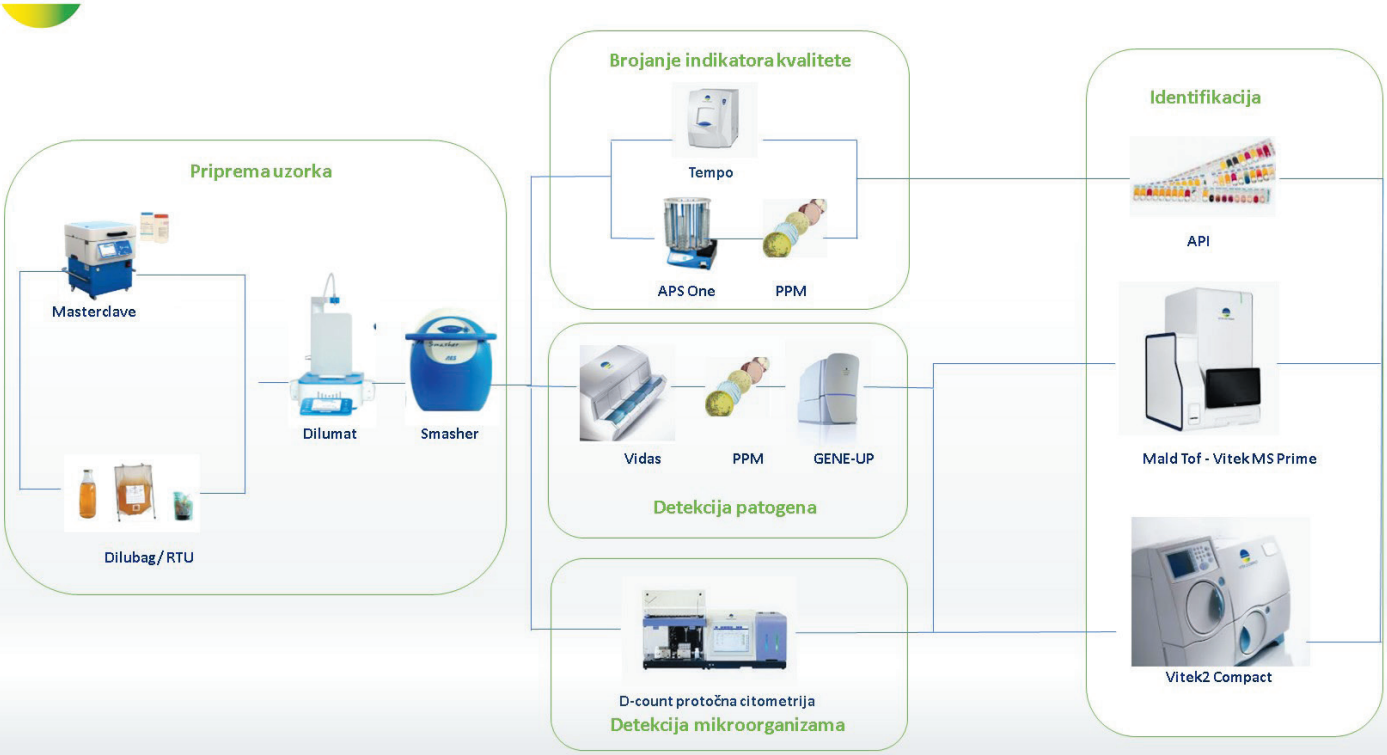

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Keynote speakers abstracts

Mass tourism – a challenge to food safety

Ljevaković-Musladin I.[1]

[1] *Public Health Institute of Dubrovnik-Neretva County*

In the last years (including 2022), the city of Dubrovnik was the top destination, while Dubrovnik-Neretva County was among the top 5 most sought-after destinations in Croatia. The city of Dubrovnik is also on the list of top 10 world destinations affected by mass tourism.

AIM The aim of this study was to assess the microbiological safety and quality of the food produced in Dubrovnik-Neretva County from 2010 to 2021 and to evaluate the eventual effect of mass tourism on food safety and quality.

MATERIAL AND METHODS During twelve years, a total of 25,333 food samples were collected from more than 1,000 food business operators in Dubrovnik-Neretva County. Food samples were analyzed according to safety and hygiene criteria prescribed by Commission Regulation (EU) No 2073/2005 on microbiological criteria for foodstuffs and Croatian Guidelines on microbiological criteria for food. Food premises were also inspected for microbial contamination of surfaces according to Croatian norms of microbiological cleanliness in facilities under sanitary supervision. For that purpose, 191,194 swabs and contact slides were collected. All microbiological analysis were conducted according to respective ISO standards in ISO 17025 accredited laboratory.

CONCLUSIONS Although mass tourism is a big challenge for food business operators, the microbiological safety of food in Dubrovnik-Neretva County was satisfactory. An improving trend was observed in microbiological quality. The implementation of COVID-19 measures in the last two years also showed that good hygiene practices have significant effect on safety and quality. Nevertheless, food safety and quality should be one of the strategic goals of sustainable tourism.

***Keywords**: food safety, food control, microbiological quality, mass tourism*

Contact person: Ivana Ljevaković-Musladin, ivana.ljevakovic-musladin@zzjzdnz.hr

Tim Hogg ETP abstract Sept 2022

The ETP ‘Food for Life’ is an industry-led stakeholder platform recognised by the European Commission as a key actor in driving innovation, knowledge transfer and European competitiveness in the food sector through the development of research and innovation agendas for action at EU level. These agendas are accessible and detailed and have shown to have been very useful to the EC in its programming.

The research that is proposed is structured under 3 major Research and Innovation (R&I) Targets 1. Increasing the engagement and involvement of the consumers; 2. Providing the basis for a more personalized and customized food supply and 3. Developing a more flexible, dynamic and sustainable food system. In the development of this work the ETP has mobilized a broad group of experts and has also received contributions from many of other parties via its consultation process.

In this presentation, the strategic agenda of the ETP Food for Life will be presented and the current state of play in the promotion and adoption of this strategy will be reviewed.

Quality and safety systems of agricultural and food products in the Croatian Agency for Agriculture and Food

Sokolić D.[1], Pintić Pukec, N.[1]

[1]Croatian Agency for Agriculture and Food, Vinkovačka cesta 63c, 31000 Osijek, Croatia

Croatian agency for agriculture and food (HAPIH) was founded by the Republic of Croatia in 2019 and the rights and duties of the founder are performed by the Ministry of Agriculture. The activity, structure, operations and relations related to management as well as the methods of financing are regulated by the Law on the Croatian Agency for Agriculture and Food (OG 111/18). The main vision and mission of the Agency are to contribute to the improvement of sustainable agricultural and food systems to participate in the implementation of public policies, strategies, programs important for the Republic of Croatia and effective implementation of public authorities, expert supervision and analysis for purpose of increasing the efficiency and competitiveness of agricultural production. Developed and maintained systems of quality and safety control in specialized organizational units of HAPIH ensure excellence in technological and development research, data traceability, gain trust in services that HAPIH provide and customer as well as employee satisfaction.

AIM

Aim was to present activities of Croatian agency for agriculture and food with its developed systems of quality and safety control of agricultural and food products.

CONCLUSIONS

HAPIH carries out its assigned mission with programs of strategic importance for the Republic of Croatia in the field of quality and safety of agricultural and food products especially through specialized organizational units and a system of optional labeling continuously.

***Keywords**: agricultural products, quality systems, safety of agricultural and food products*

Contact person: Darja Sokolić, darja.sokolic@hapih.hr

REFERENCES

Official Gazette of the Republic of Croatia No. 111/2018 The Law on the Croatian Agency for Agriculture and Food

Croatian Agency for Agriculture and Food (2021): Annual Report on the Work

web page of Croatian Agency of Agriculture and Food, https://www.hapih.hr

6th IMEKOFOODS hybrid Conference

EUROLAB Presentation by Laura Martin, EUROLAB Secretary General

EUROLAB: developing an international collaboration.
Food Fraud and the impact on consumers' safety.

As the European Federation of National Associations of Measurement, Testing and Analytical Laboratories, EUROLAB gathers 25 national associations all over Europe and beyond. One of its main goals is to cooperate with European and international stakeholders to represent the interests of the Members and raise visibility within laboratory communities, as well as to the external public on the added value and importance of testing for their safety.

The first part of the presentation will be an introduction of EUROLAB, its scope and added value for the members, including publications and technical reports, as the Cook Books, webinars and events on topics of interest for the laboratory community. In particular, insights will be given regarding cooperation activities and strategies with EU institutions and international stakeholders, focusing on key organisations as TIC Council, EURAMET, IMEKO and Eurachem, including the new partners My Green Lab and the European Chemicals Agency (ECHA).

The second part will provide an overview on Food Fraud as a growing issue worldwide, and the impact that counterfeits have on consumers' safety. In fact, food fraud not only erodes consumer trust, but it can cause harm to people's health as fraudsters might ignore the risks of toxicity and allergenicity in their drive to make a profit. Moreover, the impact of food fraud stretches far beyond consumers and creates unfair practices in the food trade, damaging the entire supply chain.

The presentation will lay out key data about food counterfeits, characteristics and types of food fraud, illegal food labelling, and final remarks on the importance of accurate testing and analysis to minimise the risk of food fraud and help identify the fraudulent food products.

Accreditation, Proficiency Testing and Reference Materials

Jones S.[1]

[1] *Asia Pacific Food Analysis Network (APFAN)*

In the year 1875, the 'Metre Convention' was signed by Diplomatic Treaty, which forms the basis for worldwide agreement on the International System of Units (SI), specifically, the second, the metre, the kilogram, the ampere, the kelvin, the mole and the candela. However, it wasn't until 1947, when the General Agreement on Tariffs and Trade (GATT) was signed by 23 nations, that attention was focussed on the accuracy of analytical measurements. Australia was the first country in the world to establish a national laboratory accrediation body, the National Association of Testing Authorities (NATA). Another six countries then followed with similar accreditation schemes until, in 1977 representatives of these schemes got together and formed ILAC, the International Laboratory Accreditation Cooperation.

In 1978 and 1982, ILAC and the ISO (International Standards Organisation) developed and revised a statement on the essential technical requirements for testing laboratories and this came out in 1990 as the ISO/IEC Guide 25, which was the first time that an international approach to laboratory technical requirements was made. In 1999, the Guide 25 became the ISO/IEC 17025 laboratory standard. From the outset, the technical requirements of this standard emphasised the traceability of results to the SI units, and the estimation of the uncertainty of measurement.

Accurate food analysis measurements are critical to safeguard public health and to facilitate food trade. The Asia Pacific Food Analysis Network (APFAN) seeks to assist laboratories in the region to satisfy the ISO/IEC 17025 traceability requirements through the use of low-cost Proficiency Testing (PT) and Reference Materials (RMs).

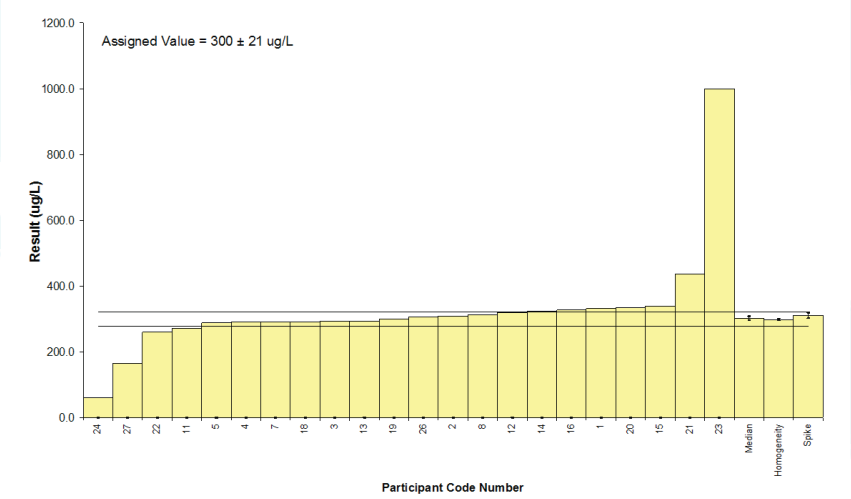

FIGURE: Participant Result Distribution and Assigned Values for Zinc in River Water Reference Material

***Keywords**: accreditation; traceability, proficiency testing, reference materials*

Contact person: Stewart Jones, apfan.apfan@yahoo.com

Oral presentations

METROFOOD-RI physical facilities active in the food safety sector by the end of the preparatory phase of the infrastructure

M.Z. Tsimidou[1], E. Pucci[2], M. Papadopoulou[1], N. Nenadis[1], F.Th. Mantzouridou[1], S.A. Ordoudi[1], C. Zoani[2]

[1] *Food Chemistry and Technology Laboratory, (FCTL), School of Chemistry, Aristotle University of Thessaloniki (AUTH), 54124, Thessaloniki, Greece*

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ABSTRACT

In the course of METROFOOD-PP project, the physical facilities of METROFOOD-RI (www.metrofood.eu) were inventoried and plans for their integration and operation were defined. Data interpretation was accomplished using different indicators for both the 'METRO' and 'FOOD' side physical facilities. Considering that food safety is one of the prioritized thematic areas of the scientific plan of the infrastructure, the presentation focuses on those facilities of the 'METRO' side that are mapped under the respective indicator. In summary, the 72% of the analytical facilities inventoried are engaged in biological or chemical hazard analysis. Regarding food safety sub-categories, most of the facilities (32%) are active in the analysis of toxic and potentially toxic elements, mycotoxins (28%), pesticides (24%), pathogenic micro-organisms (23%), environmental contaminants (21%) and food contact materials – migration (21%). Those engaged in additive analysis, allergens and process contaminants assessment are ~18%. Considerable is the number of analytical facilities for other classes of hazards. The data are discussed in view of the emerging risks identified in the scientific plan (Tsimidou et al., 2022). Plans for their involvement in the service provision and for their integration within the physical infrastructure and with the electronic component are presented, too.

***Keywords**: METROFOOD-RI; analytical laboratories, food safety*

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The influence of lifestyle choices (food, alcohol, smoking) on the blood concentration of Cd, Pb and Hg of newborns, adolescents and adults from Wallonia (Belgium).

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AIM

In the present study, we assessed (cord)blood concentrations of toxic metals (cadmium [Cd], total mercury [Hg], and lead [Pb] in a representative sample of different age groups (newborns, adolescents and adults) of the Walloon population in Belgium. We examined the associations of Cd, total Hg and Pb with habitual intakes of fish and alcohol and other possible determinants such as age, sex and smoking.

MATERIAL AND METHODS

We analysed blood concentrations of Cd, total Hg, and Pb in a sample of 284 newborns, 283 adolescents (aged 12-19) and 261 adults (aged 20-39) for the BMH-WAL survey (2019-2020) using inductively coupled plasma mass spectrometry. The participants completed self-administered questionnaires on socio-demographic characteristics, diet, certain risk factors for chronic diseases, intake of food supplements, general environment, housing and life behaviors such as smoking.

RESULTS

Almost all participants had detectable concentrations of Cd, Hg, and Pb in whole (cord)blood, except for Cd in newborns (100%<LOQ) . The GM blood concentrations for adolescents and adults together were 0.16 µg/L for Cd, 0.75 µg/L for Hg, and 10.4 µg/L for Pb.

Since tobacco is a major Cd source, the most significant partitioning criteria for blood Cd is typically the smoking status, but also age and gender show effects. Participants from all age categories who report fish consumption 4 days prior sampling (including mothers of newborns) show a median blood Hg level almost twice as high compared to people who do not. Significant partitioning factors evidenced in this study for blood Pb are age, gender and alcohol consumption, as already reported in other general population surveys.

CONCLUSIONS

Smoking and alcohol were confirmed determinants for Cd and Pb exposure respectively. We found that fish was a potentially important source of exposure to Hg in the Walloon population, including for newborns. Newborns are also already exposed to Hg and Pb, for Hg even to a higher extent than adults and adolescents.

***Keywords**: Biomonitoring, Metals, (cord)blood*

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Acknowledgment

This project is financially supported by the Direction Générale Agriculture, Ressources Naturelles et Environnement of the Walloon Public Service (SPW). The authors wish to thank the members of the steering committee of the project for their helpful advice.

Accumulation and depuration assessment of microcystin congeners in Basil grown on a hydroculture

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AIM

Accumulation of hepatotoxic microcystin congeners (MCs) in crops through irrigation with contaminated water can result in human health risks. MCs are produced by cyanobacteria, which can proliferate in various water bodies. These waterbodies could consequently be used for irrigation. Data on occurrence, accumulation and depuration of MCs are still lacking for many crops. The current study examines the accumulation and depuration of several MCs in basil as an example of a consumed plant in Belgium. MCs occurrence in basil was assessed by collecting samples from the Belgium market.

MATERIAL AND METHODS

Basil plants were grown in a hydroculture and exposed to 5, 10 or 50 µg/L MC-LR (the most prevalent microcystin congener worldwide) for 7 days. Afterward, plants were transferred for 7 days to uncontaminated Hoagland solution to assess the depuration process. An extra set of basil plants were exposed for 7 days to 5, 10 or 50 µg/L total MCs mixture (MC-LR, MC-YR and MC-RR) obtained from cyanobacterial culture. Basil leaves (lab and market) and roots (lab only) were analyzed using a validated UHPLC-MS/MS-based method.

***Keywords**: Microcystin, agriculture, UHPLC-MS/MS, Food safety, cyanotoxins*

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The combined use of elemental analysis and pattern recognition to detect frauds: an added value for asparagus recognised with a Protected Geographical Indication

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Fraud detection is an important task in the agri-food chain, especially in the case of products distinguished by some kind of quality label. Elemental analysis combined with chemometrics has often been used in fraud detection and identification of the geographical origin of foodstuffs.

White asparagus is a delicate vegetable in great demand in Europe, especially in Germany and Spain. According to FAO's data (2016), the main producer of asparagus is China (with nearly 8 million tonnes harvested), followed by Peru, Mexico, Germany and Spain. In 2017, around 4000 tonnes of high quality white asparagus were produced in Navarra under the Protected Geographical Indication (PGI) "Espárrago de Navarra", with more than 95% marketed as canned/bottled product in Spain. However, the Spanish market is invaded by cheaper asparagus produced in China and Peru and, to a lesser extent, in other countries such as Holland, Namibia and Ethiopia. The risk of fraud is therefore obvious.

In this work we have collected processed asparagus grown both in the PGI area (n=11) and in other areas of the world (n=15), e.g. China, Peru, Namibia, Ethiopia, the Netherlands and Spain. The concentrations of 34 elements were simultaneously measured in the HCl/HNO_3 extracts of the samples by ICP-MS. Principal Component Analysis of the dataset allowed us to discriminate between samples harvested under the PGI and the rest of the asparagus. Furthermore, the model obtained after Lineal Discriminant Analysis of the data was able to discriminate the samples between the "PGI" and "non-PGI" classes with 100% of success.

***Keywords**: Elemental analysis, Pattern recognition, Asparagus, Geographical origin, Fraud, Chemometrics*

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Elemental analysis as a simple tool to classify beans according to their geographical origin

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Beans (*Phaseolus vulgaris*) are one of the most consumed legumes in the world. The number of varieties with different morphologies is enormous, although the nutritional characteristics are similar in all cases. Although factors such as irrigation water, pesticides, fertilisers and weather can affect the elemental composition of beans, it depends mainly on the soil in which they have been grown. Elemental analysis of beans is therefore a good tool to investigate the geographical origin of beans.

In this work, we have investigated the potential of elemental analysis in combination with chemometrics to classify beans of different varieties, production years and growing area according to their geographical origin. To this end, beans (n=47) were analysed for which the variety was known, as well as the year and area of production. Most of the samples were obtained directly from the producers. The rest were purchased from local supermarkets. All the samples were subjected to an microwave-assisted acid digestion and the resulting solution was filtered and analysed by ICP-MS to measure the concentration of 26 elements.

Principal Component Analysis of the data set suggested that the geographical origin of the beans was the main factor governing the separation of samples in different groups. The influence of the variety was low and that of the year of production negligible. Linear discriminant analysis allowed the definition of a model capable of classifying the beans into six different classes (production zones) with a 95% success rate (39 out of 41 samples were correctly classified).

***Keywords**: Elemental analysis, Pattern recognition, Beans, Geographical origin, Fraud, Chemometrics*

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Elemental analysis combined with pattern recognition as a tool for fraud detection in canned red peppers

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For products with some kind of quality label, the identification of the geographical origin is an important task that adds value to the product itself. Elemental analysis is a useful tool to identify the geographical origin of most foods and beverages.
The cultivation of red peppers (*Capsicum annuum*, L., variety "piquillo") is an important activity in the South of Navarre. Most of the production (around 1500 tonnes per year) is commercialized under the Protected Designation of Origin (PDO) "Pimiento del piquillo de Lodosa". They are grown in eight specific municipalities (some 180 ha) and, after a simple but laborious elaboration process that includes fire-roasting and peeling by hand, they are mostly packaged and commercialized in tins or jars. The market price of this product is high compared to similar ones produced from peppers grown in other parts of the world (mainly Peru).
In this work we have analysed four different kinds of processed peppers, namely with PDO label (n=6), grown in the PDO geographical area but without PDO label (n=7), grown in Spain (n=6), and grown in Peru (n=8). Concentrations of 28 major and trace elements were measured in all samples by ICP-MS. Chemometric analysis of the data obtained allowed us to discriminate between all classes. Moreover, to our surprise, the PDO-labelled peppers were also clearly different from those grown in the same geographical area but without a PDO label, suggesting that another variable, probably related to the processing, also affects the elemental composition of the samples.

***Keywords**: Elemental analysis, Pattern recognition, Peppers, Geographical origin, Fraud, Chemometrics*

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Organochlorines as contaminants in butter, margarine, and other shortenings available on the market

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AIM. Organochlorine pesticides and PCBs were banned for use many years ago, but concern remains about their presence in the food chain as emphasized in the Stockholm Convention on POPs entered into force in 2004. Food is by far the most important source of exposure to these compounds whose toxic properties seem to have been underestimated in the past; they probably have a broader impact on health than previously assumed, even in very low doses. This is the case of non-dioxin-like PCBs which have recently been classified as “carcinogenic to humans” by IARC. In the present work experimental measures were carried out on dietary fats available on the market or purchased online, by choosing products of animal origin (lard, butter) or other solid fats (hydrogenated palm/soybean oils, margarine, coconut oil). The products came from different countries in the world. Due to the widespread use of such ingredients and due to the known characteristic of organochlorines to accumulate in fats, the study is useful to evaluate the risk to the consumer deriving from the presence of organochlorines in the food chain (except for the risk deriving from fish consumption). The research is also important to assess whether the concentration of these contaminants in food has decreased over the years since they were banned.

MATERIAL AND METHODS. Analyses of organochlorine pesticides and PCBs were carried out according to the guidelines in this field. In particular, the "Guidance on the Global Monitoring Plan for POPs" by UNEP (United Nations Environment Program, 2015) was followed.

Keywords*: POPs; dietary fats; PCBs; organochlorine pesticides; risk assessment*

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The Good, the Bad and the Ugly about food additives multi-methods.

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Although the use of food additives (FA) is strictly regulated under various EU acts, national authorities have the responsibility to ensure adequate controls and monitor the consumption of food additives by their respective population. To fulfil these two requirements, analytical methods are compulsory and have to be able to quantify these substances in various types of foodstuffs for a large number of items available on the market. Many analytical applications are already successfully implemented but generally cover very few additives and/or few food matrices. Under these conditions, it is very challenging and expensive to control the levels in foods considering the large availability of products on the market.

One way to make the analytical process more efficient is to develop versatile, high-throughput multi-methods that can easily cover the largest number of FAs and matrices while juggling with maximum permitted levels from ppb to ppm values. In this context, method development is complex, and validation procedures are extensive.

This presentation will show the implementation of an LC-MS-based multi-additives method from development to routine analysis and how most challenges were overcome with an ingenious combination of matrix grouping, calibration and validation strategies.

***Keywords**: Food additives, multi-methods, validation criteria, food categories*

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Creation of a European Metrology Network for Safe and Sustainable Food

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Safe food is a prerequisite for good human health, however currently almost one out of ten people in the world fall ill after eating contaminated food. National food safety authorities need to be able to manage food safety risks along the entire food chain. The Official Controls Regulation (EU) 2017/625 was put in force to ensure that the food and feed law stipulates the need for validated analytical methods. However, whilst food safety method development and proficiency testing are well established by European Union Reference Laboratories and National Reference Laboratories, validation of the measurements involved, certified reference materials and internationally recognized calibration and measurement capabilities are currently lacking. This erodes trust in the accuracy of the measurements.

This paper describes the European Metrology Network for Safe and Sustainable Food, which was recently approved by the European Association of National Metrology Institutes (EURAMET). The network aims to establish a long-term dialogue between the metrology community, reference laboratories and regulatory bodies, in order to (i) identify stakeholders' needs, (ii) develop a sustainable knowledge-sharing programme and web-based platform for stakeholders and (iii) develop roadmaps and a strategic research agenda. Improved access to more reliable and accurate food safety measurements will enable reference laboratories to more confidently and effectively compare their measurement results and support accreditation. This is particularly important when national food safety authorities need to assess potential new contaminants, novel food ingredients and newly emerging food risks, that requires new measurements methods as well as input into new documentary standards. The activities for sustainable food intend to boost the activity within the "EU green deal framework" to reduce food waste and losses, and the development of standards and methods that allow the reuse of food waste.

Keywords:
Food safety, Food Sustainability, European Network, Reference Laboratories

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Exposure to lead when manufacturing cookware from scrap metal: A public health threat in the artisanal sector in DR Congo

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AIM The objective of this study was to investigate the exposure to lead (Pb) among artisan workers manufacturing cookware from scrap metal and their community.

METHODS We conducted a cross-sectional survey in six cookware manufacturing workshops and, for comparison, eight carpentry workshops (negative controls) and 14 lead batteries repairing workshops (positive controls). All workshops are located in areas without mining activities of Lubumbashi city. We collected surface dust samples of the workspaces, and blood and urine samples of the workers and residents from the sites where the workshops are installed. Element determination was performed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

RESULTS In the artisanal cookware manufacturers (ACM) group, bood and urinary lead concentration geometric mean {121.5 µg/L [interquartile range(IQR 79.1-206.5)] and [3.3 µg/g (1.5-7.1)]} were estimated to be about twice as high as the negative control group {[60.2 µg/L (37.2-94.0)] and [0.9 µg/g, (0.3-3.8)]} and half the value of the positive control goup {[241.8 µg/L (82.8-591.7)] and [7.2 µg/g (1.1-26.3)]}. Among residents from the site of the workshop, children had higher urinary Pb concentrations [6.2 µg/g (2.3-19.3)] than the workers.

CONCLUSION This investigation demonstrates a substantial occupational Pb exposure among ACM and warns on the hazards for residents, especially children, due to the installation of these activities in residential sites.

Keys words: *Lead exposure, artisanal cookware, low income countries*

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Fish fraud detection: can Raman spectroscopy be an alternative?

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AIM

Fish fraud by species substitution is well known, with reported labelling errors reaching 40%. Cod (*Gadus morhua*), Hake (*Merluccius* spp.), Grouper (*Epinephelus* spp.), Flounder (*Solea solea*), Flounder (*Limanda aspera*) and Catfish (*Pangasius* spp.) are among the most frequently involved species.

The Surface Enhanced Raman® Spectroscopy (SERS) technique significantly improves the Raman signals, up to 10^{10} molecules or bacteria adsorbed on substrate surfaces. SERS can identify several food contaminants, such as pesticides, antibiotics, bacteria and toxins, and even determine quality aspects, including the species of raw materials.

This work exploits the possibility of using SERS in food control to detect fish fraud, which is reflected in terms of Proteins (C-H stretching region and fingerprint region). The observed changes are typically reflected in the global Raman spectra, whether plasmonic materials are employed or not. Herein, the sample is analysed directly, and the resulting spectra are compared and analysed through the complete Raman shift range. Additional data is presented at the conference.

MATERIAL AND METHODS

Fish samples will be analysed in Raman (Thermo Scientific, DXR) using frequency Nd/YAG laser at a dual-wavelength 532 nm, with a power failure of about two mW, in the spectral band 2800 to 3050 cm−1 (C-H stretch region), in the 500 to 180 spectral band cm−1 (fingerprint region).

***Keywords**: Raman; SERS, Fish, fraud, authenticity*

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The propagation of measurement uncertainty in PCA: the case study of the elemental composition of cooking salts

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AIM (STYLE HEADERS) A method to consider the uncertainty associated with the data in the chemometric elaboration of a PCA model is proposed to enhance the robustness and reliability of the PCA outputs. The characterization of cooking salts of different colours and different origin was considered as a representative case study.

MATERIAL AND METHODS The elemental composition of different cooking salts from different geographical origins was investigated with instrumental neutron activation analysis (INAA), as a calibrated and validated multi-element technique, suitable for the accurate determination of trace concentration of most natural elements. The elemental fingerprint differences between samples were explored by principal component analysis (PCA), which was expanded with a simple data augmentation method called "*Data explosion*" with the scope of propagating the uncertainty budget associated with the raw data in the PCA model, using a Monte Carlo simulation.

RESULTS The PCA models with and without considering the uncertainty of measurement were compared using common figures of merit, attesting that, in the absence of the uncertainty regions associated with the scores (which can be obtained by propagating the expanded uncertainty of the INAA results into the PCA model), erroneous conclusion about sample similarities and differences could be drawn.

CONCLUSIONS Even though few samples were analysed, the results drawn from the PCA scores plot can be considered valid and reliable since uncertainty of measurements was considered during the elaboration of the PCA model and the evaluation on the results, proving the significance of group separation.

Keywords: PCA, measurement uncertainty, neutron activation analysis, salt, elemental composition

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Raman spectroscopy as a new measurement tool in winemaking

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AIM (STYLE HEADERS) Raman spectroscopy was tested in different phases of vineyard practices and winemaking process as a rapid and portable tool for *in-situ* monitoring. The scope of these studies was to test the efficiency of this technique, end eventually its variants, such as surface enhanced Raman scattering, in comparison with more traditional control methods.
MATERIAL AND METHODS Portable Raman spectrometer and bench spectrometer were used to collect sample spectra from intact samples, being these grape berries or wine samples. Data were processed using chemometrics to obtain predictive multivariate models for diagnosis, and process control.
RESULTS Three different studies were conducted focusing on different phases of the winemaking process, from the plants' growth to the final product. First the possibility to follow phenolic ripening of grape berries before harvest was tested combining Raman measurements and spectrophotometric determination of the phenolic content in grape berries of different varieties; secondly, the potential of Raman for on-line monitoring of winemaking processes, such as the malolactic fermentation, was tested with promising results and finally a rapid method to measure the sulphites in wine by surface enhanced Raman scattering was set and validated against the official OIV method.
CONCLUSIONS The versatility of Raman spectroscopy, the ease of use and its portability represent a great opportunity for the oenological sector, to shift to a lean approach to process control.

***Keywords**: Raman spectroscopy, on-site measurements, rapid methods, grape, phenolics wine.*

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Production and Certification of Reference Materials to Prevent Food Adulteration

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AIM: In the field of food and feed safety, TUBITAK UME was able to develop 10 certified materials and 17 reference materials since year 2013.

UME CRM 1312 Certified Reference Material was produced and certified as $\delta^{13}C$ delta value to detect adulteration in sugary foods. In addition, UME CRM 1201 (Elements in Spring Water), 1302 (Aflatoxins in Dry Fig) and 1202 (Elements in Hazelnut) were also produced by TUBİTAK UME. Details of certification processes are given in TUBITAK UME website dedicated for reference materials [1]. In addition to the certified reference materials, reference materials were also produced for food adultration and quality control purposes such as, meat species, sunflower oil, sülfür dioxide in dried appricot, wheat flour, honey, tomato paste, mineral oil in edible oils, baby food for PAHs [1].

MATERIAL AND METHODS EA-IRMS instrument and method was used for certification of $\delta^{13}C$ delta value of UME CRM 1312.

Keywords: CRM, isotope ratio, adulteration

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Many thanks to TUBITAK UME personnel for their help during the production process.

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CCQM-K140: carbon stable isotope ratio delta values in honey, Metrologia, P J H Dunn[1], H Goenaga-Infante[1], A C Goren[2], A Şimşek[2], M Bilsel[2], N Ogrinc[3], P Armishaw[4] and L Hai[5], Metrologia, Volume 54, Number 1A, Citation P J H Dunn *et al* 2017 *Metrologia* 54 08005

Occurences of phytoestrogens as potential endocrine disruptors in food

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Nowadays, exposure to chemical compounds is part of our daily lives and represents a real threat to human health. Some of these chemical compounds belonging to various classes may have endocrine disrupting properties and can, on many occasions, be transferred to the human diet. These substances can disrupt the body at various levels, often in a discreet manner and at doses, sometimes reaching levels as low as the order of physiological concentrations of hormones. Most of these molecules are synthetics, produced by humans. However, phytoestrogens are natural compounds derived from plants and are found in many foods and food supplements. Phytoestrogens exhibit a duality. Indeed, it is frequently reported in the literature that phytoestrogens have many benefits for human health. However, considering the structural similarities with estrogens, they can potentially act as endocrine disruptors by binding and activating estrogenic receptors. This study aimed to quantify twelve phytoestrogens in 230 various food samples using the QuEChERS extraction method and analysed by ultra-high-performance liquid chromatography coupled to tandem mass spectrometry (UHPLC-MS/MS). The results showed phytoestrogens in almost all the food samples. Nevertheless, higher concentrations of phytoestrogens were found in vegetarian/vegan food up to 44,2 mg/kg of Daidzin and 62.3 mg/kg of Genistin. Results of the present study indicate the need for caution with phytoestrogens until a complete assessment.

Keywords:*Endocrine disruptors, food, phytoestrogens*

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Financial stress and eating habits among university students: pilot study

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AIM The aim of this study was to evaluate the eating habits of university students in the relation to the declared financial stress level.

MATERIAL AND METHODS This study presents the results of a survey of 114 Polish students aged between 18 and 26 years old. The research was conducted in 2022 and respondents were interviewed using online questionnaires (CAWI method). Survey questions referred to the number of meals during the day, the amount of selected diet components and, the level of financial stress according to to Northern et al. (2010).

RESULTS Nearly 50% of respondents rated their financial stress as high. Moreover, almost 20% of questioned students marked 6 points on 7 point financial stress scale.The majority of respondents (41%) ate 3 meals per day. However, breakfast was indicated as the most skipped meal. Moreover, around 8% of respondents declared that they ate only 2 meals per day.

In addition, the majority of questioned students (46%) declared that they avoided red meat. On the other hand, around 30% of respondents declared that they had one portion of red meat or meat products per day. In contrast, 40% of respondents declared that they ate only one portion of vegetables per day.

CONCLUSION Financial stress could be a significant source of stress for many university students. This factor has been linked to a variety of negative outcomes including improper eating habits. Individuals with a higher level of financial stress may have fewer cognitive resources to allocate to other concerns like proper meal planning.

***Keywords**: Financial stress, Eating habits, Students diet*

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Classification of liquid samples with NIR spectroscopy

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AIM: In the classification of the near infrared (NIR) spectra of aqueous solutions, where the light absorbance of water molecules is too dominant to capture subtle differences among the samples, the result is highly variable with the method used for data analysis. A proper method that yields consistent results is needed.

MATERIAL AND METHODS: A total of 52 liquid samples of eight different groups, including drinks and seasonings, were subjected to a portable NIR spectrometer. The observed absorbance spectra, smoothed spectra, first derivatives, and second derivatives, were respectively classified with eight different distance measures. The classification result was evaluated with the rate of group proximity that one sample and its nearest neighbor belong to the same group.

RESULTS: For the absorbance spectra, smoothing did not consistently improve the group proximity, and five distance measures (Correlation, Euclidean, Angle, Manhattan, Bray-Curtis) performed better than the rest. For the first and second derivatives, however, smoothing greatly improved the group proximity, and the distance measures were bundled by their performance into two: (a) Manhattan, Canberra, and Bray-Curtis, (b) Correlation, Euclidean, Angle, Aitchison, and Info-div, where the former was obviously superior to the latter.

CONCLUSIONS: Manhattan and Bray-Curtis that perform consistently well for all differently prepared datasets are suitable for the classification of liquid samples with NIR spectroscopy.

Keywords*: NIR spectroscopy; aqueous solution; classification; distance measure; smoothing.*

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Chemometric discrimination of X-ray irradiated mozzarella cheese based on the volatile profile by HS-SPME/GC-MS

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AIM X-ray irradiation is a non-thermal technology employed to destroy and inactivate pathogen and microbial contaminants in foodstuffs. To date, few analytical investigations have been carried out on volatile profile of X-ray irradiated dairy products (Zianni et al., 2022). For this reason, in this work, a Central Composite Design (CCD) for Response Surface Methodology (RSM) was employed to optimise the HS-SPME parameters for investigating the volatile organic compounds (VOCs) of irradiated mozzarella cheese. The best conditions were applied to non irradiated and irradiated samples at three dose levels (1.0, 2.0 and 3.0 kGy), the differences have been evaluated by means of a chemometric discrimination.
MATERIAL AND METHODS The X-ray radiation treatment was performed using a low-energy X-ray irradiator. VOCs were sampled by HS-SPME and analysed by GC-MS.
The collected data were handled by Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) and Partial Least Square-Discriminant Analysis (PLS-DA), to discriminate the variation of volatile profiles among non-irradiated and irradiated samples.
RESULTS LDA and PLS-DA demonstrated that the X-ray irradiation treatment differently affected the volatile classes of aroma mozzarella cheese. The results highlighted the effectiveness of the volatolomic approach to evaluate the variations with respect to the irradiation and to identify potential markers of X-ray treatment.

***Keywords**: Experimental design, Statistical analysis, Food irradiation, Volatile organic compounds, HS-SPME/GC-MS*

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Determination of phosphorus content as an alternative way of quantification of nucleic acids in food

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AIM A growing number of studies raise the matter of dietary nucleic acids (dietNA) and their components as essential nutrients (Głazowska et al., 2017; Ding et al., 2021). However, the range of methods for quantification of nucleic acids in food samples is very limited and none of them are quantitative in chemical terms. The aim of the presented research was to develop an alternative simple method for dietNA determination in food samples based on the phosphorus content. The origin of this method idea is the fact that the two main cellular sources of phosphorus are phospholipids and NA, which differ strongly in their physicochemical properties and are thus easy to separate from each other.

MATERIAL AND METHODS For the purposes of this research, the former colorimetric method of phosphorus determination was modified. First step involves quantitative isolation of dietNA from food samples. The organic phosphorus contained in the isolated dietNA fraction is hydrolysed with a strong acid at 180ºC to the orthophosphate form. Then, a reaction with ammonium molybdate is carried out to transform orthophosphates into blue-coloured complexes. The colour intensity was measured spectrophotometrically at 797 nm and was shown to be proportional to the phosphorous concentration. The phosphorus content is determined on the basis of the standard line and recalculated to dietNA content.

***Keywords**: quantification, dietary nucleic acids, food analysis*

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The impact of dietary nucleic acids and their components on the growth of human alimentary tract cells *in vitro*

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AIM The aim of this study was to determine the impact of isolated dietary DNA (dietDNA) and their components on the growth of HT29 (human colorectal adenocarcinoma) and HepG2 (human hepatocellular carcinoma) cells representing human alimentary tract, and the ability to use exogenous dietDNA by these cells under the conditions of impaired cellular DNA synthesis.

MATERIAL AND METHODS Two representative food products were selected for the presented research, i.e. green beans (product of plant origin) and chicken liver (product of animal origin). The isolation of dietDNA was carried out by the classical method using solvent extraction and by commercially available kits for DNA isolation. The obtained isolates were subjected to agarose electrophoresis to profile the dietDNA size distribution. Obtained dietDNA was used in *in vitro* studies using the above-mentioned cell lines. The influence of the isolated dietDNA on cell growth was tested with the aid of MTT test in the absence or presence of hydroxyurea, which is DNA synthesis inhibitor. Analogous studies were performed for pure deoxynucleosides representing the end products of dietDNA digestion in the gastrointestinal tract.

RESULTS The obtained results showed a greater level of degradation of dietDNA isolated from chicken liver compared to dietDNA from green beans. The experiments carried out in this study also confirmed the ability of gastrointestinal cells to use dietNA and deoxynucleosides under conditions of impaired DNA synthesis.

***Keywords**: dietary nucleic acids, deoxynucleosides, intestinal cell growth*

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Stable isotope ratio of native honey and cheese from the Republic of Croatia

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AIM

Thanks to the geographical location, the diversity of natural and climatic conditions, and the rich cultural heritage and tradition there are many high-quality native agricultural food products in the Republic of Croatia. Geographical origin and authenticity have been investigated only in a limited number of Croatian food products. Stable isotope ratio analysis is commonly used for verification of authenticity and origin of various food products. The aim of this study is to determine the characteristic ranges of values for stable isotope ratios in honey and cheese produced in Croatia. It is a way to create a "fingerprint" base, as a basic starting point for scientifically based determination of the origin and geographical origin of food products.

MATERIAL AND METHOD

The carbon isotope composition in honey was analysed using LC-EA-IRMS (Thermo Scientific). Combining LC with IRMS enables the separation of sugar components in honey and the determination of the $\delta\ ^{13}C/^{12}C$ in each of the sugars (fructose and glucose), their ratio, and the total $\delta\ ^{13}C/^{12}C$. After lyophilization, the cheese samples were analysed using EA IRMS technique and the total ratios of carbon $\delta\ ^{13}C/^{12}C$ and nitrogen $\delta\ ^{15}N/^{14}N$ isotopes were determined.

***Keywords**: isotope ratio, origin and authenticity, honey, cheese*

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METROFOOD-RI[i] Service Chart: Service provision via RI for the promotion of metrology in food & nutrition

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AIM: METROFOOD-RI is a distributed European Research Infrastructure (RI) for the promotion of metrology in food & nutrition. It aims to create a unique platform providing access to a worldwide distributed network of scientific facilities and state-of-the-art services, data, information & metrological tools for measurement & assessment of food from agrifood primary production until consumption. The aim of the work was to define the service chart and service provision for METROFOOD-RI.

MATERIALS AND METHODS: Inventorying & characterization of facilities and services available via the consortium participants was done via LimeSurvey. Further selection of core & integrated services was done via a voting & a scoring exercise, where aspects of innovation, market analysis, contribution to a circular economy, scientific excellence, etc. were taken into consideration.

RESULTS: The service chart describes all potential services that the RI can/will provide to diverse user categories. The services have been detailed and classified based on different criteria (e.g.: physical, electronic, combined; way of organisation and provision: by specific service, by technique, by specific application, access type). Furthermore, for ensuring the sustainability of the infrastructure, *core* and *additional services* have been defined, including *integrated services* to tackle strategically crucial societal challenges. The selection of services have been based on scientific excellence and priorities, adherence to METROFOOD-RI mission & objectives, market position analysis, innovation potential of proposed services, target users, and involvement of associated & participating METROFOOD-PP institutes.

***Keywords**: European research infrastructures, METROFOOD-RI, Service chart, food metrology, food safety & authenticity, nutrition*

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[i] RI: Research Infrastructure

Anisakis in seafood: unwanted guest on a plate

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The present work aims to give a comprehensive overview of *Anisakis* parasites, uncommon human pathogens of rising public health concern. *Anisakis* nematodes are marine parasites, using marine mammals as definitive hosts and fish and cephalopods as paratenic (transport) hosts. Following consumption of raw or thermally lightly processed seafood infected with live *Anisakis* spp. larvae humans can become accidental hosts, thus contracting a disease termed anisakiasis. In the last few decades, *Anisakis* abundance in paratenic hosts has increased more than 200-fold globally, likely with implications for human health. The disease can present as four clinical entities (gastric, intestinal, ectopic and (gastro)allergic) with unspecific symptoms often resembling other pathologies, making it highly underreported and misdiagnosed. Historically, anisakiasis has been prevalent in cultures with a tradition of eating raw or thermally unprocessed seafood. However, due to changing dietary habits, e. g. the increased popularity of consuming raw fisheries products as they represent valuable source of high-quality proteins and other nutrients, a rise in anisakiasis prevalence has been evidenced in areas where the disease was previously uncommon. While other forms of anisakiasis are still relatively rare, in the last two decades, there has been a surge in the number of allergic reactions to *Anisakis* allergens, which persist in seafood even after a thorough thermal treatment. A recent quantitative risk assessment analysis for Spain supports such observations, estimating several thousands of anisakiasis cases annually requiring medical attention, compared to previously reported 500 cases in Europe.

***Keywords**: Anisakis, anisakiasis, zoonosis, seafood, food safety*

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The effect of culinary processing on the microbiological quality of *Tenebrio molitor*

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AIM

The placing on the market of dried, frozen and powder yellow mealworm (*Tenebrio molitor* larva) as a novel food under Regulation (EU) 2015/2283 has been recently authorized by the European Commission. Insects are consumed with their gastrointestinal tract and therefore their microbial risk should be considered. The aim of this study was to monitor microbiological of yellow mealworm larvae during their heat treatment, namely cooking, roasting, drying and microwave heating. The effect of killing (boiling or freezing) was also monitored. From microbiological aspects *Bacillus cereus* and total bacterial counts were determined.

MATERIAL AND METHODS

Culture methods according to ISO standards for individual categories of bacteria were used for the detection of microorganisms.

CONCLUSIONS

Killing by boiling alone had a significant effect on the decline of all microbiological indicators, in contrast to insects killed by frost. In the case of further processing, the best microbiological results were recorded in the insects, which were subsequently roasted. However, the smallest overall loss of microorganisms was observed in the microwave treatment, but it was still acceptable. In the case of *Bacillus cereus*, there was a significant decrease when killed by boiling, but the overall destruction of *Bacillus cereus* was only after the namely cooking.

Overall, it can be stated that if the insects are killed by boiling before culinary preparation, they provide sufficient microbiological quality regardless of further processing.

***Keywords**: bacillus cereus, cooking, roasting, drying, microwave heating*

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Are edible insects suitable for people suffering gout?

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AIM

The aim of the study was to evaluate the purine and uric acid contents in six selected edible insect species and four common purine-rich food products, and to assess whether tested insects are suitable for people suffering gout.

MATERIAL AND METHODS

Purines (adenine, guanine, xanthine, and hypoxanthine) and their metabolite (uric acid) in two different developmental stages of six insects (*Tenebrio molitor, Alphitobius diaperinus, Gryllus assimillis, Acheta domesticus, Locusta migratoria*, and *Blaberus discoidalis*) and meats (chicken, pork, beef, and salmon) were analysed by HPLC/DAD (Sabolová et al., 2021).

RESULTS

Compared to meat, edible insects contained equivalent or higher amounts of total purine (3.23–13.22 g/kg edible insect DM vs. 3.61–5.53 g/kg meat DM) and uricogenic purines adenine + hypoxanthine (1.55–8.86 g/kg edible insect DM vs. 2.97–4.91 g/kg meat DM). Although the uric acid content was significantly affected by the developmental stage and species, the total purine content did not vary within the stages.

CONCLUSIONS

The obtained results confirmed that insects belong to foods with high levels of total purines and uricogenic purines. Most insects contained amounts of such substances analogous to commercial meat, except fish. From this perspective, edible insects are unsuitable alternatives for low-purine diets.

***Keywords**: purines; gout; insect*

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Optimisation of Method for pesticide analysis using Gas Chromatography with ECD detection

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AIM

The widespread use of pesticides that are used against crop pests, for improving yields and protecting crop quality has resulted in contamination. So, there is necessity for their analysis in different kind of commodities. All matters related to legal limits for pesticide residues in food and feed are covered by Regulation (EC) No 396/2005 where are specified the Maximum Residue Levels (MRL) that are legally tolerated when pesticides are applied correctly in accordance with Good Agricultural Practice. The aim of this paper is to optimize the Chromatography method in order to achieve the better separation of 25 pesticides.

MATERIAL AND METHODS

The method for simultaneous determination of 25 organochlorine pesticides was developed using Agilent 8890 gas chromatography coupled with electron-capture detector (GC-ECD).
A stock solution of 25 pesticides (1000 μg mL^{-1}) was prepared by dissolving 10 mg of each standard in 10 mL of acetonitril. Working solutions were prepared by serial dilution of the stock solution. The sample injection volume was 1 μL. Improvment for the proper separation of pesticides was achieved with the changing the operational parameters of the temperature program rate. By serial of subsequent changes of the temperature gradient program the proper separation of 25 pesticides was achived and optimized within the run time of 40 minutes by using DB-5 silica microcapillary column. The method was validated folowing the rules of the SANTE 2021 document.

***Keywords**: pesticide, optimization, gas chromatography*

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Analytical quality control and method validation procedures for pesticide residues analysis in food and feed SANTE 11312/2021

Occurrence, Importance and Control of Mycotoxins: A review

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Abstract:

Mycotoxins are poisonous chemical compounds produced by certain fungi. There are five mycotoxins or groups of mycotoxins that occur quite often in food: deoxynivalenol/Nivalenol, zearalenone, ochratoxin, fumonisins and aflatoxins. The fungi that produce mycotoxins in food fall broadly into two groups: those that invade before harvest, commonly called field fungi, and those that occur only after harvest, called storage fungi. There are three types of toxicogenic field fungi: plant pathogens such as *Fusarium graminearum* (deoxynivalenol, nivalenol); fungi that grow on senescent or stressed plants, such as *Fusarium moniliforme* (fumonisin) and sometimes Aspergillus flavus (aflatoxin); and fungi that initially colonize the plant before harvest and predispose the commodity to mycotoxin contamination after harvest, such as *Penicillium verrucosum* (ochratoxin) and A. flavus (aflatoxin). The favourable conditions for mycotoxins production are instigated with poor hygienic conditions at the time of transportation and storage, high temperature and moisture content and heavy rains. Mycotoxins are distributed in different items such as animal feeds, cereal crops, leguminous plants and animal products. Concentrated animal feedstuffs harbour highest level of mycotoxins. Noug cake and sorghum was warranted as the main source of aflatoxin contaminant among those concentrated animal feeds. Health effects occur in companion animals, livestock, poultry and humans because aflatoxins are potent hepatotoxins, immunosuppressant, and mutagens and carcinogens. Factors that affect mycotoxins production and contamination can be categorized as physical, chemical and biological. Therefore, developing countries particularly Africans governmental jurisdictions should implement and regulate level of mycotoxins in animal feedstuffs and human foods.

Keywords: Mycotoxin; Occurrence; Importance; Control

Use of Brewers' Spent Grains as a Potential Functional Ingredient for the Production of Traditional Herzegovinian Product Ćupter

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AIM

Ćupter is Herzegovinian candy made of must and flour/semolina. Much research about the incorporation of brewers' spent grains into the human diet has been published. The purpose of this study was to partially replace semolina (Samples 1 and 2) and flour (Samples 3 and 4) with brewers' spent grains originating from industrial (Samples 1 and 4) and craft breweries (Samples 2 and 3) and study nutritive, chemical, and preference properties of the product. In this research, the authors aimed to find application of this already proven functional ingredient in ćupter production.

MATERIAL AND METHODS

The control sample traditionally prepared (TC) was homemade and donated for the purpose of this research. The traditional recipes for ćupter made from white grape must + flour and white grape must + semolina were modified; i.e., 62% of semolina and 37% of flour were replaced with BSG. In the preparation of ćupter, must was used mostly from the white grape variety of Žilavka mixed with Smederevka, Krkošija, and Dobrogoština sorts of must. It was obtained from the AgroOdak d.o.o., a local producer of wine from Čitluk, Bosnia and Herzegovina. Craft BSG (CBSG) was obtained from Trojanska pivovara, a local brewery located in Čapljina, Bosnia and Herzegovina. Industrial BSG (IBSG) was obtained from Hercegovačka pivovara, an industrial brewery from Mostar, Bosnia and Herzegovina. Nutritive and chemical analyses were performed by applying ISO methods and standard analytical methods. All measurements were done in 3 replicates using chemicals of analytical grade.

RESULTS

Results of nutritive and chemical composition of TC and ćupter with BSG (Samples 1, 2, 3, 4), mean ± standard deviation values.

Sample	pH	Water Activity (%)	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Total Sugars (%)	Energy kcal/kJ
TC	3.56 ± 0.01	0.89 ± 0.01	27.08 ± 0.54	0.68 ± 0.01	0.67 ± 0.01	0.10 ± 0.03	52.25 ± 0.32	212.9/891.4 ± 0.87
1	4.11 ± 0.01	0.73 ± 0.01	24.02 ± 1.52	1.50 ± 0.39	6.13 ± 0.07	0.75 ± 0.03	51.07 ± 0.83	275.3/1152.6 ± 0.22
2	3.94 ± 0.005	0.71 ± 0.01	21.92 ± 0.69	1.87 ± 0.37	5.95 ± 0.02	0.44 ± 0.04	37.43 ± 0.87	277.1/1160.2 ± 0.27
3	3.90 ± 0.01	0.86 ± 0.01	41.82 ± 1.68	1.41 ± 0.10	5.93 ± 0.12	1.31 ± 0.01	39.66 ± 0.72	200.1/837.8 ± 0.65
4	3.86 ± 0.01	0.86 ± 0.01	41.11 ± 1.41	1.42 ± 0.10	6.60 ± 0.17	0.47 ± 0.01	40.37 ± 0.77	200.0/837.4 ± 1.15

CONCLUSIONS

The reuse of agricultural by-products is of great interest. The present study demonstrated that the use of BSG as a potential functional ingredient in ćupter production could be one of the ways to reuse this cheap and easily available by-product from the beer industry. Due to its high nutritive value with a special accent on high-quality protein content, its addition significantly improves the nutritive value of ćupter. Consumers want to benefit their health with the consumption of functional food, but another challenge left for future research is to improve general acceptance from "moderately-like" to "like extremely" or "like very much" by changing recipes.

***Keywords**: brewers' spent grain; functional food; ćupter; traditional product; grape must*

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Comparison of HPLC-FLD and LC-Q-TOF-MS methods for the quantitative determination of aflatoxin B1 and ochratoxin A in raw nuts collected from local markets in Valencia

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AIM

Nuts, an important component of the Mediterranean Diet, provide a significant amount of calories, essential amino acids, and unsaturated fatty acids, they are rich in vitamin E, B2, folate, and vital minerals[1]. Regardless, nuts can contain toxic compounds known as mycotoxins which are secondary metabolites produced by toxigenic fungi, especially *Aspergillus* and *Fusarium*[2]. In this study, two analytical methods HPLC-FLD and LC-Q-TOF-MS were compared for the quantitative determination of aflatoxin B1 (AFB_1) and ochratoxin A (OTA) in raw walnut, almond, cashew nut, hazelnut, and pistachio samples.

MATERIAL AND METHODS

Organic (n=29) and conventional (n=42) nuts were collected from local markets in Valencia. QuEChERS procedure and immunoaffinity columns were used for sample extraction and cleanup. The samples were analysed by LC-Q-TOF-MS and HPLC-FLD.

RESULTS

AFB_1 and OTA were detected in 35 (49.30%) and 9 (12.68%) of 71 nut samples, respectively. AFB_1 was the most common aflatoxin, ranged between 0.80 and 2.5 µg/kg, the amount of AFB_1 in 4 samples was higher than the maximum limit defined European regulations (2.0 µg/kg). OTA was detected in 7 samples with a range of 1.60-4.30 µg/kg. The application of both methods was useful in the quantitative determination of AFB_1 and OTA in nuts at low concentration.

***Keywords**: Nuts, Aflatoxin B1, Ochratoxin A, HPLC-FLD, LC-Q-TOF-MS*

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Biosensors in the meat chain continuum as a tool for animal health, food safety, food quality and food crime control

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AIM

Meat chain is composed of several modules (farm, abattoir, processing, distribution, retail). Preconditions for meat safety and quality are healthy and well-kept animals, slaughter and dressing practices, processing hygiene, cold chain and hygienic handling in distribution and retail. Consumer awareness increased regarding animal health/welfare, meat safety/quality and food labelling. Pathogens of public health importance (zoonotic foodborne bacteria) may enter the meat chain in multiple points due to unauthorized food manipulation (unintentional – poor biosecurity and hygiene, and intentional – food fraud and food terrorism). International trade associated with sourcing of raw materials from different regions and fraudulent practices in manufacturing of added-value meat products (meat species different from the labelling statement) require low-cost solutions for point-of-care detection of pathogens responsible for majority of food borne diseases (*L. monocytogenes*, *Salmonella*, *Campylobacter*), including identification of meat species. Biosensors that require little sample preparation and can provide rapid detection of major pathogens and meat species represent a tool for effective food safety/food defence management.

Keywords: meat chain, meat safety, meat quality, food fraud, detection, biosensors
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Enabling Chemical Metrology for Food Safety in Africa

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In 2015, NMISA initiated a reference material programme to enable food trade in support of Africa's growth strategies and trade agreements by providing Africa-relevant training, reference materials (RMs) and Proficiency Testing (PT) schemes, that would allow laboratories to demonstrate the comparability of their measurement results. These services have been delivered within the Africa Food Safety Network, targeting testing needs for priority food contaminants such as mycotoxins, pesticide residues and heavy metals for maize, ground nuts, cassava, wheat, cocoa, and fruit.

On behalf of the Intra-Africa metrology system, AFRIMETS, NMISA surveyed Africa's Food Testing Laboratory Capacity during 2022, which focussed exclusively on the analytical measurement capabilities of food testing laboratories within the newly established Africa Continental Free Trade Area (AfCFTA), as an essential component of an effective food control system. The aim was to identify where the gaps and needs are for laboratories that can be appropriately supported through relevant metrology training, RMs and PTs, aligning with the recent African Union's Food Safety Strategy for Africa 2022-2036.

The availability of locally produced metrologically traceable RMs and PT reference values has not only shortened the metrological traceability chain for the region but has also proven invaluable for consistent evaluation of laboratory performance and measurement result comparability. An overview of NMISA's reference materials and PT schemes and the Pan African Food Testing Survey will be presented.

***Keywords**: Food Safety; Chemical metrology, CRMs, PT schemes*

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A Web Application to provide Food Contamination Data to Consumers

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AIM

A web application was developed to inform the public about the occurrence of potentially harmful substances in foods. The application visualises concentration data collected in a Total Diet Study (TDS) and provides additional information related to population-based intake levels and the substances itself.

MATERIAL AND METHODS

The web application is optimised for smart phones and should show consumers concentration data in a simple and understandable way. The application is divided into two sections: Search Substance and Search Foods.

The first section allows users to search for a specific substance and its occurrence in various foods. Concentrations are presented as bar charts and information is provided about contribution of food groups to dietary intake as well as nutritional and toxicological information.

The second section enables the user to search for a specific food to get the respective concentration data presented in a bubble chart. It also allows to compare concentrations to other foods in the same chart.

Data used to develop the application were received from the German pilot-TDS conducted in the TDS-Exposure project.

***Keywords**: TDS; total diet study; food contamination data; web app, web application; consumers*

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TDS Exposure was funded by the EC's 7th Framework Program (FP7/2012–2016) under Grant agreement No. 289108.

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Electronic Core Components of METROFOOD-RI

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AIM

The aim is to present the electronic core components that are needed to run the electronic research infrastructure of METROFOOD-RI. This includes a central user management, databases, data exchange standards, a catalogue app, and an inventory app.

MATERIAL AND METHODS

METROFOOD-RI is a distributed research infrastructure for promoting Metrology in Food and Nutrition. One part of METROFOOD-RI is an electronic research infrastructure that should provide databases and apps to users. The core components of such an electronic research infrastructure were identified in the METROFOOD-PP project. The first core component are databases providing data such as analytical lab results, available reference materials or information on analytes. A second core component are applications using data from these databases performing statistical analyses, dataset linkage, data aggregation or data visualisation. Data exchange between databases and applications should happen automatically and therefore standardise data formats and electronic interfaces are needed being the third core component. A catalogue, which is the fourth component, should help users to find desired databases and applications providing information what the databases contain and what the applications can do. The fifth component is a central user database to simplify login for users. A user should only login once to his/her organisation and then be able to use all the databases and apps. Finally, a sixth component is an inventory app that contains all information about the physical and electronic facilities that are part of METROFOOD-RI.

***Keywords**: Electronic core components, electronic research infrastructure, METROFOOD-RI, e-RI, user database*

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Forgotten pathogen

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Food poisoning caused by toxins secreted by certain types of staphylococci have been known for more than a century, but recently they have not been given too much attention. This paper describes food poisoning by staphylococcal enterotoxins that occurred at the beginning of the year in Zagreb. the reason for sampling is food poisoning in a fish restaurant in 6 people, 2 of them were hospitalized due to digestive problems. They vomited over 30 times a day and had diarrhea. The common dish for all was shellfish - oysters and sushi.

Food testing was carried out according to the HRN EN ISO-6888 standard for determining the number of coagulase-positive staphylococci in food, and testing of nasal swabs of workers in the kitchen and waiters was carried out. The isolated strains were tested for the presence of 13 enterotoxicity genes.

All samples showed amplification at the same three gene loci, while no amplification was detected at other loci. This food poisoning shows that caution is needed in food preparation and the introduction of corrective measures in the kitchen so that such poisonings are as rare as possible.

(style abstract)

Keywords*: control points; Enterotoxins; Food Poisoning; Hygiene; Staphylococcus aureus*

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Stable isotope ratio of Strawberry fruit (*Fragaria x ananassa* Duch., cv. 'Albion') at two stages of ripeness and after processing

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AIM

There is a growing interest in agricultural products that combine safety and quality characteristics with a clear regional identity. Strawberries (*Fragaria x ananassa* Duch., cv. 'Albion') are a very popular fruit among consumers, either as fresh produce for consumption or for processing, e.g., into juices. In this, work we wanted to find out if the isotopic ratio of stable C and N isotopes changes after processing strawberry fruit into juice and by-products. In addition, strawberries were harvested at two stages of ripeness (75% *vs.* 100%).

MATERIAL AND METHOD

To determine the isotopic profile and authenticity of a strawberry sample, we determined (measured) the ratios of the stable isotopes of the elements $^{13}C/^{12}C$ and $^{15}N/^{14}N$. The representation of these isotopic elements was fixed when planet Earth formed on a global scale, and their composition or ratios have not changed since. Subtle variations in the isotopic composition of materials can be caused by biological, chemical, and physical processes. Isotopic ratios were obtained by analysing freeze-dried samples of strawberry juice, by-products, and pulp using the device EA-IRMS (elemental anlyser isotope ratio mass spectrometry), Thermo Scientific, type: LC-EA-IRMS.,

RESULTS AND CONCLUSION

From the results, it is evident that the δ value for ^{13}C was constant regardless of the interventions performed in the juice samples and the ripening stage, while the δ ^{15}N values in the by-products decreased compared to juice or pulp at both ripening stages.

***Keywords**: isotope ratio, strawberry juice, by-products and pulp*

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Safety and quality of the *Spirulina* nutritional supplements on the Slovenian market

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AIM *Spirulina* microalgae is a popular dietary supplement and a good source of vitamins and essential nutrients. Product adulterations, undeclared ingredients and misleading information on the product label might pose a threat to consumer; inspection of the dietary supplement industry, however, still remains limited. Therefore, in this study, fatty acid, amino acid and elemental content of commercial *Spirulina* dietary supplements in Slovenia was characterized and the obtained data was compared to products nutritional declaration.

MATERIAL AND METHODS Methods ICP-MS, EDXRF and GC-MS were used for elemental, fatty- and amino acid analysis of *Spirulina* supplements from the Slovenian market. Gathered results were compared to products nutritional declaration.

RESULTS The obtained data shows that, when used within recommended amounts, *Spirulina* dietary supplements are a good source of phosphorous (3.36–26.7% of RDA), selenium (0.01 to 38.6% of RDA), calcium (0.15 to 29.5% of RDA) and potassium (0.5 to 7.69% of RDA). Despite high iron content (7.64 to 316% of RDA), its bioavailability is low, as it is mainly presented in its ferric form. Pure *Spirulina* supplements have also been confirmed to be a good source of ω-6 polyunsaturated fatty acids, essential and non-essential amino acids; ω-3 polyunsaturated fatty acid content, however, was low. Additionally, 86.7% of declarations regarding the elemental content were found to be inappropriate.

CONCLUSIONS Results of the study point towards the need for a stricter control and inspection of the *Spirulina* food supplements available in the Slovenian market.

Keywords: *Spirulina*, elements, amino acids, fatty acids, quality, safety

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Smart nutraceuticals for the prevention of childhood obesity

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AIM

Optimization of the encapsulation procedure of flax, cod liver and sardine oils to provide significant changes or improvements in quantitative parameters of the process. Likewise, the study of the oxidative stability of these microencapsulated oils under two stability conditions: long-term, in a climatic chamber at 25 °C at 60% humidity for 1 year; and accelerated, at 40 °C at 75% humidity for 6 months.

MATERIAL AND METHODS

The analytical parameters selected for the study of oxidative stability were percentages of omega-type fatty acids, p-anisidine index and antioxidant capacity. For this purpose, analytical techniques such as gas chromatography-mass spectrometry (GC/MS), UV-Vis spectrophotometry and fluorimetry were used.

RESULTS

The values of the percentage of omega-type fatty acids, p-anisidine index and antioxidant activity remained constant in the three microencapsulated oils studied during the first 2 months. After this time, the percentage of fatty acids decreased, while the p-anisidine index and the antioxidant activity increased.

CONCLUSIONS

The synthesized controlled and sustained release 'core-shell' microencapsulates were shown to be stable for at least 2 months in the two stability conditions tested.

***Keywords**: nutraceuticals; oxidative stability; quality parameters.*

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Smart nutraceuticals for the prevention of childhood obesity

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AIM

Optimization of the encapsulation procedure of flax, cod liver and sardine oils to provide significant changes or improvements in quantitative parameters of the process. Likewise, the study of the oxidative stability of these microencapsulated oils under two stability conditions: long-term, in a climatic chamber at 25 °C at 60% humidity for 1 year; and accelerated, at 40 °C at 75% humidity for 6 months.

MATERIAL AND METHODS

The analytical parameters selected for the study of oxidative stability were percentages of omega-type fatty acids, p-anisidine index and antioxidant capacity. For this purpose, analytical techniques such as gas chromatography-mass spectrometry (GC/MS), UV-Vis spectrophotometry and fluorimetry were used.

RESULTS

The values of the percentage of omega-type fatty acids, p-anisidine index and antioxidant activity remained constant in the three microencapsulated oils studied during the first 2 months. After this time, the percentage of fatty acids decreased, while the p-anisidine index and the antioxidant activity increased.

CONCLUSIONS

The synthesized controlled and sustained release 'core-shell' microencapsulates were shown to be stable for at least 2 months in the two stability conditions tested.

***Keywords**: nutraceuticals; oxidative stability; quality parameters.*

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New plant-based food products enhanced by microbial processing

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AIM Dietary shift towards a more plant-based diet has created a need for new sustainable plant-based foods. Pulses and cereals are sustainable sources of proteins and they also contain fiber, minerals, vitamins, and phytochemicals, but their bioavailability can be impaired due to the presence of antinutrients. In the SIMBA project, fermentation was used as a technology with the aim to produce high-quality plant-based food with enhanced digestibility and applicability.
MATERIAL AND METHODS Lactic acid bacteria strains were screened for their ability to reduce the level of antinutrients, like condensed tannins, alkaloid glycosides (vicine and convicine) and galacto-oligosaccharides during fermentation process of faba bean, lentil and pea. Based on the obtained results, the starter mixtures have been designed for further fermentations with pulses.
RESULTS Fermentations with microbial mixtures showed a significant reduction in contents of vicine and convicine in faba bean and degradation of oligosaccharides in all selected materials. Some proteolytic activity was observed during fermentation and changes in protein and peptide profile in faba bean, lentil and pea. LAB strains were also characterized for their ability to survive in a static *in vitro* digestion model in the presence and absence of the fermented food matrix. Among the strains tested, two strains, namely *Levilactobacillus brevis* and *Limosilactobacillus fermentum*, showed a promising survival rate.
CONCLUSIONS The selected microbial starter mixtures have the potential to be utilized in the development of new food products based on pulses.

***Keywords**: fermentation, pulses, in vitro digestion, nutrition, antinutrients*

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Adaptation of Onion Varieties and Their Agronomic Performance Under Tropical Zimbabwe Conditions

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Abstract

The study was conducted to evaluate the yield performance of eleven (11) varieties of onion against the commonly grown variety Texas Grano. • The eleven different cultivars were grown at three different agroecological regions and the experimental design was a complete randomized block design. The results indicated that Crenola Digon was the best performing onion variety as it produced the highest yield of 17.35t/ha followed by Texas Grano (16.49 t/ha), then and Regent F1 and Star 5525 (15.53t/ha and 15.52t/ha respectively). Further, Crenola Digon had limited physiological disorders including less rotting upon storage which was comparable to Star 5525. Participatory Variety Selection studies on the farm were aligned with these findings. The study subsequently identified Crenola Digon, Regent F1, and Star 5525 as the most promising varieties adaptable to local farming systems. The project is now set to develop agronomic packages for enhancing the genetic potential of the adaptation varieties for productivity and profitability.

Keywords: - Onion; Allium cepa; mulch, yield, sustainability, Africa, Integrated Crop Management.

Providing Proficiency Testing Schemes for Elemental Content in a variety of Food Products: Highlights and Lessons learned

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AIM During 2018, the National Metrology Institute of South Africa (NMISA) responded to industry requests to coordinate a proficiency testing (PT) scheme to provide an independent assessment of the measurement capabilities of laboratories to measure sodium. The request came in response to the mandatory local regulations aimed at the reduction of the sodium content in processed foods.

MATERIAL AND METHODS The PT scheme ran over a period of a year, during which six food commodities targeted in the regulations were covered. To evaluate the contribution of sample preparation procedures employed by the laboratories, the study design included the distribution of both homogenised samples and samples as consumed (not homogenised) for analysis. Parameters such as nutritious and toxic elements were added as additional parameters for analyses as the PT scheme progressed.

During the evaluation of the PT results, the impact of the selection of appropriate reference values (consensus vs external reference value) and suitable standard deviation of proficiency assessment (SDPA) values (Horwitz vs regulated tolerances) were considered. Following the completion of this PT scheme, the NMISA has since coordinated several other PT schemes for elemental content in food.

CONCLUSIONS Results from these PT schemes will be shown, illustrating some of the lessons learned along with some success stories.

***Keywords**: proficiency testing; elemental analysis; food*

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Development of methods and matrix certified reference materials for toxic and nutritional elements in food

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AIM The National Metrology Institute of South Africa (NMISA) develops accurate quantification methodologies and produces matrix certified reference materials (CRMs) for toxic and nutritional elements in food. The focus of the projects is on the production of CRMs for food matrices that are unique to the African continent or would support the export of African food products to the rest of the world.

The laboratory is also expanding its measurement capabilities into speciation analysis using ion chromatography (IC) coupled to inductively coupled plasma mass spectrometry (ICP-MS).

MATERIAL AND METHODS In 2021, the laboratory launched its first matrix CRM for toxic and nutritional elements in wheat flour (NMISA CRM006) with certified values for fourteen (14) elements, including Ca, Cd, Co, Cr, Cu, K, Mg, Mn, Mo, Ni, P, Pb, S and Zn and information values for Fe and Na. In 2022, the laboratory will complete the projects for the production of a matrix CRM for toxic and nutritional elements in white maize and a second matrix CRM for toxic and nutritional elements in cocoa powder.

An accurate quantification method has been developed for arsenic speciation in grains and is currently being expanded to arsenic species in fish and seafood. The laboratory is also developing methods for selenium speciation analysis in soils, vegetation and maize with a PhD-project involving a life cycle study on selenium covering three regions in South Africa.

***Keywords**: toxic and nutritional elements in food, matrix certified reference materials, elemental speciation analysis*

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Production of Proudly (South) African Mycotoxin Certified Reference Material Calibration Solutions

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AIM The National Metrology Institute of South Africa (NMISA) has prioritised the production of mycotoxin calibrators under ISO 17034 accreditation, that are traceable, affordable, and more accessible to food and feed testing laboratories on the continent to support the aims of the African Continental Free Trade Agreement (AfCFTA).

MATERIAL AND METHODS The mycotoxin CRM calibration solutions are prepared from well characterised, high purity, crystalline material. Traceability to the SI units through the amount of substance (mass fraction concentration mg/g) was performed in-house. The indirect or "mass balance'' approach [Deuwer (2004)] to quantify the impurities is not feasible as too much material is required to perform all the measurements, therefore the primary ratio, quantitative nuclear magnetic resonance spectroscopy (Q-NMR) analytical technique was employed to assign the purity of the main component [Saito (2009)].

CONCLUSIONS An overview of the purity assessment, solution preparation, value assignment, homogeneity and stability assessment, and uncertainty estimates of the NMISA mycotoxin CRM calibration solutions will be presented together with benchmarking results [Josephs (2020,2022)] which demonstrate international equivalence of these proudly African mycotoxin CRMs solutions.

***Keywords**: certified reference materials; mycotoxins*

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Food crime cases–qualification and prosecution

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AIM

Unauthorised food manipulation could lead to food crime if there are conscious motive and perpetrator's intention. According to Djekić et al., 35.8% of food fraud cases were classified as mislabelling, 18.9% as adulteration and 13.2% as ingredients substitution. These acts does not exists in the Croatian Criminal law, but there are prescribed offenses that could be useful for such qualification. Among 2010–2020, food fraud cases were reported most commonly in meat/meat products, seafood and honey. Mislabelling is reported mostly in wine, meat/meat products and honey; dilution and weight increasing in seafood, dairy products and meat/meat products; cheaper ingredients in meat/meat products, seafood, honey and olive oil, non-edible ingredients in meat/meat products, dairy products and spices; origin masking and contamination were mostly found in alcoholic drinks. Mislabelling could be qualified as intellectual property rights violation (counterfeiting of signs for marking goods and registered mark of origin or trademark infringement) while adulteration, incorporation of cheaper ingredients and substitution as fraud (obtaining an illegal property benefit by misleading someone in delusion with falsely presenting or concealing facts to the detriment of their property). Contamination could be qualified as production/trade of a product harmful to human health. The police department collect evidence and qualified the act. Public Attorney prosecutes the food crime.

***Keywords**: unauthorised food manipulation, food crime, food fraud, criminal law, prosecution*
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Effects of beneficial microbial consortia and biochar application on rhizosphere biodiversity and maize growth: The SIMBA Project

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AIM The main objective of the present work is to exploit the potential of three microbial consortia for sustainable crop production of maize and to assess the impact of their application in field on indigenous rhizosphere microbial diversity.

MATERIAL AND METHODS Microbial consortia were applied alone or in association with arbuscular mycorrhizal fungi (AMF) and biochar in open field under conventional and organic management. The rhizosphere microbiota and plant growth were investigated at different maize growth stages and with different fertilization levels.

RESULTS The application of SIMBA's microbial consortia had clear effects on plant growth while did not significantly affect species diversity and richness of native rhizosphere microbial communities. A significant change in rhizosphere microbiota diversity was found following application of commercial Micosat F1, AMF and biochar as well as increased fertilization level.

CONCLUSIONS Overall, our results suggest that SIMBA microbial consortia may be effectively exploited as biofertilizer in sustainable maize cultivation without altering the biodiversity or the resident microbiota, thus removing risks of long-term impacts on natural soil microbial biodiversity.

***Keywords**: microbial consortia, maize, field trials, rhizosphere microbiome.*

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The SOLE project: a plant greenhouse demonstrator for fresh food production in space

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AIM Future human long-term space exploration demands for fresh food production during missions, independently on periodic supplies from Earth (1). The possibility to grow plants in space positively impacts both astronaut diet and psychological wellbeing (2). It has been estimated that a facility of a few cubic meters is sufficient to supply the diet of 4 to 6 crew members with key vitamins and fresh bioactive substances (3). Soilless cultivation is the best suited for production of high quality food in space, where resources are limiting factors (4). In this context, the project SOLE aimed to realize a hydroponic cultivation module based on LED lighting systems for growing plants, specifically microgreens, for space applications.

MATERIAL AND METHODS:

Two genotypes of mustard and radish were cultivated using three different light recipes. The best performing light recipe was identified and the increased accumulation of plant active compounds (chlorophyll, flavonols, anthocyanins), was determined by nondestructive fluorometric and hyperspectral analysis.

***Keywords**: Microgreens, Hydroponic, LED lighting, Agrospace, Fluorometric and Hyperspectral analysis*

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Supporting a safe transition towards sustainable food systems: FoodSafety4EU

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AIM (STYLE HEADERS) Food safety, being an integral part of food and nutrition security, is crucial for sustainable development. However, due to the complexity of underlying science, intensifying cooperation between food safety ecosystem actors has become a prerequisite to deliver future-proof solutions. To serve this purpose, FoodSafety4EU, a H2020 collaborative action, is building a multi-stakeholder collaborative platform aimed at supporting a safe transition towards a more sustainable food system.

MATERIAL AND METHODS Through a structured co-creation process, FoodSafety4EU is going to provide input for future research needs, by delivering a proposal for Strategic & Innovation Agenda, that will address emerging and circularity related food safety issues. Four operational social labs started in 2021 to feed the participatory process by involving multi-stakeholder expert groups at Hub level, thus representing different EU geographical areas.
The digital platform, including new apps, is hosting and supporting the co-creation process, enabling the interaction among different actors within the system and facilitating access to a variety of resources related to Food Safety issues.

RESULTS The FoodSafety4EU outputs will contribute to better position and keep the focus on Food Safety in the new framework, which is being defined by the new sustainability regulation (to be adopted by EC in 2023).

Keywords: food safety, sustainability, risk assessment, multi-actor approach
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EPA extraction from microalgae through supercritical carbon dioxide at pilot scale

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AIM Microalgae represent an important biological source which may provide valuable nutrients, pigments and bioactive compounds, driving the industrial sectors towards more sustainable process and humans to healthier lifestyle (Molino et al., 2020). The marine unicellular microalgae belonging the *Nannochloropsis* genus are among the most attracting natural producers of lipids –especially polyunsaturated fatty acids (PUFAs) which find wide applications in food and energy sectors. In particular, eicosapentaenoic acid (EPA, omega-3) is highly contained in *Nannochloropsis gaditana*, a microalgae for which in 2012 an application as "novel food" was presented to the EC by the Spanish *Plataforma Europea de los Consumidores y del Medio Ambiente*. However, the extraction of EPA from natural sources through emerging future proof technologies is still a challenge. An efficient potential solution is offered by supercritical fluid extraction (SFE) mediated by carbon dioxide (CO_2) as cheap, non-toxic, chemically inert, widely available solvent.

MATERIAL AND METHODS *Nannochloropsis gaditana* was subjected to SFE-CO_2 in a pilot plant trials with the aim to recover fatty acids and EPA, allowing to evaluate the achieved results prior to full-scale production. The effect of the main parameters affecting the extraction process was examined and optimized for the maximization of EPA content and purity.

***Keywords**: microalgae, Nannochloropsis gaditana, supercritical fluids, supercritical carbon dioxide,eicosapentaenoic acid, omega-3*

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Characterization and discrimination of Italian olive cultivars by production prea using elemental analysis and LPAS combined with chemometric analysis

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AIM Olives and olive products are particularly important for the Mediterranean agroindustrial sector, thus determining the origin of these products is essential to establish their authenticity. This study is aimed to evaluate the suitability of the trace element profile in olives of different cultivars as a marker of the production area and the influence of the cultivar.

MATERIAL AND METHODS The multi-elemental profile of olive drupes and olive leaves of eleven italian olive (*Olea europaea sativa*) cultivars arising from two different production areas was evaluated. ICP-MS and ICP-AES were applied to determine 14 elements (Sr, Cu, Rb, Ti, Ni, Sn, Cr, V, Co, Sb Cd, Pb, As, and Zr) in olives and 17 elements (Al, Sr, Fe, Ba, Rb, Mn, Zn, Cu, Ti, As, Sb, Pb, Ni, Cd, Co, Cr, and V) in olive leaves. Moreover, with the purpose to verify the suitability of LPAS for geographical origin demonstration, the same samples of leaves were analysed, and the results compared with the ones obtained by elemental analysis. Finally, chemometric approaches were applied for extracting the relevant information to discriminate between the different cultivars and the different geographical origins.

CONCLUSIONS The obtained results, combined with chemometric tools, showed the possibility of discriminating samples according to the production area on the basis of the elemental content, as well as by LPAS.

***Keywords**: Olea europaea L., cultivars, trace element profile, geographical origin, ICP-MS,ICP-AES, LPAS, chemometrics*

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Integrated research infrastructures' initiatives in support to the agrifood and the agroecological transition

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The agrifood sector is a strategic asset of all European Countries and one of the largest and most important economic sectors, with particular social relevance: it is vital to ensure employment, preserve rural public goods, supply healthy and quality food, and facilitate the integration of SMEs into the food chain. It is essential to consider whatever affects the quality & safety of food, from raw materials to the environment of primary production, food processing, logistics, retail, and post-retail, up to domestic procedures, thus making health converge into a unicum as a system by applying the *One Health* approach. Food quality and authenticity have now become a focus of consumers' requirements all over the world; food traceability and safety are key factors to ensure food quality and to protect consumers' and producer's interests. Finally, it is even more essential to apply circular bioeconomy and industrial symbiosis approaches, in support of the sustainability and resilience of agrifood systems, in a view of an agroecological transition. Another key element is the promotion of integrated traceability systems, enhancing the digitalization of the agrifood system in support of transparency. To address these societal challenges and contribute to the achievement of these objectives, the scientific community must consider the high inter-sectoral and inter-disciplinary dimension of studying and supporting the agrifood systems. Research Infrastructures (RIs) have the capacity to provide resources and services for research communities on a long-term basis, making the RIs well positioned in addressing societal challenges. In particular, initiatives focused in integrating RIs knowledge, facilities and services can boost the definition of an integrated and structured landscape, promoting more and more advanced research and highest cooperation with and within the agrifood systems' stakeholders, thus enhancing the social-economic impact. With this reference, two relevant Horizon-funded initiatives are AgroServ and iNEXT-Discovery: AgroServ aims at providing access to innovative, customized and integrated services for resilient and sustainable European agriculture systems and the agroecological transition; iNEXT-Discovery aims at enabling access to structural biology RIs, and among its activities there is a focus in strengthening the bridge between the "structural biology community" and the "agrifood community" by promoting agrifood-related structural biology applications.

***Keywords**: Research Infrastructures, Agrifood systems, Agroecological transition, Integrated landscape, service provision*

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METROFOOD-IT - The Italian Research Infrastructure for Metrology and Open Access Data in support to the Agrifood

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In the frame of Mission 4 “Education and Research” of the Italian National Recovery & Resilience Plan (NRRP) a new project aimed at strengthening the Italian Research Infrastructure for Metrology and Open Access Data in support to the Agrifood - METROFOOD-IT has been approved for funding. It is related to the Italian Node of the European Infrastructure METROFOOD-RI – *Infrastructure for promoting metrology in food and nutrition* (www.metrofood.eu - ESFRI Roadmap, domain Health and Food).

The project focuses on the RI’s electronic component and its integration with the physical one, to provide services in support to the digitalization of the agrifood system for food quality & safety, traceability, food transparency, sustainability, and resilience of agrifood systems, and circular economy. It aims at developing the organizational and operational framework of the RI and structuring the strategy, procedures and supporting system for the service provision via TransNational Access and wide Virtual Access, thus making the Italian infrastructure fully implemented, operational and sustainable in the long run.

METROFOOD-IT will be characterised by the application of ICT solutions with an integrated supply chain approach. The innovation potential relies on the state-of-the art services, tools and concepts deployed, along with FAIR data management, data quality and open data, crossing the 4th digital evolution applied to the agrifood.

Overall, METROFOOD-IT will contribute to overcome fragmentation and research compartmentalisation, enabling researchers to access, create, share, connect, analyse, and interpret various and heterogeneous factors and paving the way to ambitious, transnational, transdisciplinary advancements in the agrifood, while significantly reducing duplication of research efforts and thereby providing stimulus for creative thinking to develop innovative practices, products, and services to advance knowledge.

***Keywords**: Research Infrastructures, Agrifood systems, Metrology in food and nutrition, Open access data*

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Agriculture, pesticide analysis and the importance of proficiency testing: An African perspective.

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ABSTRACT

Agriculture is an essential sector for many African countries, not only to ensure food security, but as a main contributor to gross domestic product (GDP), as well as overall employment. Much of the economic value is directly linked to export outside the African continent. To secure the export market, it is important that laboratories can meet the regulatory requirements of their selected export markets. This can be challenging, as these requirements evolve with changes to the current scientific knowledge. In many cases the maximum residue levels (MRLs) are decreasing, or new generation pesticides are less chemically stable, making the measurements more challenging. One-way to ensure the quality of the measurements is to continuously participate in proficiency testing schemes (PTSs). These schemes can be tailored to assist with risk assessments when considering changing the MRLs for a specific crop category or reacting to implemented regulatory change. This approach has been applied in South Africa in co-operation with growers' associations and other interested parties. Tailored proficiency testing schemes are also a very useful tool for new laboratories. These schemes can be amended to suit a laboratories precise needs including covering the full scope of analytes measured. The only drawback being the short shelf-life of such PT materials, as many pesticides are not stable and are sensitive to interactions within groups. This paper will reflect on the importance of running a successful PTS for pesticides in fruit towards a stable and effective quality infrastructure, lessons learnt and possible areas for concern.

Metrology in food authenticity and traceability: stable isotope approach

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AIM: Stable isotope-ratio signatures ($\delta^{2}H$, $\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$, and $\delta^{34}S$) play an increasingly important role in food forensics in three main areas of application: (i) detection of adulteration; (ii) assignment of geographical origin; and (iii) identification of mode of production, i.e. organic vs. conventional farming systems. Ensuring that all stable isotope measurements are metrologically sound, for example, improving the quality of datasets and model evaluation by incorporating measurement uncertainty and, more generally, having the necessary metrological support, is equally important.

MATERIAL AND METHODS: First, the theoretical background will be presented and will highlight state-of-the-art analytical techniques and data interpretation tools including compound-specific isotope analysis (CSIA). It will also cover appropriate metrological approach such as the use of official, standardized methods, reference material (RM), data handling, evaluation of measurement uncertainty and participation in interlaboratory comparisons.

RESULTS: Second, selected applications will be given, including major food groups and how these techniques can be used to detect fraud. For example, the discrimination of olive oil according to the country of origin was much improved by including compound-specific (^{13}C) isotope analysis of fatty acids. The isotope approach can be used to differentiate aroma compounds of natural versus synthetic origin of fruits and vanilla. It can be also used to differentiate the origin of fish and seafood (farmed vs. wild).

CONCLUSIONS: This approach will serve as the basis for the further development of robust food authenticity and traceability system.

***Keywords**: food, authenticity, traceability, metrology, stable isotopes, IRMS*

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All these examples will be put in the context of relevant projects and infrastructure, including ISO-FOOD, METROFOOD-RI (https://www.metrofood.eu/), new established European Metrology Network (EMN) for Safe and Sustainable Food, MSCA IT FoodTraNet and FishEUTrust.

Chickpea Proteins and Functional Properties

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AIM Chickpeas are among main legumes grown in different parts of world and the major chickpea producers are India, Turkey and Pakistan. Chickpeas are rich in protein, fibre, and fat, and have lower carbohydrate content than wheat. They also contain various beneficial substances, such as phenolic acid and isoflavones. Due to their high protein bioavailability, biological value, and well-balanced amino acid profile, chickpeas are regarded as a good source of dietary protein despite lacking the sulphur-containing amino acids methionine and cysteine. The solubility, water and oil absorption capacity, emulsifying, foaming, and gelling capabilities of chickpea proteins are also good, and these characteristics are strongly affected by the protein profile as well as the choice of extraction method and processing conditions. So, for the formulation of ingredients that are protein-enriched, chickpeas provide an appealing source of protein. Chickpea proteins have been extracted using a number of techniques, including micellar precipitation, salt extraction/dialysis, and alkaline extraction/acid precipitation. Alkaline extraction/acid precipitation is still the most widely used method for producing chickpea protein when operating parameters and production costs are taken into account. However, compared to other pulses, the extraction and characteristics of chickpea protein recovered by alkaline extraction are low, which has limited the use of chickpea protein. This study provides researchers and industry with information on the potential uses of chickpea protein ingredients in the formulation and production of novel food products by describing the effects of extraction methods on composition, functionality, and applications of chickpea protein ingredients.

Keywords*: chickpea proteins; protein isolate; process optimization bioactive peptides*

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Impact of various fish cooking processes on the fate of Hg and Se species and the Hg-Se antagonism

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It is largely accepted nowadays that a better understanding of the impact of food chemical contamination on human health is important as food represents one of the most important pathways of humans' exposure to chemical hazards. For some elements, such as Hg and Se, the knowledge of their total content is not adequate to accurately assess their impact on the human health via food consumption, due to the difference in toxicity of their species.

This study aimed at the assessment of the impact of various culinary processes on the fate of Hg and Se species in fish. In order to mitigate the exposure to methylmercury (MeHg, the most toxic Hg species) via the consumption of fish, three (marine) predatory fish known to accumulate high levels of this contaminant, such as yellowfin tuna, swordfish and small-spotted catshark were studied. The fish samples were cooked by boiling, steaming, grilling and deep-frying without adding any of food additive. The simultaneous speciation analysis of MeHg and Se (Se(IV), Se(VI), selenomethionine and selenocysteine) was carried out by HPLC-ICP-MS following enzymatic extraction in a closed microwave system. The Se data (total level and speciation) are provided here to assess whether Se species play a role Hg detoxification in fish as a result of cooking. The loss in Hg and Se species is largely dependent on the cooking procedure but also on the fish species. This confirms the importance to consider cooked rather than raw food for accurate chemical risk assessment related to Hg and Se species.

***Keywords**: Hg speciation; HPLC-ICP-MS; fish; cooking; Hg-Se antagonism*

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Efficiency investigation of different solvents for Ochratoxin-A extraction from *Aspergillus* section *Nigri* strains

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AIM This study aims to investigate the Ochratoxin-A (OTA) extraction efficiency of different solvents (chloroform, methanol and 98% methanol-acetic acid) and techniques (vortexing, ultrasonication and blending) from mycotoxigenic fungi. In this study, *A.carbonarius* and *A.niger* strains, which were found as mycotoxin producers in the previous studies, were used.
MATERIAL AND METHODS In this study, an *A. carbonarius* (MA0012) and an *A. niger* (MA0037) strain isolated from grapes were used. These strains were inoculated in MEA- Malt Extract Agar medium (Merck) and incubated at 25 °C for 7 days. Conidial suspensions of each strain were individually prepared and their concentration was standardized at 1-5x10^5 conidia/mL. Yeast Extract Sucrose (YES) agar and broth medium were used for OTA production by the strains. Spore suspensions (100 µL for agar, 1mL for 100ml broth) were inoculated on to the YES medium and these cultures were incubated for 7, 14 and 21 days at 26±1°C. Three agar plugs (1,2 mm) were excised from the centre, medium and outer edge of the colony for extraction. Different extraction solvents (chloroform, methanol and 98% methanol-acetic acid) and different extraction techniques (without mixing, vortex, ultra-sonication and blending) were applied to compare their OTA extraction efficiency. All extracts were analysed by High Performance Liquid Chromatographic (HPLC) for their OTA contamination.
The highest OTA extraction efficiency was observed for application of 98% methanol-acetic acid solution at solid medium and no meaningful difference was noted between the applications of different extraction techniques.

Keywords*: Ochratoxin A; Extraction; Aspergillus carbonarius; Aspergillus niger*

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Worldwide Mycotoxin Management via Co-Creation of Innovative Strategies
MycoTWIN

Enhancing Research And Innovation Capacity of TÜBİTAK MAM on Management of Mycotoxigenic Fungi and Mycotoxins

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Mycotoxins are secondary metabolites produced by specific filamentous fungi that can contaminate food and feed when it is being harvested or while being stored or processed in less-than-ideal conditions. Any number of commodities, including as cereals, fruit, spices, wine, beer, cocoa, coffee, and even dairy products through secondary exposure through feed, might include them. Aflatoxins, fumonisins, ochratoxin A, patulin, citrinin, trichothecenes, zearalenone, and ergot alkaloids are the examples of mycotoxins that can be harmful to both humans and animals.

The general objective of MycoTWIN is strengthening research in the field of mycotoxigenic fungi and mycotoxins through close collaboration and co-creation of three institutes; TÜBİTAK/Turkey, CNR-ISPA/Italy and UV/Spain. For this purpose, a series of activities short term visits, summer schools, workshops, info days and technical visits were defined within the project. Within the scope of MycoTWIN project, short-term visits, summer schools and worskhops were organised on several subjects in the field of mycotoxin such as ‘’Pre and post-harvest management for mycotoxins and toxigenic fungi minimization in dried fruits, nuts, cereals and spices; Mycotoxin monitoring and toxigenic fungi identification’’, ‘’LC-MS/MS analysis of mycotoxins in nuts and dried fruits and risk assessment trough the deterministic approach’’, “multi-mycotoxin analysis by GC-MS/MS and LC-MS/MS”, “mycotoxigenic fungi prevention and control” and “molecular identification of fungi and mycotoxin analysis by rapid advanced analysis techniques”. Info-days on the solutions of the problems in the agriculture, processing and marketing of peanuts and hazelnuts were organized to inform related actors of the sector such as farmers, academia, public institutes representatives to increase their awareness on importance of mycotoxin management for these crops. Through these scientific activities, MycoTWIN is having/will have a active role on increasing the awareness of farm-to-fork releated actors on worldwide mycotoxin management via co-creation of innovative strategies.

***Keywords**: MycoTWIN, mycotoxigenic, fungi, mycotoxin*

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