11th Central European Congress on Food and Nutrition

CEFood Congress Book

"Food, technology and nutrition for healthy people in a healthy environment"

Editors:
Peter Raspor, Andrej Ovca, Sonja Smole Možina,
Bojan Butinar, Mojca Jevšnik

(2nd Edition)

Čatež ob Savi, Slovenia, October 2022

What you sow, you reap.

(Kar seješ, to žanješ)
(Slovenian Proverb)

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11th Central European Congress on Food and Nutrition

"*Food, technology and nutrition for healthy people in a healthy environment*"

Under the honorary patronage of
the President of the Republic of Slovenia Borut Pahor

Acknowledgment

With these words, we would like to acknowledge all those who contributed so that we can celebrate on Sept. 27-30 2022 the 20th Anniversary of CEFood meetings, which started in Ljubljana in September 2002, and enjoy the 11th Central European Congress on Food and Nutrition, and publication you have in your hands.

First of all CEFood Community which gives Slovenia the opportunity to organize this meeting in our country and the state where the first CEFood Congress was born. This would not be the case if the previous organizers of CEFood congresses Diána Bánáti, Kostadin Fikin, Kata Galić, in particular Viktor Nedović would not support the idea.

Secondly, we have to acknowledge past presidents of CEFood meeting for the moral and active support as follows: Diána Bánáti, Viktor Nedović, Kata Galić, Kostadin Fikin, Peter Šimko, Zlatan Sarić, Vladimir Kakurinov, Ovidiu Tița.

Third, we have to admit that without real support of the majority in advisory committee members Nadiya Boyko, Daniela Borda, Éva Gelencsér, Ladislav Kokoška, Antonello Paparella, Dasha Mihaylova, Ilirjana Boci, Mirjana Pešić, Małgorzata Wronkowska, Verica Dragović Uzelac, Elena Velickova Nikova, Gerhard Schleining, Martin Polovka, Slavko Mirecki, Božana Odžaković and Aliona Ghendov-Moşanu new concept of plenary and keynote speakers would not be born and implemented for CEFood 2022.

But all this would not be realized in any form if the Program and organizing team would not struggle all year round to build and keep standards for a new decade of CEFood meetings. Nonetheless, motivation and leadership are important, but nothing is without teamwork. The team did the demanding job, from the sponsors to the program, to socializing activities and to publications and the final event: Mojca Jevšnik, Andrej Ovca, Irena Vovk, Bojan Butinar, Sonja Smole Možina, Igor Pravst, Aleksander Bohinc, Bety Breznik, Primož Treven, Vladimir Mrša, Evgen Benedik, Lea-Marija Colarič-Jakše, Tjaša Vidrih.

Management of the activities related to the International Scientific Committee, with 15 members of the Program and Organizing committee, 17 members of the Advisory Committee from all CEI

countries, and 9 members of the Honorary Committee, former presidents of CeFood congresses have managed a lot of obstacles in the so-called post-Covid period to bring this enterprise to a great finale. Without the enthusiasm, persistence, and devotion of key persons in the team, who needn't be motivated, who were able to motivate all other members to join and work for this idea, the event would not be possible to realize.

All this spirit and challenge was successful in this difficult time when Covid is changing and war is starting in Europe. But in spite of this the CEFood 2022 Congress: attracted active participants: 245 presenters (8 plenary, 11 keynote, 45 oral, 6 flash, 18 workshop, round table and world café, 13 project, and 144 poster presentations of research and professional work in the field of food and nutrition from more than 25 countries all over the world. Within oral presentations, special thanks are going to the 13 CE-I-FooDay (Central European Inspiration Food Day) lecturers who contributed their position papers in a very short time, together with the statements of their promotors from the same CEI countries, in a special publication »Food, nutrition and environment: Positions in Central European space«. Our thanks go also to the reviewers, who dedicated their time to improvements of the papers and to Vlado Mrša who encouraged Croatian Academy of Engineering (HATZ) to publish reviewed position papers in special publication

Special thanks are given to all contributors to this publication as well – "CEFood Congress Book" – with all important information for the congress participants, some introductory papers and contents of the congress, summarized in abstracts of all contributions, where the authors present relevant topics of food and nutrition under the motto "Food, technology and nutrition for healthy people in a healthy environment" comprehensively in their talks and posters, but shortly in abstracts, with the beauty of the language and the clarity of professional terminology, in particular to Irena Vovk, Andrej Ovca, Sonja Smole Možina, Bojan Butinar. Thanks to all who have prepared this publication so that it can be printed, and edited in time to be useful in hands of all congress participants.

Slovenian day was designed by Bety Breznik and her team Lea-Marija Colarič-Jakše, Tjaša Vidrih with enormous support and co-organization from Ministry of Agriculture, Forestry and Food.

Distinct thanks also to the patrons, sponsors, donators, and all unnamed individuals who helped us financially in organizing the event and enabling it to be reachable to more people, also for many students and young researchers from the countries, where this would not be possible without a grant. This was a particular struggle that was not an easy task, first to get money from Gorenje, d.d., Jožef Stefan International Postgraduate School, ETA Kamnik, d.o.o., Science and Research centre Koper, National Institute of Biology, Faculty of Chemistry and Chemical Technology, Slovenian Microbiological Society, Mlinotest, d.d., and Jagros, d.o.o then to disseminate the fellowships to economically less favored countries. Colleagues in our team did a great job in these difficult circumstances when some countries even with the appeal to their embassies did not react to our requests. But 28 young colleagues were awarded and they will bring some fresh thinking to their countries. The sponsor from Slovenian companies and institutes: Mercator Emba, d.o.o., Mercator, d.d., Pivovarna Laško Union, d.o.o., Kmečka zadruga Krško, z.o.o., Kemomed d.o.o., Norsan Srl, Medis d.o.o., Chemass d.o.o., Don Don d.o.o, Radenska, d.d., Vinakoper, d.o.o., Agricultural Institute of Slovenia, and European Parliament Office of Franc Bogovič MEP (SLS/EPP) made our event to be a pleasure for all, in different aspects, mainly professional, but also cultural, enjoying Slovene hospitality, food, and environment.

And all this would not be going on in the beautiful Dolenjska region in Slovenija without the teams in Terme Čatež, and CEFood2022 web page creator Tomaž Gregorič with his fresh design, Tian Gajžl for graphical design of all printed materials, European Declaration on Food, Technology and Nutrition Network from Ljubljana for publishing congress book and Principal Congress Organizer Borbona congress, d.o.o. and its director Aleksander Bohinc, who added a great deal to the shape and efficiency of managerial issues.

And finally, thanks to all of you who decided to participate in the Congress – without your contribution it would not be possible.

September 2022
The President of the 1st and also of the 11th CEFood Congress,
Professor Emeritus Peter Raspor

Let me acknowledge all the participants who contributed to Cefood2022 meeting in Slovenia. Due to various reasons some of planned participations could not take place and were concealed.

In this after COVID period the organizer faced this uncomfortable situation and tried to find relevant replacement. This was possible for selection of lectures as you will find out comparing original program and current edition of CEFood Congress book.

The organizer would like to express clear recognition to colleagues who took their chances and presented their views at last moment considering cancelations at the congress.

October 2022
The President of the 1st and also of the 11th CEFood Congress,
Professor Emeritus Peter Raspor

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Introductory

[1]Peter Raspor, [2]Andrej Ovca, [3]Irena Vovk
[1]Professor Emeritus University of Ljubljana, Ljubljana, Slovenia
[2]Univerza v Ljubljani, Zdravstvena fakulteta, Slovenija
[3]National Institute of Chemistry, Slovenia

The organizers of 11th Central European Congress on Food and Nutrition (CEFood 2022) gathered at the sunny side of the Alps, where the agriculture is still alive and where food is still harvested in seasonal mode and culinary and cultural tradition is still respected as part of the nation's philosophy. Globalization is a fact, but we see that this paradigm also has some limitations which cannot be ignored. However, globalization also has some good lessons which have to be respected in our research, development and practice. This is why we will come together in September 2022, to discuss and to offer solutions to practitioners, to policy makers and to the business world. Food is big business. It must not be allowed to fall into the wrong hands.

CEFood 2022 is providing a relevant scientific program with the optimal selection of speakers from Central European initiative countries, as it is possible in this after COVID19 period and war which is going on in Ukraine. Beside the scientific content, the congress is also offering important experiences highlighting Slovenian food and its gastronomic heritage. What is food science and technology and nutrition without basic sensorial experiences?

The program is focused and open, at the same time to pinpoint and recognize the latest advances along the food supply chain including research and education with open discussions on current issues in this area respecting environmental concerns via round table workshops and World cafe. It provides relevant guidance to the ongoing projects in Food Science, Technology and Nutrition, involving hands-on professionals, scholars, researchers and policy makers.

Over the last two years, due to COVID-19 and the fact that we have been mostly meeting each other on-line, we have lost face-to-face sharing, not just sharing food around a table, but also exchanging knowledge and skills face-to-face.

So, this publication has intention to gather thoughts and statements of professionals from different countries around Central European basin including Albania, Austria, Bosna and Herzegovina, Bulgaria, Croatia, The Czech Republic, Hungary, Italy, Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovakia, Ukraine and Slovenia as well. However, professionals including researchers, teachers and other specialists from eight other (non)European countries outside Central

European basin are contributing to the program of the CEFood2022. We feel confident, that we put together cluster of different, for current food and nutrition relevant themes, what showed with diversity of food, language and climate.

But still. The organizer wants to deliver advanced platform for CENTRAL EUROPEAN SPACE which is recently named CEI as stay for central European initiative.

Inspired by our common future and with mutual activities, needs and challenges, we decided to offer to our scientific and professional community new frame with new triggers which can deliver fresh answers and new solutions for the current world straggling for quality, safety and health as it is well embodied in our congress motto.

Provoked and inspired by this thinking we decided to offer following platform which is born to celebrate 20th anniversary of CEFood congress.

Let us explain the concept:
First and last congress day we understand as pillars. First pillar represents **Central European Food Project Day** where we offer participants journey from yesterday, when project was coined, until today when, it started to deliver first results. So it is the way from linkling to food project based on ideas in food science which inspired projects. We should humbly admit that this concept is just improved concept from the first CEFood2002, where we spoke about project networking. But still, it is clear that this type of structured presentations delivers much more substances to audience.

On the contrary, the last day represent totally new pillar and has profoundly new dimension. We named it **Central European Inspiration Food Day (CE-I-FooDay)** and offered to each CEI country slot to present position paper where they fill comfortable to offer some challenging novelty or solution reflecting on congress motto: “Food, technology and nutrition for healthy people in a healthy environment.“ It is really unique approach from selection of potential speaker to materializing her or his ideas in position which might help us to overcome current obstacles to more prosperous future and delivered to the public in 12 contributions and additionally special publication of position papers by Croatian academy of technical science (HATZ).

Two days in between just connect these pillars with current knowledge, discoveries and dilemmas. The day one covering important research and practical blocks **From technology to food** not ignoring soil, water to food production and processing and day two where critical questions touching elements **From food to nutrition** again not ignoring essentials from food processing to the consumer.

In this rather complex and solid structure we imbedded also elements of culture, heritage and networking possibilities for congress participants.

We have to admit, to be inspired by the first meeting 20 years ago and with good examples during the time course of CEFood congresses in many countries till now. Respecting reach and diverse history we organized Slovenian food day, promoting Slovenia food heritage and demonstrating current developments from this area as well.

Consequently, in spite of hard time “after” Covid period the outcome of this exercise is summed up in 7 plenary lectures coming from Austria, Bulgaria, Croatia, The Czech Republic, Hungary, Serbia, and Slovenia opening 11 sessions: “Plants - a staple food or an alternative?”, “Before and after the harvest”, “Potentials and limitations of bioactive compounds”, “New food products, technologies and techniques”, “Can we improve food properties and prevent food fraud at the same time?”, “Food related health hazards and risks”, “Nutrition: is the point in the food or in the gut?”, “Biotechnology: evolution or revolution?”, “Food microbes: friends or foes?”, “Consumer's food choices and risk management” and “Food analytics”. The sessions just listed were opened by key note lectures, selected by International advisory committee by scoring among three suggested topic by top researchers from each CEI country. By this method of selection key note speakers from following countries Albania, Austria, Bosna and Herzegovina, Croatia, The Czech Republic, Hungary, Italy, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia and Ukraine had the honor to open the session with key note address.

Significant part of the program are three Workshops: “Food safety; Modern food: local vs. global, traditional vs. innovative in the “healthy” perspective”, “Challenges for beer and wine in today's food world”and “Food and its safety in a fast changing world” touching important elements of food in nutrition in profound focused way, a roundtable: Edible insects - food of the future? and World cafe: Supplements and nutrition?

The FLASH presentations for young researchers and poster session additionally expand the scientific landscape addressed by the oral presentations

So let’s conclude this introduction with an observation. We worked very hard and we trust that celebration of 20th anniversary is bringing more new question than answers to food surface, but also we were able to demonstrate that quality is still among us and it is proper and worthy to share it with events like Central European Food Project Day, Slovenian day and CE-I-Food day integrated to traditional congress schemes with plenary, key note and Offered lectures, and posters which illustrate state of the art in research and partial also in the practice in each CEI country in which this event is conducted.

Last, but not least, we decided to name this publication “CEFood Congress Book” and not Book of Abstracts as it is common in congress practices. The reason for this name lays in its concept. We include in this book contribution

"**CEFood from Slovenia back to Slovenia in 20 years**" where we follow the time course of CEFood congresses. We trust that the future colleagues from food domain will appreciate this piece of work which was not so easy to be delivered and we appreciate very much help of some colleagues.

Nonetheless, we opened also new field of awareness and new page in current Congress Books for future. This is the chapter about "**Distinguished Slovenian contributors to the development of the food and nutrition domain".** We deeply believe and trust, that our current time would not be as it is if we would not have them to bring us where we are now. So we believe in human respect and this is how we decided to express our view. It is short, yes. But in the time of digitalization it looks we do not need books. Name and few details are enough to build the picture.

The future will tell us, if our generation was thinking right along these lines.

CEFood from Slovenia back to Slovenia in 20 years

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Throughout the centuries Central Europe has always been a very influential melting pot of ideas for transnational and regional cooperation. At the end of the last and at the beginning of this century there was a great spirit of cooperation in Middle Europe as evidenced first by The Alps-Adriatic Working Community and later by the Danube initiatives – these two initiatives having a wide variety of cross-border motives for cooperation, not just political clustering. Various platforms had claimed a necessity for cooperation. However, the Central European initiative (CEI) which was established in 1989 in Budapest remains the one that offers a good frame for scientific research and educational cooperation in the area related to food.

Expansion of the European Union to Middle Europe later stimulated new visionary cooperation, not just in the North-South orientation, but also in the West-East orientation. This was a good climate to establish a platform for the Central European Congress on Food and Nutrition (CEFood congress) in Ljubljana. After 20 years of continuous activity, we see the year 2002 as a key milestone for food researchers, teachers, and related professionals. The scientific and professional framework of the 1st CEFood congress in 2002 offered a solid basis and a guarantee for the CEFood congresses to continue into future events, which we still enjoy regularly. Since 2002 CEFood congresses have been organized biannually in different CEI countries as listed in this paper.

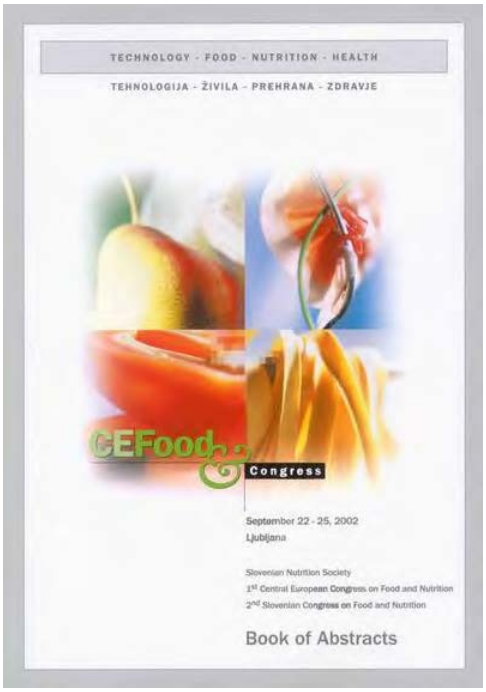
In 2006 the European Federation of Food Science and Technology (EFFoST) showed a definite desire to enter this network, due to good and efficient organization, based on the devotion of the CEFood congresses' principal organizers and their teams. The federation is staying aside and it is not really involved to help meetings financially or with some other means. From time to time they use it to spread ideas about EFFoST activities.

After two decades we had ten meetings where scientists, professionals, and policymakers met and discussed the relevant issues regarding food from the perspective of the organizer. Some of those discussions were efficient

and fruitful to influence other meetings to include some novelties, like project day exercises and structuring the congress-type meetings with more firm agenda.

So, all organizers in the past showed great devotion to gather and to disseminate the knowledge and skills to others and in particular to the younger generation, as you can see from the topics in the program of some CEFood meetings. But in general, every one of these congresses had a specificity of the region, culture, hospitality, and participation. In each of these congresses, young researchers had the opportunity to meet recognized professors and key researchers in the area. The organizing committees have been established on very different principles since the CEFood network is not a very rigid organization.

Ljubljana, SI, 1st CEFood, September 22 - 25, 2002, Peter Raspor

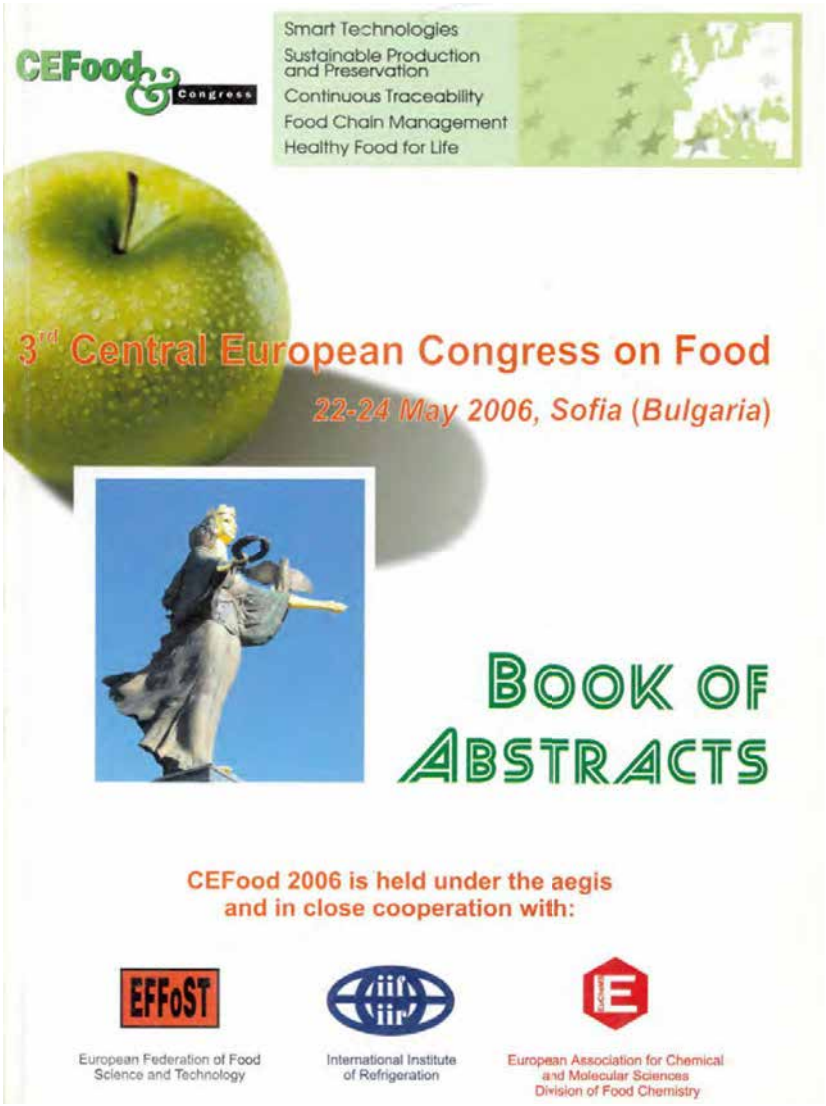


Three plenary sessions Food and technology, Food and safety, Food and nutrition were followed by 21 sections Food production, Food processing, Positive microbial processes, Negative microbial processes, Food and health risks, Public perception of food, Food engineering, Food preservation, Food commodity as quality, Food packaging, Antioxidants, Risk factors and chronic diseases, Fats and oils, Minerals, Nutrition and health, Food microbiology, Food quality assurance, Novelties in plant foods, Legislation, consumers and foods and presented in 207 contributions presented by 430 authors.

Budapest, HU, 2nd CEFood, April 26 – 28, 2004, Bánáti Diána

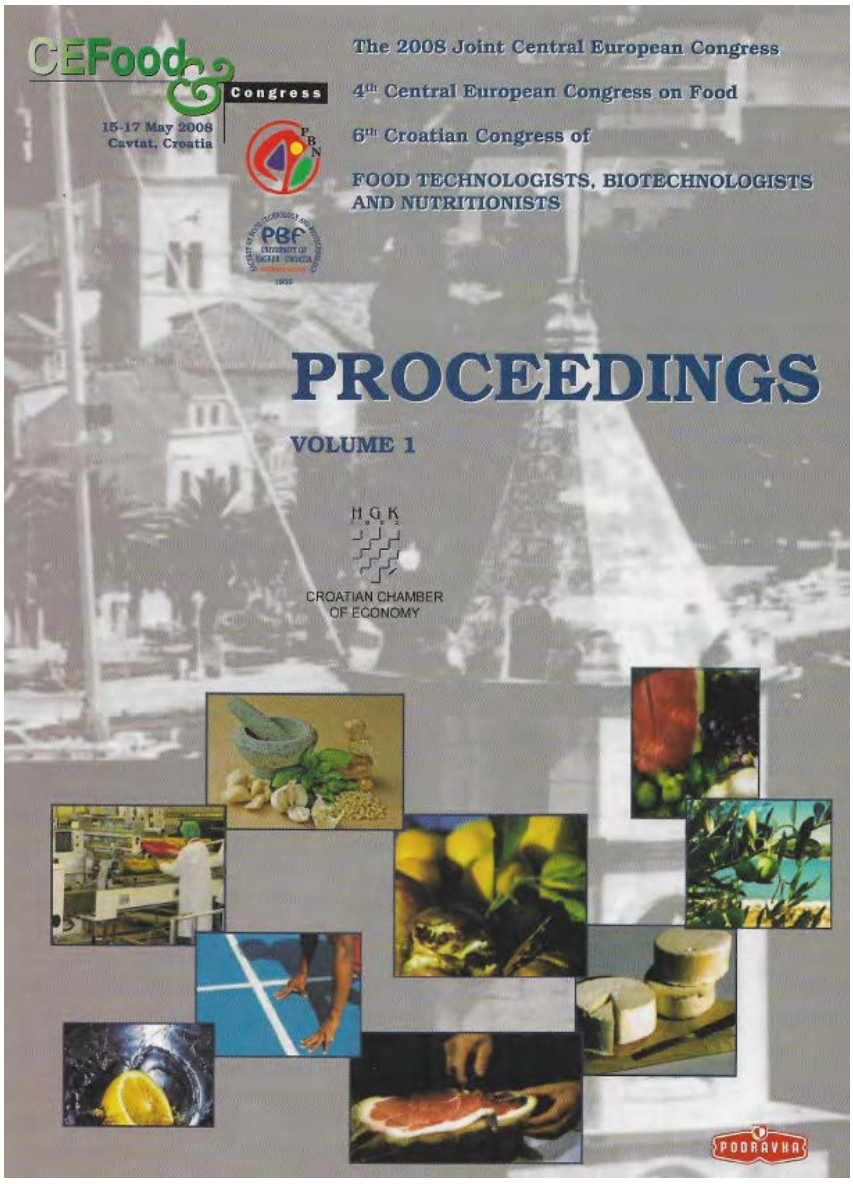
The program had no special predefined structure and was composed solely of lectures, posters, and round tables, all together with 245 abstracts of contributions that were oriented to Food safety, Nutrition, Consumer approach, and Food science and technology in particular.

Sofia, BG, 3rd CEFood, May 22 – 24 2006, Kostadin Fikiin



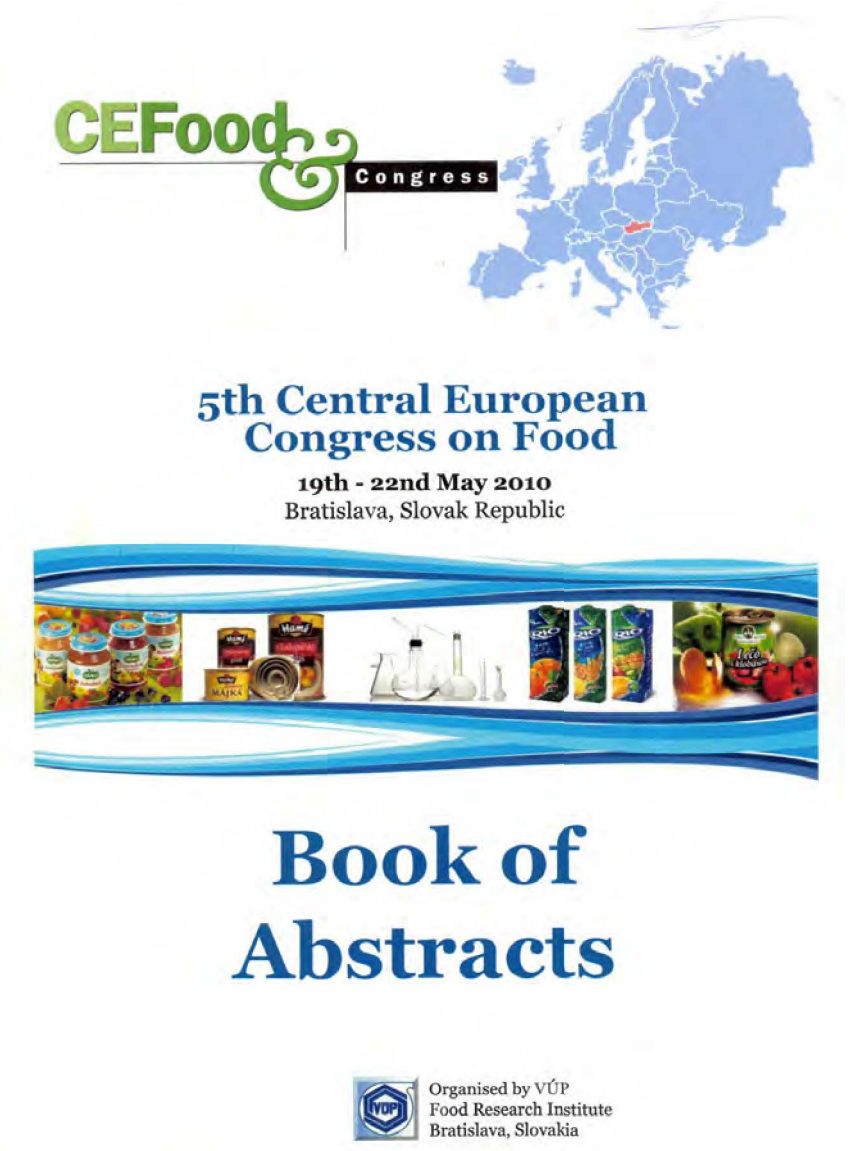
The program had the following sessions: Food preservation, refrigeration, innovations and logistics, Cold chain management and traceability, Food traceability, analysis and control, Improved quality, safety, nutrition, and consumer health, Food legislation and global harmonization initiative, Risk analysis, Smart technologies for production and supply, manufacturing, handling, quality and sustainability, EU food research and poster sessions with more than 150 abstracts of contribution to congress program.

Cavtat, HR, 4th CEFood, May 15 – 17, 2008, Damir Karlović



The program was composed of sessions like Food Engineering, Food Processing and Food Refrigeration, Food and Health, poster sessions, round tables, and satellite events of the 8th Croatian congress of Food technologists, biotechnologists, and nutritionists with more than 120 abstracts of contribution to congress program.

Bratislava, SK, 5th CEFood, May 19 – 22, 2010, Bratislava Peter Šimko

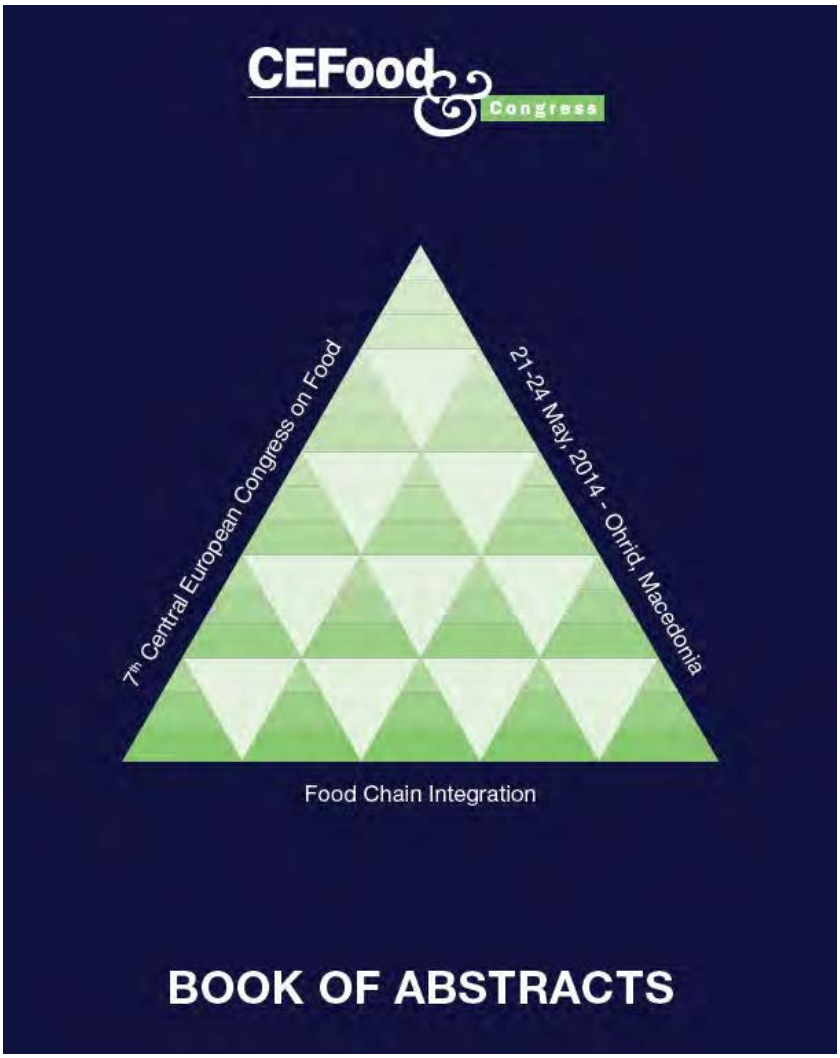


The program was composed of sessions like Antioxidants, Food safety, and analysis, Processing, Microbiology, Young scientist session general, Young scientist session – nutrition, Young scientist session – safety, Young scientist session – analysis and was presented as lectures and posters in 188 abstracts.

Novi Sad, RS, 6th CEFood, May 23 – 26, 2012, Viktor Nedović

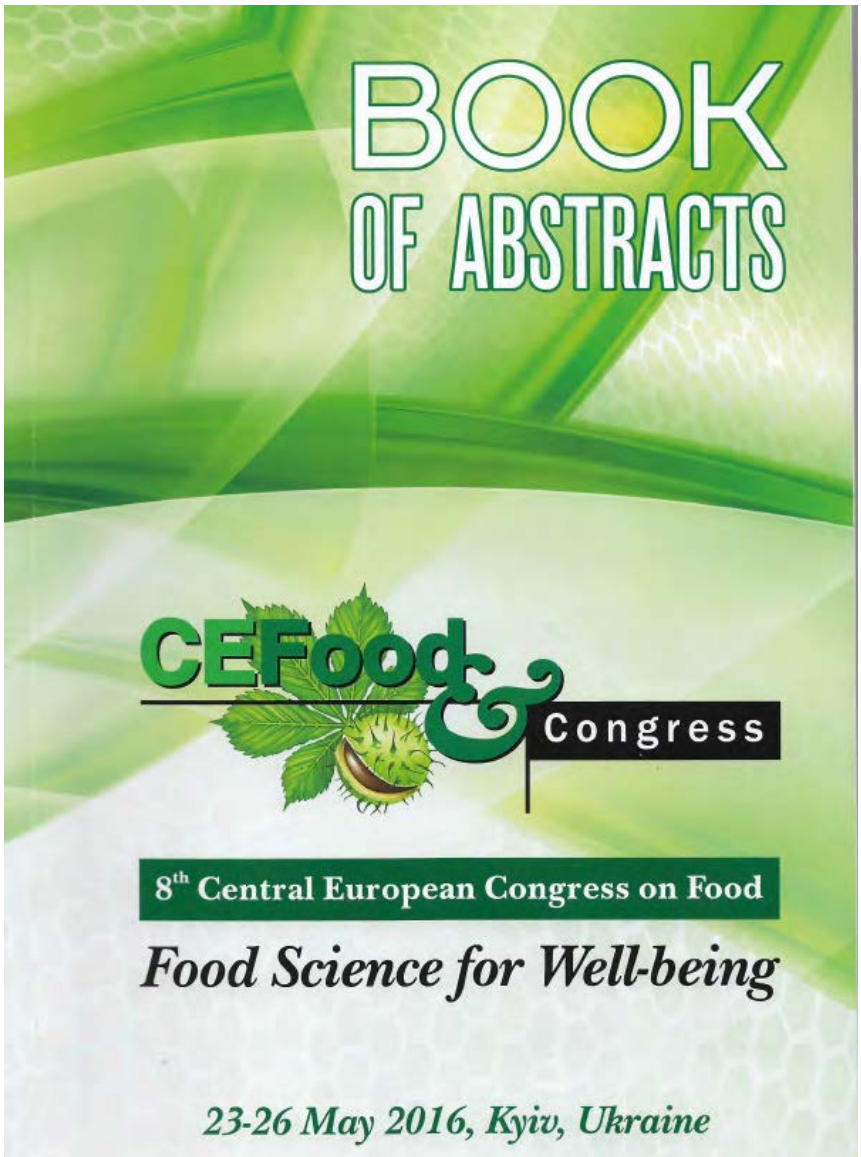
The meeting concept was designed around five main themes: Smart Technologies for Sustainable Food Production and Preservation, Food Quality, Manufacturing and Preservation, Continuous Traceability and Ubiquitous Food Chain Management, Advances in Food Refrigeration and Cold Chain Logistics, Improved Nutrition for Life, Health and Longevity. The program was structured in 11 sessions; Food Ingredients, Health and Nutrition, Functional Foods, Food Analysis, Microbiology Quality, and Safety Assurance, Food Engineering, Processing and Technology, Packaging and Shelf Life, Product Design, Food Biotechnology, Novel Bioproducts, Food Structure, Sensory Analysis, Food, Traditional Food, Food With Appellation of Origin, Food, and Feed Chain Management, Feed as Challenges for Food Supplier Chain; And Consumers, International Programs and Projects in Food Science, Education, Innovation and Knowledge Transfer and was presented with more than 620 abstracts for plenary, session lectures, and posters.

Ohrid, MK, 7th CEFood, May 21 – 24, 2014, Vladimir Kakurinov



The program was composed of the following sessions: Traditional Food, Food with Appellation of Origin, Food Management, Packaging, and Shelf Life, Product Design, Food Biotechnology, Novel Bioproducts, Functional Foods; Food Biotechnology, Novel Bioproducts, Functional Foods; Food Production, Engineering, Processing and Sustainability; International Programs and Projects in Food Science and Food Ingredients, Food Structure; Food Quality and Safety; Food Refrigeration and Cold Chain; Hygienic Engineering and Design, Consumers, Health, Nutrition, and Sensory Science; Food Analysis, Food Microbiology, Chemistry, Biochemistry; Education, Innovation and Knowledge Transfer, Food Management, Food Processing and a poster session with a total contribution of more than 220 abstracts.

Kiev, UA, 8th CEFood, May 23 – 26, 2016, Iaroslav Zasiadko



The program was presented in 5 sessions: Food expertise, safety, and technologies, Energy systems for the food chain, natural bioactive compounds, functional and national food products, Packing, storing, and processing, Modern challenges, and competitiveness, Young food scientists – our horizon.

Sibiu, RO, 9th CEFood, May 24 – 25, 2018, Ovidiu Tița

The congress conducted 3 communication sessions and one which was more practical and performed in the Romanian language. Altogether the meeting had more than 160 contributions focused more on closing regional situations in the field of food technology and processing.

Sarajevo, BA, 10th CEFood, June 10 – 11, 2020, Zlatan Sarić

Faculty of Agriculture and
Food Sciences
University of Sarajevo
Bosnia and Herzegovina

10th Central European Congress on Food (CEFood)

Book of Abstracts

Sarajevo
June 10–11, 2021

The program was conducted virtually during a very difficult COVID time. The Program was structured by topic and sessions, beside plenary lectures they had the following sessions: Food Analysis, Food, And Feed Chain Management, Food Energy Systems, Modern Challenges, and Covid-19 Challenges what was covered with more than 100 contributions as documented by the number of abstracts.

The authors of this paper trust that the openness of organizational principles is an important element of this network. We trust that openness is crucial for keeping the willingness of highly devoted teams to face the

challenge to enter the next meeting circle with suitable support from institutions within the country where this important activity is going on.

Figure 1: Creation of CEFood Bell in 2008 in Cavtat from Left: Prof. Damir Ježek, Prof. Damir Karlović, Dr. Sona Supekova, Dr. Marian Honza, Prof. Kata Galić, Prof. Diana Banati, Prof. Viktor Nedović, Prof. Peter Raspor

Figure 2: CEFood Bell

Respecting this specific situation in the last twenty years, which experienced in CEI area different turbulences, speaking politically regarding the expenditure of European Union but also in other dimensions

which escorted that movement which is still going on. Although the trend and perspectives slightly change depending on global circumstances. Today, in the second decade of 21st century, it is not much different. Yes, science is at least verbally very much respected. Also, food and nutrition research came to the main pages of social media. It is still not everyday practice to address these demanding questions in the political world regularly. Once a year in October and in June we directly address this challenging task for human society. In October as World Food Day and in June as World Food Safety Day. Each of these regular meetings has a slogan that is adopted to the relevant situation at that moment. CEFood congress's mission also started with the slogan "**Technology - Food – Nutrition - Health"** in 2002 but was not followed by organizers regularly. Although some of them mentioned particular importance, but only the meeting in 2018 stressed **Food science for well-being.** Only the 2008 congress was organized as a joint meeting with the regular national congress. But all congresses attracted eminent professionals and well-known experts not just for the lectures but also for their contributions to round tables and workshops, which again brought together speakers from the central European territory, but also from the global world as they were ready to share knowledge, skills, and findings with all, positively and carefully motivated people. Individuals who are aware that tomorrow's day on our planet might be very different. It looks like the organizers had selected individuals who care about what we are doing and what we will continue to do along the food supply chain.

They were many conferences in the last 20 years dealing with agriculture, technology, food, nutrition, and style of life. We enjoy CEFood activities since the dimension of this particular gathering just fits into central European tradition and innovation. We are linked also to EFTN activities since the European declaration on food, technology, and nutrition for health supports the Mediterranean spirit in nursing chains was also coined in Ljubljana in 2008. And further on, we have moral support from many colleagues in the area, they cannot be with us for various reasons, but they still see our activity as an excellent interface between science and practice for scholars, professionals, and the lay public. In a way they are right.

We hope that information delivered, and discussions that will be open will give additional wind to the CEFood movement and will encourage small and medium enterprises to start producing some traditional but forgotten food items. Schools to give more emphasis on this issue. Politicians to start listing to those who know how to handle such challenges. And all nutrition advisors to start educating themselves regularly before they transfer information to lay consumer in a such populistic and often misleading way.

Food, cuisine, industry, and environment have big opportunities and many limitations. This is why we have to come together regularly and discuss important issues step by step and consequently suggest better solutions for old problems. How to handle food and nutrition for a healthy and happy life.

Reflecting on this very moment it looks like we will face our civilization's mistakes very soon.

But humankind always managed to survive difficult times. We hope that the generation who is coming to the surface of man's activities will find motto of coexistence with Nature. We must build scenarios and foresight also for that direction. Because human greed brought us to the surface, and let's control it not to push us down again.

Acknowledgment:
The authors would like to express their gratitude for getting particular information for CEFood congresses 2nd Bánáti Diána, Kostadin Fikiin, 4th Kata Galić, 5th Peter Šimko, 6th Viktor Nedović, 7th Vladimir Kakurinov, 8th Viktor Nedović, and Kata Galić, 9th Ovidiu Tița, and 10th Zlatan Sarić.

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Recognized Slovenian Contributors in the food area

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[1]Professor Emeritus University of Ljubljana, Ljubljana, Slovenia
[2]Science and Research Centre, Koper, Slovenia

Distinguished individuals who contributed to the development of the food area in the broadest sense are important for each nation but also for culture in general. With the aim of promoting Slovenia and Slovenia's knowledge and experience, we want to highlight several meritorious contributions to the development of the food and nutrition domain of our Current state. Individual contributions have spanned scientific discoveries, special technological breakthroughs, and significant improvements that have remained in use for many years.

This list was assembled from written materials from the past, hints from professionals in specific areas in the agri-food-technology and nutrition domain, and our humble knowledge. Based on all this information we coined the list which you have in continuation.

The program and organizing committee have been brave enough to listen to our proposal and respecting our selection it decided to attribute the selection of topics and sessions to pay respect to individuals from the past. To our knowledge, such a list of individuals was not present until now. This is the first attempt to start building such a selection.

Our basic criterion for inclusion was the recognizable impact on the food domain either domestically or internationally and of a strictly theoretical or practical nature. We hope that this list will steer further in the relevant circles to form the food domain of a scientifically sound background with some deeper roots than the life span of Slovenia as an independent state.

For centuries, the territory of Slovenia has been crossed by traditional transportation routes connecting northern Europe with southern, eastern, and western Europe. Slovenia's location in the north-western part of the Mediterranean's most inland bay on the Adriatic Sea where the Alps, the plateaus of the Dinaric Alps, and the western margins of the Pannonian Basin meet gives it relatively quiet advantageous traffic and geographical position distinguished by its transitional character and the links between these geographical regions. In a wider macroregional sense, this transitional character and these links have not changed since prehistoric times. So, Slovenia in recent history has been the crossroads of Slavic, Germanic, and Romance languages and cultures (Černe 2004). Its territory has been part of many different states: the Roman Empire, the Byzantine Empire, the Carolingian Empire, the Holy Roman Empire, the Kingdom of

Hungary, the Republic of Venice, the Illyrian Provinces of Napoleon's First French Empire, the Austrian Empire, and the Austro-Hungarian Empire (Slovenia). In October 1918, the Slovenes co-founded the State of Slovenes, Croats, and Serbs. In December 1918, they merged with the Kingdom of Serbia into the Kingdom of Serbs, Croats, and Slovenes which in 1929 was changed into Kingdom of Yugoslavia. During World War II, Germany, Italy, and Hungary occupied and annexed Slovenia, with a tiny area transferred to the Independent State of Croatia, a newly declared Nazi puppet state. In 1945, it again became part of Yugoslavia. Post-war, Yugoslavia was allied with the Eastern Bloc, but after the Tito–Stalin split of 1948, it never subscribed to the Warsaw Pact, and in 1961 it became one of the founders of the Non-Aligned Movement. In June 1991, Slovenia became the first republic to split from Yugoslavia and become an independent sovereign state.

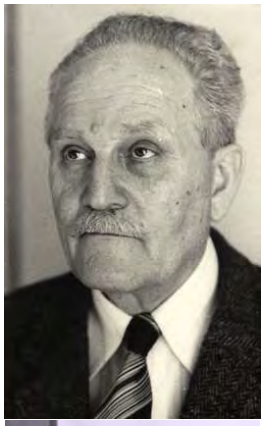
For that reason, it is no wonder that our nation contributed its knowledge and skills to states where Slovenians lived and contributed to it in all sectors including food education and research. Slovenia is today, a developed country, with a high-income economy ranking highly on the Human Development Index. The Gini index rates its income inequality among the lowest in the world. It is a member of the United Nations, the European Union, the Eurozone, the Schengen Area, the OSCE, the OECD, the Council of Europe, and NATO.

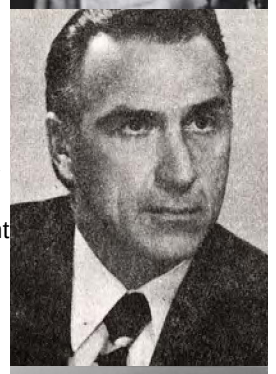
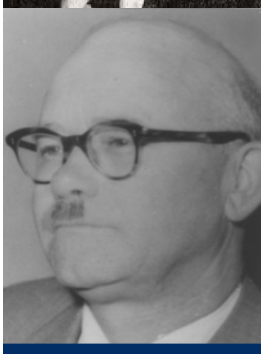
We believe that during this time colleagues who respect knowledge but also its origin, will focus further on this challenge, and one day we will have a much more comprehensive and mature picture of our “Slovenian” contribution to the global pot of knowledge in the area of food domain.

Last but not least, with this move we would like to induce other organizers of CEFood Congresses, who will follow; to do this list for their countries as well. One day in the future, we will eventually have a list of “Food giants” which will be a good attraction for further struggling in this demanding area for human survival.

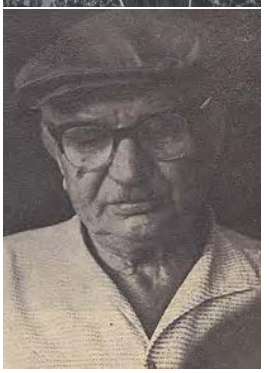
Consequently, from that perspective is highly demanding to build such a list.

But we took our chances and we prepared the list as follows: last/ first name, the frame field of work key achievement, impact on agro-food supply chain/public health and name photograph:

Adamič, France	1911-2004 Agronomy Fruit growing Academic of Slovenian oliveculture	
Adamič, Jelisava	1929-2014 Agronomy & Microbiology Bacteriological control of food Food Microbiology	
Bitenc, Franc	1926-1977 Food technology Plant food technology Fruit juices	

Blinc, Marta	1904-2000 Chemistry of starch Starch colloids Microbiology/Biotechnology/ Cereals	
Bučar, Franc	1926-2000 Food technology Founder of Food technology studies Establishment of Department of Meat Technology	
Fišer, Ferdo	1908-1992 Agronomy Hop technology Agricultural expertises in former Yugoslavia	
Gerbec, Marko	1658-1718 Medicine Founder of medical prevention in today's territory of Slovenia Food as a cause of disease	

Gerl, Friderik	1901-1987 Food technology Beginner of biotechnology in Slovenia (Yugoslavia) Food factories: Arrigoni, Fructal, TOK	
Hausenbichler, Janez	1838-1896 National awakener Father of hop growing in Savinjska dolina in Slovenia National master (hop growing, horse breeding, weaving)	
Ivačič, Ivan	1939-1984 Gastronomy The First Slovenian Culinary TV Star Popularization of culinary	
Janša, Anton	1734-1773 Beekeeping The complete science of beekeeping (posth.) Beekeeping schools in Habsburg dominions (Maria Theresa)	

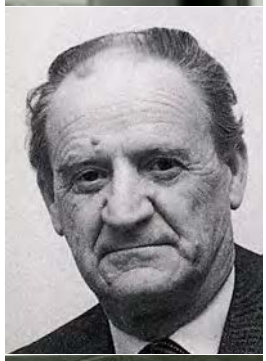
Jesenko, Fran	1875-1932 Genetics/Agronomy Triticale Plant breeding research	
Knafelj Pleiweis, Magdalena	1815-1890 Gastronomy The author of the first Slovenian cookbook Foundations for further cookbooks - e.g. Felicita Kalinšek's cookbook	
Kornhauser Frazer, Aleksandra	1926-2020 Chemistry of natural compounds Impact on sustainable development - EU, UNESCO "Pro Natura" Fund	
Kovačič, Stanko	1898-1977 Agronomy Setting up the food supply of the province of Trieste 1945-1947 Founder of post-war Oliveculture research institute in Slovenia	

Kuhar, Boris

1929-2018
Ethnology/Anthropology
World-food Cookbooks
Nutritional culture of Slovenian regions

Ločniškar, Franc

1923-2010
Genetics
Description of chromosomal translocations
Animal biotechnology

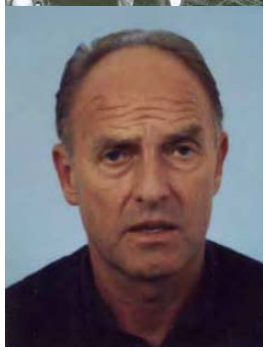


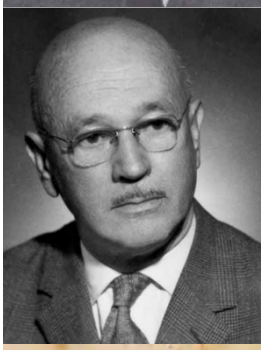
Ložar, Rajko

1904-1985
Archeology/Art history/Ethnology
The first attempt of a rural food descriptive synthesis
Nutritional culture of Slovenian regions

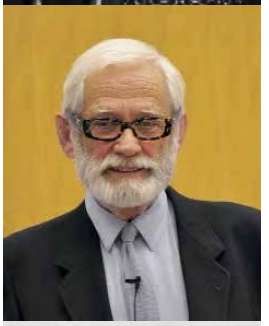
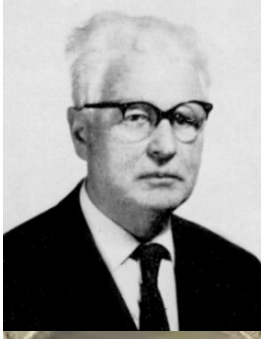
Marinšek, Janez

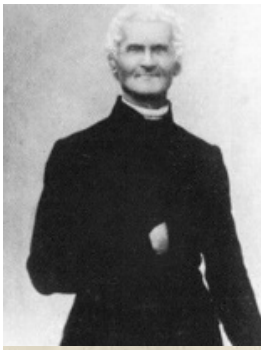
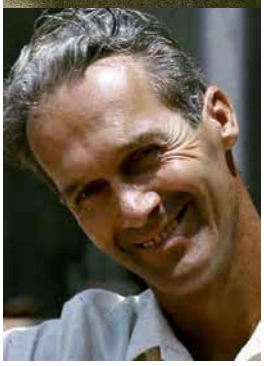
1942-2022
Veterinary Medicine
Development of the Faculty of Veterinary Medicine
Food Safety / Food Hygiene



Megušar, France	1931-2017 Microbiology Foundation for the study of microbial ecology and the physiology of microorganisms Idea leader of the undergraduate study of microbiology at the University of Ljubljana	
Novak, Vilko	1909-2003 Ethnology/Slavic linguistics Father of the culture of nutrition research in Slovenia Folk nutrition in the Prekmurje region	
Pirc, Ivo	1891-1967 Hygiene National health and welfare equality in pre-WWII Slovenia Founder of public health in Slovenia	
von Plenčič, Marko Anton	1705-1786 Medicine Harbinger of the bacteriological era “Opera medico-physica”, 1762	

Pokorn, Dražigost	1941-2009 Nutrition Contemporary dietary recommendations Creating the concept of the public nutrition system	
Priol, Josip	1889-1969 Agronomy Apple breeder cv. "Lonjon"	
Samec, Maks	1881-1964 Chemistry of starch Starch colloids Pioneer of wheat starch research	
Simčič, Marjan	1960-2016 Nutrition Settlement of Nutrition laboratory Nutrigenomics	

Šikovec, Venčeslava	1929-2021 Viticulture and oenology Technological of selected yeasts for relatively pure alcoholic fermentation. Mapping of viticultural regions of Slovenia.	
Štirn, Jože	1934-2021 Marine biology Coastal sea research Delamaris factory: research of population dynamics and ecology of small pelagic fish and the possibilities of shellfish farming	
Tavčar, Alojz	1895-1979 FAO expert Genetics of Wheat and maize varieties and creating new cultivars	
Valvasor, Janez Vajkard	1641-1693 Polyhistor Glory of the Duchy of Carniola First written recipe for 'potica', the preparation of mead, food writing	

Vertovec, Matija	1784-1851 Viticulture Winegrowing for Slovenes Agricultural chemistry	
Vodnik, Valentin	1758-1819 Culinary The first cookbook in the Slovene language The burst of new to come cookbooks	
Zei, Miroslav	1914-2006 Marine fishery Mariculture/FAO/UNESCO The practical aspect of sea fishing	

Acknowledgment
As proper, we had asked all key persons in the specific fields for suggestions. With this statement, we express our gratitude for their help and their hints.

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PLENARY LECTURES


TERME
11th Central European Congress on Food and Nutrition
The future Partnership Sustainable Food Systems (SFS):
consequences for Food Science and Technology (FST) and vice versa
Hugo de Vries*

PL-1

FROM ENVIRONMENT TO FOOD (AND BACK): WHAT HAS TO BE DONE IN THE NEXT DECADE

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Agriculture and the food system are key to global climate change responses. About 21–37% of total greenhouse gas emissions are attributable to the food system: agriculture and land use, storage, transport, packaging, processing, retail, and consumption. Although overall agricultural productivity has increased, climate change has slowed this growth over the last decades and has reduced food security. Ocean warming and acidification have caused the redistribution of marine fish stocks ad adversely affected production from shellfish aquaculture and fisheries. Weather extremes are also causing economic and societal impacts across national boundaries through supply-chains, markets, and natural resource flows, with increasing transboundary risks. Climate change will negatively impact the four pillars of food security – availability, access, utilisation and stability – and their interactions. At 2°C or higher global warming food security risks due to climate change combined with non-climatic drivers will lead to malnutrition concentrated in Sub-Saharan Africa, South Asia, Central and South America and Small Islands. For adaptation and mitigation throughout the food system, enabling conditions need to be created through policies, markets, institutions, and governance. Effective adaptation options include cultivar improvements, agroforestry, community-based adaptation, farm and landscape diversification, and urban agriculture. Adaptation strategies which reduce food loss and waste or support balanced diets also contribute to nutrition, health, biodiversity and other environmental benefits. Other sustainability-driven trends should also be promoted including preferences for food production that supports biodiversity and mitigates climate change, preference for locally and ethically sourced food, for vegetarian product consumption and for products that have waste designed out or repurposed. Greater transparency and digital evidencing across the food supply chain and utilisation of biodegradable and informative product packaging is also important. Last bit not the least: citizens should be encouraged to grow food and we need to treat food like the valuable good that it is.

PL-2

DIETARY CHALLENGES RELATED TO DEMOGRAPHIC SHIFT IN AGING POPULATION

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Aging is a natural and multi-factorial phenomenon characterized by the accumulation of degenerative processes that are in turn underpinned by multiple alterations and damage within cellular and molecular pathways. The prevention of age related physical and mental impairment, as well as the reduction of chronic diseases is one of the main objectives to improve quality of life and reduce the costs for healthcare in the elderly. This is important since the proportion of people over 60 years of age will be doubled by 2050. The age-related loss of muscle mass, function and strength—termed either as sarcopenia or dynapenia—has a profound impact on mobility in the elderly. This loss of physical function capabilities compromises the ability to independently perform every-day activities. There is profound evidence that there is a close interaction of physical activity, diet, function and aging. Whilst all elements of dietary intake are critical for the maintenance of muscle mass, it is the regular adequate consumption of protein, that is essential to stimulate protein synthesis **[1]**. One other important player is regular physical activity to preserve muscle function on a high level. Other very important nutrients in the aging populations are e.g. vitamin D, iron, zinc, folic acid or vitamin B12. Importantly, both, physical activity and a well-balanced diet are the key factors for a good and long lasting (muscle) health and when combined, their synergistic impact on muscle tissue is even stronger. Within the talk I will present international as well as own data such as from the ACTIVE AGEING study, where we performed supervised resistance training in 117 institutionalized elderly (mean age 82.8±6.0 years) over 6 months with and without a nutritional intervention **[2].** In the recently finished NUTRIAGING studies we compared protein or vitamin D at different intake levels with and without supervised resistance training on various health marker **[3,4].**

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PL-3

THE FUTURE PARTNERSHIP SUSTAINABLE FOOD SYSTEMS (SFS); CONSEQUENCES FOR FOOD SCIENCE AND TECHNOLOGY (FST) AND VICE VERSA

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The European candidate Partnership Sustainable Food Systems [1] focuses on the needed transition towards sustainable food systems (SFS) via system approaches [2]. However, this makes only sense if we understand what sustainable food systems are and how they function. Sustainability is defined as 'whatever we do, we should not compromise future generations' (Brundtland report, 1987). Hence, SFS are systems that have the capacity to endlessly evolve, continuously providing affordable, safe, healthy, delicious, functional foods for all people in their various cultural settings, and produced in an environmental-friendly manner. This is what the Partnership SFS strives for in all Europe regions, by changing the way (what) we eat, how we process and supply, how we connect ourselves to food systems, and how we govern them [1]. The implications for new developments in Food Science and Technology (FST) are numerous. First, these target an efficient usage and reusage of biomass in time (in our open thermodynamic planetary system fuelled by solar energy). Secondly, the handling of all diverse resources and food products respects both upper and lower limits for all environmental, social, economic and health indicators. Third, food process-structure-function relationships are considered in robust and performing food systems from a broader perspective. This includes playing fields (context), players (food actors), pieces (resources, products, waste, services), moves (food chain activities), rules (food laws, incentives...), duration (e.g. in terms of renewing resources) and outcomes (win/lose); i.e. the seven building blocks of a game [3]. Several case studies are presented that provide new research questions for the future Partnership and serve to exchange insights in FST with Central and Eastern European Countries.

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[2] N. Halberg, & H. Westhoek European Union Publication. ISBN 978-92-76-08794-6. (2019).
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PL-4

PLANT IN VITRO TECHNOLOGY FOR FOODS AND FOOD ADDITIVES: CURRENT STATUS, SPECULATIONS AND FUTURE PROSPECTS

Atanas Pavlov

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From time immemorial, humans have been highly dependent on plants as sources of proteins, carbohydrates and fats. Furthermore, the volume and range of phytochemicals used by modern society (inter alia as drugs, nutrients, cosmetic additives and biopesticides) are continuously expanding. On the other hand, the critical global challenges facing humanity are achieving sustainable development in the context of global climate change, limited access to fresh water, limited food supply and growing energy needs. These high demands are driving efforts to develop new ways to produce plant-derived metabolites. Plant in vitro techniques, in which plant cells, tissue and organs are cultivated under controlled conditions offer effective tools for sustainable supply of phyto-ingredients with reduced energy, carbon and water footprints. The advantages of this technology over the conventional agricultural production are: 1) independence of geographical and seasonal variations and various environmental factors; 2) insurance of the continuous supply of products with uniform quality and yield; 3) possibility to produce novel compounds that are not normally found in parent plants; 4) efficiency in downstream recovery and product; 5) reduced energy, carbon and water footprints; etc. The lecture will be focused on integrated approaches for bioactive substances production in different plant in vitro systems with application in food products. Current status, speculations and future prospects as well as challenges of the commercialization of the products of plant cell and tissue cultures will be outlined. The specific technological requirements for the final product formulations will be discussed. Finally, some examples of products developed in our laboratory will be presented as eco-friendly alternative methods for sustainable production of plant-derived additives with application in foods.

PL-5

IMPORTANCE OF AMINO ACIDS AND BIOGENIC AMINES IN FOOD QUALITY AND NUTRITION

Livia Simon Sarkadi

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The re-recognition of the important role of health-conscious nutrition has brought revolutionary changes in both food science and food production. A greater knowledge of the nutritional content of foods is needed to understand fully the food/health interactions, which could facilitate more efficient production of foods tailored to promotion of human health. Based on their essential role in the body, amino acids and their derivatives, biogenic amines, can be of great importance for food quality and nutrition. It is well known that 20 αL-amino acids are involved in the structure of proteins in genetically encoded form. The nutritional value of a protein depends on how well the essential amino acid composition merits the requirements of the human body. In addition to protein-building amino acids, free amino acids content and their changes during processing and storage play important role in food quality, and taste of food and may have beneficial effects on human health. Other components that influence food quality and health are biogenic amines. In food biogenic amines are mainly formed as a result of microbial decarboxylation of amino acids. Consumption of food containing high amounts of biogenic amines is responsible for many pseudo-allergic food related reactions and increased levels of biogenic amines in food are indicators of its microbiological quality. There are significant differences in the nutritional quality of the two major types of food, of plant and animal origin. However, the assessment must also take into account the new concept of sustainable food production and consumption. Research on amino acids and biogenic amines dates back decades, but remains an excellent area for research due to new perspectives and challenges.

PL-6

NEXT-GENERATION PROBIOTICS AND PREBIOTICS – AN EFFICIENT STRATEGY FOR BALANCING THE HUMAN MICROBIOTA

Blaženka Kos, Jagoda Šušković, Jasna Novak, Andreja Leboš Pavunc, Martina Banić, Katarina Butorac, Nina Čuljak

Faculty of Food Technology and Biotechnology, Laboratory for Antibiotic, Enzyme, Probiotic and Starter Cultures Technology, University of Zagreb, Pierottijeva 6, 10000 Zagreb, Croatia
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Research of the human gut microbiome has confirmed the presence of phylogenetically diverse bacterial species with health-promoting effects and potential of faecal microbiota transplantation as long-term engraftment of the patients gut microbiota. Microbiota present on mucosal and skin surfaces also impacting the interactions along the gut-liver-brain axis. According to the results of our research, selected and functionally characterized autochthonous strains of lactic acid bacteria (LAB), isolated either from the breast milk microbiota or artisanal fermented food, have a huge potential as a next-generation of probiotics [1]. They produce specific macromolecules such as surface S-layer proteins (Slps), bacteriocins, exopolysaccharides (EPS) and proteolytic enzymes, which are associated with their probiotic activities. Slps and EPS contribute to the stress-resistant properties of the producer cells during biotechnological production by freeze-drying as well as during gastrointestinal transit, and adherence in the colon, with potential immunomodulatory activity. Additionally, EPS are also prebiotic substrates for the gut microbiota – producers of short-chain fatty acids and lactate, metabolites with antibacterial and immunomodulatory activity, energy supply for the enterocytes, and the modulation of cholesterol and lipid metabolism. Bacteriocins, Slps and EPS promote competitive exclusion of pathogens, whereas bacteriocins and biopeptides-released upon the proteolytic activity, display antimicrobial activities. Biopeptides have also shown anti-inflammatory, ACE-inhibitory and antioxidant activities. Selected LAB strains have promising applications, ranging from the design of future functional food, food supplements or live biotherapeutic products. The impact of next-generation probiotics and prebiotics on human microbiota balance will be further defined through an advanced meta-omics approach and data analysis by new bioinformatics algorithms and analysis tools.

Acknowledgments
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Reference
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PL-7

SYSTEMATIC ANALYSIS OF FORMAL EDUCATION AND TRAINING IN THE FIELD OF FOOD SAFETY WITH COMBINED RESEARCH APPROACH

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Suitably trained personnel coming into contact with food is a fundamental part of any food safety management system. The system of formal education and training should already provide sufficient qualifications to an individual, before he or she enters the labour market. Unlike other (less formal) forms of education and training for food handlers, the formal education undergoes a systematic evaluation of the content and operators. A combination of different approaches and research methods (triangulation) was applied (content analysis of curricula, survey, experiment with workshop, focus group discussions, observation). The objective of triangulation is to increase confidence in the findings through the confirmation of a proposition using two or more independent measures. The findings revealed that formal education is suitably planned, although it does not evenly consider all aspects of food safety along the food supply chain. In addition, it does not make an individual sufficiently sensitive regarding his/her perception towards food-related health hazards. The concepts of the food supply chain and of shared responsibility for food safety are not known. At the end of formal vocational education, elements of the preventive food safety management system (HACCP) are poorly known and / or misinterpreted. The impact of formal education on the knowledge regarding new technologies is weak and selective. At several levels, the teacher is identified as the key person in achieving the learning objectives. The findings of systematic analysis of formal education and training should be considered by the providers of education and training regarding the critical points of the existing approach and could or should also assist food safety and educational policy makers regarding the education of future food handlers.

PL-8

FOOD TECHNOLOGY AND NUTRITION IN A SCOOP- ICE CREAM

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The limited resources of our planet and the contribution of food systems to the total greenhouse gas emissions makes us question the sustainability of many food items considered today as a matter-of-course in our diet. To be able to still indulge deserts such as ice cream, we need to shift from highly CO2 producing footprint processing systems in place today towards sustainable processes, based on circular economy and support the development of formulae of ice cream better balanced in nutrients (with low sugar and fat content) and associated with clean labels. Numerous so-called green technologies like sonocristalization, high pressure processing, microfludization cand help processing ice cream in a more sustainable way, while using antifreezing proteins and transglutaminase can help improving ice cream texture and nonetheless the addition of bioactive compounds like probiotics, prebiotics, postbiotics but also antioxidants and polyphenols could exert benefits on consumers` health. Short processing food chains, re-engineering of parts of the processing flow to make them more economically and environmentally sustainable, valorization of local resources and return of valuable by-products into processing while taking on board the latest innovation trends in food manufacturing are keys to successfully develop new formulae of ice cream making in the near future. Also, sustainable packaging can help limit food loss and improve ice cream safety. However, to be able to build a future for our food production systems younger generation of food technologists should be inspired to contribute to the development of new food in a sustainable manner. Food technologists should be taught besides basic food engineering to innovate, use IoT, robotics and blockchain, understand big data and critically think over the current solutions in order to ensure a sustainable future, for providing nutritious, accessible and tasteful food able to satisfy consumers` preferences and bridge the food production with consumption.

KEYNOTE LECTURES

KN-1

UNDERUTILIZED AND FORGOTTEN CROPS: FUTURE FOR SMART FOOD

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Among of 7000 crops 12 plant species are dominating. Together with 5 animal species they provide about 75% of word's food. 60% of caloric input we obtain from wheat, rice and maize. Cereal production across the EU is based currently on three main crops – wheat, barley and maize (accounting for more than 85 % of the cereals produced and grown on about 78 % of the land cultivated with cereals). But in total 7,000 crops were used for food worldwide through agricultural history. It means, that too small diversity is deployed in farming and food systems. We can make better use of diversity having a wide range of neglected (forgotten) and underutilised crops. This huge potential for diversification is represented by minor cereals (einkorn, emmer, spelt, rye and oats) and small grains. Small grains are a big group of different cereals: sorghums, millets, misc grains and pseudo cereals. Sorghums include broomcorn, sweet sorghum and grain sorghums (durra, kafir, milo, shallu, koaliang, feterita, hegari); millets - foxtail millet, proso millet, pearl millet, finger millet, teff; other millets (belong to the genus *Echinochloa*)– Japanese millet, shama millet, barnyard millet; misc grains - wild rice and Job's tears, pseudo cereals – by buckwheat, breadfruit and quinoa. We developed special breeding program for cultivation sweet sorghum in the northern and central parts of Ukraine. In parallel we introduced finger millet in Ukraine and developed original varieties with high productivity. Another group of crops are represented such neglected and underutilized legumes (rich in high-quality proteins) as cowpea, pigeon pea, lablab, mung bean and others as well as some oilseeds as camelina, Ethiopian mustard (carinata), crambe, pennycrass and other. During last ten years we developed germlasm pools for camelina, different crambe species and started to work with introduction and breeding of carinata in Ukraine. Thus, the results of the presented studies are aimed at boosting cultivation of neglected and underutilised crops and their consumption in order to diversify food production in Europe and bring to the market species and varieties that have high nutritional quality.

KN-2

WHEAT ON THE CENSORED - WHETHER WE REALLY SHOULD ELIMINATE WHEAT PRODUCTS FROM OUR DIET ?

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Wheat (Triticum) is one of the most important cereals in the world in terms of economic importance. It is mainly used for consumption and feed purposes, as well as a valuable raw material in processing for non-food purposes. Currently, two species dominate the cultivation: common wheat and durum wheat. There is also a growing interest in the „ancient" wheat species: einkorn, emmer, spelt, Kamut, as well as Persian and round grain wheat. The production of flour is the basic direction of using wheat grain for food purposes. In addition to flour, they are produced: semolina, groats, flakes, bran, germs, various types of bread, cakes, pasta, expanded and extruded products, wheat starch, vital gluten, wheat malt, beer, spirit and vodka. The market also offers unprocessed or slightly processed wheat grains. Moreover, various dishes and meals are prepared with the use of wheat products. In the last decade, there have been many controversial statements and opinions, as well as publications on the harmfulness of gluten and wheat grain products. The authors of these opinions and publications suggest that wheat foods should be completely eliminated from the diet because they pose a threat to human health. Such opinions are not confirmed by scientific studies. A diet that eliminates wheat grain products and gluten is absolutely necessary for people suffering from celiac disease, people who are hypersensitive to gluten and who are allergic to wheat. A gluten-free diet in combination with the exclusion of other ingredients is sometimes recommended in the case of autism. It is also sometimes passed on to people with various autoimmune diseases, such as Hashimoto disease. Some doctors use it in patients during chemotherapy. Apart from people diagnosed or suspected of the above diseases, eliminating wheat products (particularly wholemeal) from the diet is unjustified, and even according to some scientific studies it may adversely affect health.

Acknowledgments
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KN-3

INSIGHTS IN ADVANCED EXTRACTION TECHNIQUES USED FOR BIOACTIVE COMPOUNDS ISOLATION

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As a result of a large difference in the structure between the different classes of target bioactive compounds and their natural sources, their physical and chemical properties differ. Therefore, it is very important and necessary to find the most efficient method of extraction of selected bioactive compounds and then optimize the extraction procedure. Conventional extraction techniques still use harmful organic solvents, while in recent time, innovative green techniques (such as supercritical/subcritical extraction, ultrasound-assisted extraction, microwave-assisted extraction etc.) which enable better extraction yield, better quality of the extract, and resource saving (time, solvent, etc.) are increasingly used [1,2]. Special emphasis in this presentation will be put on the possible commercial valorisation of the research results and on the transfer of those results to the application level [3], as well as on strengthening the relationship between the academic community and the industry, developing the economy, and creating a positive social impact.

Acknowledgments
This work has been supported by Croatian Science Foundation under the project “Application of innovative techniques of the extraction of bioactive compounds from by-products of plant origin” (UIP-2017-05-9909).

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KN-4

DEVELOPMENT OF SWEET BAKERY PRODUCTS WITH CONTROLLED NUTRITIVE QUALITY, ACCORDING TO THE RECOMMENDATIONS FOR A HEALTHY NUTRITION

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The negative impact and rising rates of overweight, obesity and other diet-related noncommunicable diseases, in all its forms, should be reduced. Food industry may improve quality of consumers' nutrition through the development and promotion of food products with nutritive quality modified according to the recommendations for healthy nutrition. The aim of this paper was to draw attention to the important role of the food industry and small producers in improving the quality of consumers nutrition by offering sweet bakery products with controlled nutritive quality. The paper presents some of many opportunities for the development of such new products or as reformulation of recipe for existing products, which includes partial or complete replacement of white wheat flour, as basic ingredient, with wholegrain cereal products, cereals and other ingredients rich in bio-active substances, which contribute healthy nutrition. Reduction of products' energy value and improvement of the overall nutritional quality can be achieved by choosing the recommended type and smaller quantities of fats and sugar, compared to the usual quantities. At the same time, product success depends on consumers' preferences, so the appropriate acceptable technological and sensory quality must be provided, using knowledge and permitted production methods. Some bakery products, intended for healthy nutrition of vulnerable consumer's groups are also presented. Selected examples for sweet bakery product development or reformulation with nutritional quality improvements, could be used as ideas for improvement the food quality on the market and enable consumers to enjoy in different new healthy products. The paper gives an example of used knowledge on healthy nutrition as a guide in activities on different food product development.

KN-5

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY: A VERSATILE AND ROBUST TOOL FOR FOOD FRAUD DETECTION

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High-field nuclear magnetic resonance spectroscopy (NMR) is an important tool for food authentication and fraud detection. The method shows unprecedented robustness, minimum sample preparation and quantitative capability, without relying on a calibration with authentic standards. NMR has shown strengths in the detection of origin and adulteration of wine, honey, fruit and vegetable juices, coffee beverages or milk. The method is gaining even more importance hand in hand with the development of automated algorithms in spectral processing, user-friendly chemometrics- and machine learning tools. The talk aims to show a snapshot of state of the art in the field and present our contribution in NMR wine analysis and cow milk adulteration, including new approaches in data processing. In wines, NMR detects approx. 30-50 most abundant metabolites of various chemical classes. Based on three thousand NMR spectra of authentic wine samples of Czech origin, regression and classification models have shown high precision in predicting some of the wine properties, such as colour, residual sugar, alcoholic strength, or acid content. Random forest algorithm has shown a good precision in classifying varieties in varietal wines. To a limited extent, location and sensory quality could also be predicted. Practical application of the models in market authenticity control will be shown. NMR has been successfully used in discriminating summer- and winter milk of small ruminants and the breed of the animal. Moreover, NMR has shown great potential in detecting goat milk adulteration with cheaper cow milk. Peaks of N-acetyl carbohydrates are precise biomarkers of cow milk presence; highly predictive models could be built based on their signals for cow milk presence above 5%. NMR metabolomics research can massively profit from open data databases and standardized workflows, which will be discussed in concluding remarks.

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KN-6

ACRYLAMIDE-FREE FOODS: A CHALLENGE AND EXPERIENCE

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Acrylamide has been in the spotlights of food scientists, technologists and food safety institutions for the last 20 years since its first recognition in heat-treated foods in 2002. The elimination of acrylamide from foods is desirable due to its potential carcinogenicity as well as other toxicological properties that significantly reduced its margin of exposure (MoE = 300 for average adults / 120 for toddlers) indicated a concern for public health [1]. The identification of the main precursors and the elucidation of the mechanism of its formation have made it possible to offer a number of options how to reduce acrylamide content [2], although its complete elimination is not possible, as heat treatment is essential for both industrial and domestic preparation of processed foods. However, most of these tools have detrimental effects on the sensory quality and consumer acceptance of such processed foods. Of the tools offered, enzymatic pre-treatment of the raw material with asparaginase before baking/roasting makes it possible to reduce the acrylamide content without significantly affecting the sensory properties. Our experience with the application of asparaginase in cereal based [3] and fruit-based products is a good example of how to reduce acrylamide to an extent that meets the benchmark levels set out in European Regulation No 2017/2158 [4] (maximum levels are currently under discussion).

Acknowledgments
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KN-7

NOVEL APPROACHES IN ENHANCING BIOAVAILABILITY OF BIOACTIVE SUBSTANCES

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The market for natural products has experienced tremendous growth in recent years. Bioactive compounds found in natural products have remarkable properties, such as beneficial nutritional, medicinal and structural properties, as well as antimicrobial and antioxidant activities. Bioactive compounds are often poorly soluble and stable and have low bioavailability. Low stability, especially during storage, leads to loss of the active component, formation of metabolites with no activity, and in extreme cases, formation of toxic metabolites. In this review, we will present some new approaches to increase the stability of bioactive compounds such as pantothenic acid and folic acid and protect them from adverse environmental conditions using lipids and/or polymeric matrices. In addition, we will discuss low bioavailability in terms of low solubility and stability of bioactive compounds in the case of anthocyanins. Anthocyanins are plant pigments that occur with different chemical structures, are widely distributed in fruits and many vegetables, and are thought to have beneficial effects on human health. The bioavailability of anthocyanins is the key factor influencing their health benefits. Current approaches to increase the bioavailability of poorly soluble bioactive components such as anthocyanins, especially for fortification of beverages and similar liquid foods, are discussed.

KN-8

ANALYTICAL METHODS FOR ENCAPSULATION

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Encapsulation of food active compounds has been widely studied with huge potential for application in the food sector. In fact, many food related encapsulates are already used as substitutes for conventional additives in food products. Encapsulated food additives include aroma compounds, colorants, vegetable oils, probiotics, mineral compounds, etc. Introduction of new types of additives i.e. in the encapsulated forms creates completely new challenges for production management and quality control. Besides concerns regarding food quality and influence on consumers, encapsulated products may also influence the environment in previously unknown relations. In order to properly distinguish physico-chemical properties and biological activity of encapsulates, it is necessary to introduce new analytical methods for characterization of encapsulated food products. One of the most important analyses are those related to particle size, surface properties and the presence of free active compounds. For release properties of encapsulates, methods based on in vitro digestion are suitable, especially in the case of encapsulated probiotics. Methods that are based on thermal analyses are suitable for establishing thermal stability of encapsulated active ingredients. Fast and non-invasive spectroscopic methods could be used for routine encapsulates quality control but also may be suitable for study of interactions between food and encapsulated compounds. Finally, encapsulates influence on the environment could be the main obstacle in further development of encapsulated food products. Hence, appropriate monitoring of encapsulates fate under environmental conditions is crucial for their acceptance by the food sector.

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KN-9

METABOLIC AND FUNCTIONAL PATHS OF MICROORGANISMS IN FRUIT AND VEGETABLES BASED FOODS

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Fermentations may lead to significant changes to the health-promoting features to plant foods. The lactic acid fermentation is the most widespread. The axis 'fermented plant foods — human health' is easily conceivable because of the inherent chemical composition of raw plant matrices, and the metabolic and functional versatility of lactic acid bacteria (LAB) [1]. Although vegetables and fruits are excellent sources of health promoting components, various anti-nutritional factors (e.g. oxalate, protease, condensed tannins, and phytic acid) are present. Such plant inherent reservoirs enable LAB and yeasts to follow various metabolic routes, which figure as a complex labyrinth where specific microbial enzymes for targeted substrates are involved [2]. The winding metabolic pathways involve several secondary plant metabolites (e.g. phenolics, fatty acids) [3]. The way out of the labyrinth coincides with the success of those paths, resulting in fermented plant foods enriched with high bio-accessible bioactive compounds and/or with weak amounts of antinutritional factors. However, as a newly discovered bacterial group, fructophilic lactic acid bacteria (FLAB) are gaining increasing interest [4]. In fact, the wide frequency of isolation of FLAB from fructose-rich habitats (e.g., flowers, fruits, fermented foods, fructose feeding insects) has been deepened to reveal their ecological significance. The success of these plant-based fermentations is connected to the adaptive growth and survival of microorganisms. A panel of various interacting omics approaches unraveled the specific traits of microorganisms to adapt to plants, which allow the optimal design of fermentation strategies for targeted raw matrices.

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KN-10

NEW CHALLENGES AND OPPORTUNITIES FOR INDUSTRY TO SUPPORT CONSUMERS IN MANAGING FOOD SAFETY RISK

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Very often, consumers are minimizing the microbiological risk associated with food consumption at home and this attitude maintains the household environment as the most commonly reported cause of food outbreaks. According to EFSA & ECDC (2021), food safety violations at the consumer stage represent nearly 40% of the food-borne outbreaks and are occurring in domestic settings. C-Tech, Keep-it, and Arcelik, three industrial partners of SafeConsume, are working on delivering innovative devices and equipment to support consumers in managing the food safety risk in their homes. To mitigate the risk associated with defrosting food at room temperature, C-Tech from the UK is developing radiofrequency equipment that allows rapid safe defrosting (30 minutes or less) and an even temperature profile of food. Unlike microwave defrosted meat, radiofrequency defrosted meat will have no hot spots and will be flexible to allow cutting, preparation, and cooking. To give consumers the possibility to know how long food is safe and to reduce food waste, Keep-it from Norway is working on Time Temperature Indicators for left-over food that can be directly purchased by consumers. To allow rapid cooling of hot meals and reduce the time spent in the dangerous zone, Arçelik from Turkey is incorporating a smart IR sensor system on a fridge shelf. Based on this technology, hot meals, even around 80-90°C can be cooled 2-3 times faster and the cooling process is automatically finished when food reaches 15°C. The specialized new cooling system does not allow temperature rise of other foods during the cooling of hot foods. Answering consumer needs for saving time, saving money by not wasting food, and supporting safe food, these innovations are not only great business opportunities but significant contributors to decreasing the health burden represented by food-borne outbreaks.

Acknowledgments
This work was supported by the SafeConsume project (Horizon 2020 Grant agreement 727580).

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KN-11

CONTAMINANTS ORIGINATING FROM HEAT PROCESSING OF FOODS

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Heating processes are important for food processing since these are necessary mainly for hygienic reasons to eliminate pathogenic and spoiling microorganisms. In addition, the bioavailability and digestibility of specific compounds (e.g. polymeric carbohydrates, proteins) is increasing and the palatability and the sensory properties improve significantly. However, during the heating a series of reactions are taking place that lead to compounds that can compromise the individual health. The main reaction types are the Maillard reaction and lipid oxidation. From both of these reactions carcinogenic compounds can arise. These are e.g. heterocyclic amines, furan derivatives, oil oxidation products. The temperatures that are necessary range from room temperature (e.g. oil oxidation) to temperatures of more than 150 °C which are necessary to form the heterocyclic amines or furan derivatives. The precursors necessary for the formation of these compounds are present in the foods and comprise amino acids, carbohydrates, and creatin which is necessary for the formation of heterocyclic amines, asparagin in combination with reducing sugars as precursors for acrylamide and a variety of possible compounds (lipids, ascorbic acid, sugars) for furan and its derivatives like furfuryl alcohol, methylfurans, furfural. For all of these reactions high temperatures are necessary for longer time. It is difficult to estimate the formation of these compounds just by judging the color or aroma, since this does not reflect completely the chemical situation behind the reactions. In the case of oxidized oil – which might be related to colon cancer or the onset of non-alcoholic liver inflammation – the situation is more complex since no clear chemical background has been elucidated by the toxicologists. Looking at the chemical background there is practically no possibility to eliminate these contaminants but with careful processing and heating or a selection of raw materials the concentrations can be reduced and a possible health risk minimized.


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OP-1

MOLECULAR TECHNIQUES FOR DETECTION AND IDENTIFICATION OF PLANT PATHOGENIC AND FOOD SPOILAGE FUNGI

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With changing conditions in open field or in closed production process, new microorganisms can be introduced into those environments. To monitor and control emerging microorganisms, methods for their detection and identification need to be continuously developed and adapted. Efficient measures need to be taken on time, to prevent huge economic losses. One of the crucial steps is monitoring of health status of the plants at production sites and when it is being transported to EU, to prevent spread of pathogenic microorganisms in new production areas. However, spread of fungal spores via wind or rain cannot be easily controlled. Further, yeasts are known to cause spoilage of food and beverage products, especially when production process aim to retain natural substances and does not include addition of antimicrobials. To tackle those challenges, molecular methods were developed, optimized and evaluated for detection and identification of target fungi. Firstly sample preparation protocols were developed for selected sample matrices, i.e. spore trap tape, filter paper, honey and syrup. Spores and yeast cells were initially homogenized to disrupt the cell walls, and the DNA was extracted. Secondly, qPCR assays were developed and optimized for detection of *Phyllosticta citricarpa*, a quarantine fungi that causes citrus black spot disease (CBS) and is detrimental to citrus growing areas. The assays detect as low as 100 spores on a spore trap tapes. For detection of yeast species from the genus *Zygosaccharomyces*, known spoilage organisms in sweet products, specific qPCR assays were developed as well. All assays were shown to be applicable for the specific type of samples and can be applied fast screening of the samples. Lastly, high-throughput sequencing technique was developed and adapted for analysis of air collected in citrus orchard. The protocol was proved to be applicable for detection of target fungi and offer possibility to monitor for fungal population present in a complex sample.

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OP-2

ANTIFUNGAL ACTIVITY OF ESSENTIAL OILS AND β-CYCLODEXTRIN/ESSENTIAL OIL MICROPARTICLES AGAINST TOXIGENIC ASPERGILLUS SPP.

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Various chemical and physical methods are used for growth control of toxigenic molds. However in recent years there has been a growing need for use of natural antimicrobial compounds, such as essential oils (EO), as well as microparticles intended to protect the highly sensitive and volatile active components of EO, responsible for their activity [1,2]. In this work, antifugal activity of wild (*Origanum vulgare* L.) and greek (*Origanum heracleoticum* L.) oregano, winter savory (*Satureja montana* L.) and french marigold (*Tagetes patula* L.) EO, as well as microparticles based on β-cyclodextrin and winter savory EO against *Aspergillus parasiticus* (isolated from walnut) and *A. ochraceus* (isolated from corn flour), was examinated. Major component of wild oregano, greek oregano and winter savory EO was carvacrol, and of french marigold EO was α-terpinolene. Obtained results showed that wild oregano, greek oregano and winter savory EO showed optimal antifungal activity (MIC 1,78 µl/ml; MFC 3,55 µl/ml), and completely inhibited the growth of molds. A. ochraceus was the most sensitive, while A. parasiticus was the most resistant. Microparticles based on β-cyclodextrin and winter savory EO (ration EO: β-cyclodextrin - 30:70), completely inhibited *A. ochraceus*, and significantly reduced *A. parasiticus*. The obtained results show a potential application of tested EO and microparticles as natural antifugal additives in food industry. Future research will include the antimycotoxin potential of the tested EO and microparticles, as well as possible applications in different food models.

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OP-3

APPLICATION OF A STARCH-BASED AEROGEL LOADED WITH HEXANAL TO CONTROL POSTHARVEST DECAY OF SWEET CHERRIES

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Sweet cherry is highly appreciated by consumers. Nonetheless, it is highly perishable, susceptible to mechanical damage and fungal postharvest diseases [1]. To extend the shelf-life of cherries, different strategies with low environmental impact could be applied such as the use of bio-aerogels releasing antimicrobial agents like hexanal [2]. Aim of the study was to develop an active packaging made of a starch-based aerogel containing hexanal in order to hinder the postharvest pathogens growth in fresh sweet cherries. Preliminarily, starch aerogels loaded with 0.1, 0.5, and 1% hexanal were prepared and *in vitro* analysis was performed to investigate the antifungal activity. Then, the in situ effectiveness was evaluated on sweet cherries inoculated with Botrytis cinerea, and finally, the impact of the treatment on quality attributes and natural microbiota of the fruit was investigated. The antifungal activity in vitro was dependent on hexanal dose and fungal strain, while the 0.5 % hexanal-aerogel reduced the disease during 5 days of storage in packed sweet cherries; the disease incidence was reduced of about 100% and 85%, at day 1 and 2, respectively. The treatment also affected total mesophilic aerobic count and yeast count, which were below the detection limit (2.0 Log CFU/g) until day 7. Interestingly, the treatment did not negatively affect the quality and sensory parameters of sweet cherries. In conclusion, starch-based aerogel loaded with hexanal shows the potential to be applied in food packaging to control postharvest decay of fruit. Further studies are needed to better encompass control and release of the antimicrobial compounds, in order to transfer these results into the industrial scale.

Acknowledgments
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OP-4

UNDERUTILIZED FRUITS AND VEGETABLES WITH FUTURE POTENTIAL FOR FOOD AND NUTRITION SECURITY: A CASE STUDY OF SOUTH EAST ASIA

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High prevalence of malnutrition, attributed mainly to low dietary diversity, still occurs worldwide. To improve nutrition and food production diversity, neglected and underutilized species seem to be the perfect tool. Underutilized tropical fruits and vegetables have been reported to contain essential micronutrients (especially vitamins and minerals) and bioactive phytochemicals (e.g. antioxidants) [1]. However, importance of these species remains unexplored because of the lack of the detailed knowledge on their nutritional value and health benefits. [2]. In our research, we investigated more than 40 underutilized fruits and vegetables (including seaweeds) traditionally consumed especially in Cambodia and the Philippines for their antioxidant activity and micronutrients content. The results revealed that *Limnophila aromatica* produces great antioxidant effect and contains high amounts of various minerals. Many other species are excellent sources of vitamins (e.g. *Garcinia cochinchinensis* and *Bouea macrophylla*) or minerals (e.g. *Actinotrichia fragilis* or *Sesbania javanica*). These plants have thus potential as a novel food/food product rich in antioxidants and various specific micronutrients which are likely able to fight against malnutrition, hidden hunger and to reduce risk of the development of chronic diseases induced by oxidative stress.

Acknowledgments
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OP-5

THE APPLICATION OF POLYACRYLAMIDE GEL ELECTROPHORESIS FOR PLANT-BASED FOOD AUTHENTICATION AND FUNCTIONAL FOOD QUALITY EVALUATION

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Plant-based food is marker of a healthy diet due to the rich source of natural oxidants that help to strengthen innate immunity. On top of the benefits to human health, plant-based food has a significantly smaller footprint on the environment than animal-based foods. Furthermore, bioactive compounds originating from plants, such as phenolics, are commonly used for food fortification. The incorporation of phenolic compounds into food systems results in significant changes in the nutritional and nutraceutical quality. These changes are mainly a consequence of phenolic interactions with food matrix components. Due to globalization and modernization of the food supply chain plant-based food fraud, food authentication, botanical origin, and functional food quality evaluation are challenges that faced food scientists worldwide. Nowadays, sophisticated analytical tools such as DNA based – methods and chromatographic or spectroscopy techniques have been employed for monitoring the quality and origin of plant-based food. However, expensive analytical equipment, high costs of implementation, and well-trained personnel are common limiting factors in their application. On the other hand, polyacrylamide gel electrophoresis (PAGE) as a cost-effective, reliable and sensitive separation technique coupled with chemometric tools can provide valuable information on the plant origin, and phenolics–food matrix interactions. For example, SDS-PAGE was successfully used for the authentication of berries, peanut, and almond varieties or investigation of interactions among pyrogallic acid-pumpkin seed proteins, grape seed phenolics - goat milk proteins, tea polyphenols - cow's milk proteins, green coffee bean phenolics - wheat bread matrix, procyanidin - gliadins, red wine phenolics - human saliva. etc. Thus, although the determination of protein profile and proteolytic activity in food matrices is one of the most common PAGE applications, the use of this technique for plant-based food authentication and functional food quality evaluation should not be underestimated.

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OP-6

ANTIOXIDANT STABILITY OF MEDICINAL PLANTS' HYDROSOLS DURING STORAGE

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In recent years, the demand for novel antioxidant agents derived from natural products is rising in the food industry. Medicinal plants such as bay laurel (*Laurus nobilis* L.), sage (*Salvia Officinalis* L.) and thyme (*Thymus vulgaris* L.) contain a variety of bioactive molecules that contribute to the plants' antioxidant potential. While the antioxidant potential of plant extracts and essential oils has been well researched, the potential of hydrosols - secondary products of hydrodistillation process, has recently raised research interest. Hydrosols consist of distillation water with small amounts of dispersed essential oils which provide them antioxidant and antimicrobial properties potentially applicable in the food industry. The aim of this study was to evaluate the antioxidant potential of hydrosols of bay laurel, sage and thyme, and their mixture (1:1:1) obtained during hydrodistillation on Clevenger apparatus, and to monitor their antioxidant stability through 28 days of storage at room temperature by DPPH Radical Scavenging and Ferric Reducing Antioxidant Power (FRAP) assays. Bay laurel hydrosol showed the highest antioxidant activity on the first day with a value of 2000 μM of Trolox equivalents (TE) as determined by both DPPH and FRAP, followed by the plant mixture (DPPH 1000 μM TE, FRAP 621 μM TE), thyme (DPPH and FRAP 370 μM TE) and sage whose antioxidant activity was at the bottom of detection level. Both FRAP and DPPH have shown that the antioxidant activity of all hydrosols has gradually decreased down to approximately 50% after 28 days. Nevertheless, bay laurel hydrosol has shown the highest potential for application in the food industry, for example in minimal processing of fruits and vegetables with the goal of prolonged shelf life, since the DPPH and FRAP values were still relatively high (1000 μM TE) after 28 days.

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OP-7

ANTIMICROBIAL ACTIVITY OF SLOVENIAN HONEYS IN RELATION TO THE CONTENT OF PHENOLIC COMPOUNDS AND ANTIOXIDATIVE ACTIVITY

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Honey is the natural sweet substance produced by honey bees from the nectar of plants or from secretions of living parts of plants or excretions of plant sucking insects on the living parts of plants, which the bees collect, transform by combining with specific substances of their own, deposit, dehydrate, store and leave in the honey comb to ripen and mature [1]. In terms of composition and properties, Slovenian honey must meet the criteria set out in the Rules on Honey [2]. Honey exhibits antimicrobial activity against broad spectrum of microorganisms. In this study, 118 samples of Slovenian honey with specific botanical origin from 2020 to 2022 were included. Total phenolic content (TPC), antioxidant activity (measured as DPPH and FRAP), and antimicrobial activity against three Gram-positive and three Gram-negative bacteria were studied. Dark mannin/forest honeys showed statistically significantly better antimicrobial activity, TPC values, and antioxidant activity compared to light nectar/flower honeys. Fir honey showed the best antimicrobial activity, followed by other dark (chestnut, forest, buckwheat) honeys and rapeseed honey, while other light (multifloral, linden, acacia) honeys showed lower activity. The best antimicrobial activity was found against *Campylobacter jejuni* and the worst against *Bacillus cereus*. The antimicrobial activity of all tested bacteria, except *C. jejuni*, correlated with antioxidant activity but not with TPCs. The highest antioxidant activity was found in buckwheat and fir honeys, and the lowest in acacia honey. TPCs were highest in buckwheat honey and lowest in acacia honey. Slovenia with a long tradition and good conditions for beekeeping, high biodiversity and unique nature is ideal for the production of honey with high bioactivity and a wide range of applications.

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OP-8

EFFECTS OF *RUBUS FRUTICOSUS* AND *JUNIPERUS OXYCEDRUS* DERIVATIVES ON THE CULTURABILITY AND VIABILITY OF *LISTERIA MONOCYTOGENES*

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Given the increasing consumers demand for safe foods obtained with green solutions, based on natural molecules with antimicrobial potential, plant and vegetable by-products can represent an important source of bio-active compounds able to prevent or reduce the development of foodborne pathogens and spoilage microbiota. In this study the possible effects of phenolic extracts (PE) or essential oils (EO) obtained from Mediterranean *Rubus fruticosus* leaves and *Juniperus oxycedrus* needles on the cultivability and the viability of *Listeria monocytogenes* were evaluated in vitro. These plant derivates have been characterized for their composition and tested for their Minimum Inhibitory Concentration (MIC) against *L. monocytogenes*. Sub-lethal concentrations of PE and EO were then added to a culture medium and the microbial growth dynamics in their presence were modelled to highlight differences in the cell behaviours. The results showed that *J. oxycedrus* and R. fruticosus derivatives were able to significantly reduce the growth kinetics, even if added at concentrations corresponding to half of MIC. In general, both EOs significantly reduced the final maximum cell culturability of approx. 1 log unit. The cell response to the stresses applied were assessed through flow cytometry analysis, to evidence EO and PE effect in terms of viability and/or cell injury. In general, the viability was higher than culturability, indicating the presence of cells not able to grow in culture media, whose fate needs to be further investigated to assess their possibility to revert to culturable status, thus bringing to an overestimation of the antimicrobial effect of these substances. The results of this study can highlight the effects of these plant derivatives on *L. monocytogenes*, contributing to increase the knowledge of these underused raw materials and by-products that can be exploited in food and other industries.

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OP-9

ISOLATION OF BIOACTIVE COMPOUNDS FROM NETTLE INFLUENCED BY DIFFERENT EXTRACTION TECHNIQUES AND ENVIROMENTAL CONDITIONS

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Nettle is a perennial plant known since ancient times in folk medicine and cooking. All parts of the nettle (leaves, stalks, roots) are a rich source of various bioactive compounds such as polyphenols, chlorophylls, carotenoids and sterols. Nettle not only grows wild, but is also increasingly cultivated to obtain higher yields of the target compounds. Various extraction techniques are used to isolate the mentioned compounds: advanced extraction techniques such as microwave-assisted extraction, accelerated solvent extraction, and ultrasound-assisted extraction, as well as conventional methods such as Soxhlet and reflux extraction. In addition to extraction parameters, the yield and composition of bioactive molecules are also influenced by environmental conditions like phenological stage, habitat, fertilization, and mowing time. Therefore, the aim of this study was to optimize advanced extraction techniques and compare the yield and composition of bioactive compounds with conventional ones. It also aimed to compare the composition of wild nettles from different habitats and at different phenological stages, and to investigate the influence of fertilization and mowing time on the composition of cultivated nettles. The results showed that the advanced techniques gave much higher yields than the conventional ones, and among them, accelerated solvent extraction proved to be the technique that gave the highest yields of polyphenols, pigments, and sterols. Moreover, habitat significantly affected the accumulation of bioactive molecules in wild nettles, and samples from the continental region before flowering contained more polyphenols, while those from the seaside region during flowering contained more pigments. On the other hand, cultivated nettle mowed for the first time with organic-mineral fertilizer contained more polyphenols, while that mowed for the first time with mineral fertilizer contained more pigments.

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OP-10

FROM VELD-TO-FORK: POST-MORTEM AGEING TECHNIQUES TO IMPROVE THE EATING QUALITY OF COMMON ELAND (*Taurotragus oryx*) MEAT

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Whilst intensification and improved efficiency have been the focus of the meat industry, the incorporation of underutilized sources of high-quality meat should not be forgotten. The common eland antelope (*Taurotragus oryx*) has been identified as a candidate for domestication [1] and meat production, but little has been done to support this initial concept. Their meat is low in fat with a higher proportion of polyunsaturated fatty acids compared to cattle on the same nutrition [2], making it a "healthier" alternative. However, the post-mortem improvement of meat quality, such as poor tenderness, requires investigation. Thus, the effects of wet (W), dry (D), and semipermeable bag (SB) ageing on the physiochemical and organoleptic quality of eland meat were studied. Six adult females were selected from the research herd in the Czech Republic and slaughtered. Both longissimus lumborum muscles were divided and randomized for ageing methods (W/D/SB) and periods (14/28 days). Physiochemical measurements were taken, and organoleptic properties were assessed by a trained sensory panel. Ageing decreased the shear force regardless of method, reaching a minimum on day 14. Overall acceptability was unaffected by method on day 14. On day 28, D scored highest for overall acceptance, due to higher beef aroma and roasted flavour scores, and lower abnormal odour scores. SB had intermediate scores for these parameters. Thus, should the objective be to improve tenderness in the shortest period, W would remain the most favourable. However, should the objective be to improve both tenderness and flavour, D would be required, but would demand a premium price and consideration of cooking method to improve juiciness.

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OP-11

THE EFFECT OF IRRADIATION ON SOME MICROBIOLOGICAL AND CHEMICAL PROPERTIES OF REDUCED FAT WHITE CHEESE FROM RAW MILK

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Direct use of raw milk without pasteurisation is a wide spread application in our country particularly in the production of traditional cheese types at family owned or small dairy plants. Although use of raw milk in cheese making have microbiological risks, due to the absence of starter culture for most traditional cheese types produced in our country today, pasteurisation is not preferred as it impairs natural flora and changes the typical taste and aroma of the product [1]. In this study, we investigated the potential of making the raw milk cheese microbiologicaly safe by irradiation process. White cheese samples are vacuum packed after holding in brine for 1 night, divided into 3 groups and gamma irradiation was applied to each group at 1, 2 and 3 kGy doses respectively (TAEK/SANAEM). Together with control groups pasteurised milk cheese and raw milk cheese that are not irradiated, 5 groups of cheese were produced in total. Chemical and microbiological properties of cheese samples were analyzed during 60 days of storage at 4±1 °C. General composition analysis was done in the first week of production; other analyses were done at 1, 30 and 60th days of the production. It was observed that irradiation decreased the microbiological load of the cheeses and slowed down the degradation of αs1-casein especially at 3 kGy. The proximate analysis results were similar to the control group cheeses.

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OP-12

CHITOSAN FORMULATIONS ENRICHED WITH INCAPSULATED PHYTO/PHYCOCHEMICALS AS ACTIVE COATING FOR POLYLACTIC PACKAGING FOIL

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The growing problem of food and packaging waste is accelerating the development of innovative packaging materials with an active approach. The active components in packaging should support both environmental awareness and customer food safety requirements. Therefore, the focus of this study was on the development of natural bioactive chemical substances such as biopolymers and polyphenols for use as coatings for polylactic acid (PLA) film. Of particular importance are colloidal solutions such as macromolecules or particle dispersions, which have as an advantage a large surface area and thus high efficiency [2]. In this work, three plant extracts (blackberry leaves, juniper, and brown algae) originating from the southeastern European region and the central Adriatic Sea were isolated and combined with chitosan in the form of colloidal formulations, which were then applied layer by layer to PLA films using roll-to-roll technology. A detailed analysis of the extracts revealed their advantages and disadvantages compared to commercially available phenols/polyphenols. The synergistic effect of the extracts and the polymeric chitosan depended strongly on the extract itself. The success of the coating was monitored by XPS and ATR-FTIR analyzes and the wettability of the films by contact angle analyzes. The antioxidant properties of the films were determined by DPPH and ABTS tests, and microbiological analysis of the films was also tested. The results showed the successful functionalization of the PLA, while XPS and ATR-FTIR analyzes clearly demonstrated the elemental composition of the extracts and chitosan on PLA surface. The newly developed films also exhibit antioxidant properties, with antioxidant efficiencies ranging from 40 %to 100% and the inhibition of *Staphylococcus aureus* is quite high (generally in the range of 50%-93% inhibition). The present functionalization of PLA is successful in imparting anti-fogging, antioxidant, and antimicrobial properties simultaneously and drives the development of a biodegradable and environmentally friendly composite material using green chemistry principles.

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OP-13

USING OMICS APPROACHES IN SEAFOOD TRACEABILITY: A CASE STUDY FROM SLOVENIA

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Seafood is an important source of protein for one fifth of humanity, especially in underdeveloped countries. In developed countries, they are a valuable commodity that often has a high market value. In the last two decades, the consumption of fish and other species such as squid has increased because of their known beneficial effects on human health. Global fisheries cannot meet the global demand for fish products due to depleted stocks, and since 2012 aquaculture has been the main supplier of seafood. In recent decades, the seafood supply chain has become very complex and vulnerable to various fraudulent activities, such as the substitution of fish species, the exchange of aquaculture species with wild-caught species, the mislabelling of the geographical origin of fish and the concealment of the fishing gear used. Fraud in the fisheries supply chain is not negligible, it can cause serious health problems for consumers (poisoning, allergies), weaken confidence in fisheries products, affect the level of taxes and is also a source of economic damage to the country as it affects the income of fishermen and traders. With advances in molecular identification tools based on nucleic acids such as DNA barcoding, metabarcoding and a variety of diagnostic tests based on PCR, including RT-PCR, LAMP and an innovative platform such as FASTFISH-ID, there are opportunities to increase transparency in the supply chain for fishery products. There are several obstacles that slow down the development of diagnostic tools, such as complex matrices and the lack of reliable genetic markers for a large number of fishery and aquaculture species. In Slovenia, the extent of seafood adulteration has recently been investigated and provided the data on the reliability of retail labelling of squid has been obtained. During the project, diagnostic tests for some squid species were developed and key stakeholders were involved in the survey to assess awareness of fish fraud and the fisheries value chain.

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OP-14

INFLUENCE OF THE ADDITION OF WHITE BUTTON MUSHROOM SUPPLEMENT IN THE DIET ON THE SENSORY AND TECHNOLOGICAL PROPERTIES OF LAMB MEAT

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The aim of this study was to determine the technological and sensory properties of *M. longissimus dorsi* in lambs. The Lička pramenka lambs were reared traditionally and fed with voluminous and concentrate feed with the addition of the dry or chopped fresh *Agraricus bisporus* as a supplement in different percentages. A feeding experiment was conducted on 30 lambs divided into three groups. The carcasses were sampled 0 and 24h after slaughter. The average slaughter weight was 10.40 kg - in the control group, 12.29 kg in group 2 and 11.99 kg in group 3. The pH ranged from an average of 6.95 in control and group 3 to 6.72 in group 2. After 24 hours, a decrease in pH was recorded (control group 5.38, group 2 5.52 and group 3 5.74). The values of the colour parameters (CIE L * a * b *) were - L* control group 61.20; group 2. 55.92 and group 3. 59.53, a* parameter was 5.22 in the control, 3.95 in group 2 and 4.68 in group 3, while b* was 3.46 in the control, 1.24 in group 2 and 1.39 in group 3. The sensory evaluation confirmed that the meat showed the characteristics of colour, smell and taste of young lamb meat. The meat was light pink in colour, sparsely covered with adipose tissue. The smell and taste in the cooking and roasting samples were specific to the lamb meat. For determination of oxidative stability with thiobarbiturate test (TBARS) and fat content, samples were collected on days 0, 3, and 6. As anticipated TBARS values were increased from day 0 to day 6, and there were no significant differences between groups 2 and 3. Cholesterol in the meat of the control group was high (31.95 mg/100g), which is significantly higher than the values found in the meat of group 2 (9.63 mg/100g) and group 3 (95.2 mg/100 g). In conclusion, by adding this specific supplement to the lambs' diet, the meat retained all the positive sensory and technological properties with reduced cholesterol levels.

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OP-15

OPTIMIZATION OF ALMOND BASED DAIRY-FREE MILK ALTERNATIVE FORMULATION FORTIFIED WITH MYRTLE, LAUREL, AND FENNEL EXTRACTS

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Herbs and spices used in traditional medicine are nowadays increasingly used in combinations to create functional food formulations aimed at treating specific symptoms and disorders. Among herbs originating from the Mediterranean, extracts of myrtle (*Myrtus communis* L.), laurel (*Laurel nobilis* L.), and fennel (*Foeniculum vulgare* Mill.) are traditionally used in gastrointestinal disorders [1]. When considering product opportunities for incorporating these extracts, dairy-free milk alternatives provide an excellent foundation [2] with almond-based drinks being among the most popular within this group [3]. Therefore, the aim of this study was to optimise the formulation of an almond drink fortified with a concentrated aqueous herbal extract (25% of dry weight) containing myrtle and bayberry extract (25% each) and fennel seed extract (50%). A central experimental design with 20 experiments varied the content of extract (6-18% v/v), lecithin (0.45-1.35% w/v) as emulsifier and xylitol (6-15% w/v) as sweetener, while antioxidant activity, total phenolic content and sensory properties were determined as dependent variables. The antioxidant activity and total phenolic content of the prepared almond drink formulations increased with the amount of added extracts, as did the colour, aromatic herb odour and taste, bitterness, and aftertaste. The addition of lecithin resulted in a darker colour and sweetness was increased by xylitol content. All formulations had good overall attractiveness, which was higher with higher xylitol content.

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OP-16

RESISTOMES OF PROBIOTIC AND STARTER CULTURES AS POTENTIAL RISK FACTORS FOR THE SPREAD OF ANTIBIOTIC RESISTANCE

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Given the growing concern about the spread of antibiotic resistance (AR) along the food chain, dairy products and dietary supplements containing probiotics have also been identified as potential reservoirs of (ARGs). In this study, the potential risk for the spread of AR by bacteria intentionally added to the food chain, such as probiotic and starter cultures, was assessed using phenotypic examination, in silico studies of whole bacterial genomes and metagenomic sequencing. Phenotypic susceptibility testing (474 strains: 157 of starter, protective or probiotic cultures – SPPF group; 154 isolates from fermented products, 90 from human intestinal mucosa/faeces, and 73 from human milk/colostrum) showed that 13.8 % of strains in the SPPF group contained acquired ARGs, most frequently for tetracycline. In the SPPF group, ARGs and mobile genetic elements were not as common as in strains from human intestinal mucosa/faeces. In order to get a metagenomic insight into the distribution of ARGs between the microbiota of probiotics, starter cultures, and cheeses, 75 samples were analysed by shotgun sequencing. ARGs (n = 539) conferring resistance to a variety of antimicrobials were detected. Of these, ARGs conferring resistance to tetracyclines (e.g. tet(34), tet(M), tet(S), tetU), aminoglycosides (e.g. ANT(6)-Ia, str), beta-lactams (e.g. PBPs, ampH), and macrolides (e.g. mph(D), mdf(A), mre(A)) were the most prevalent. Compared with supplements, starter cultures and cheeses made from pasteurised milk with starter cultures, the cheeses produced from raw milk, with or without starters, contained the highest number and diversity of ARGs. Our study highlights that starter cultures and supplements are less rich in ARGs compared to the gut microbiota and the microbiota of dairy products prepared from raw milk without the use of starter cultures, and therefore do not pose a significant risk. However, because several potentially transmissible genetic elements associated with AR have been detected in individual probiotic strains, control with advanced methods is required.

Acknowledgments
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OP-17

TRACEABILITY AND PREDICTION OF ALLERGENIC RISK OF ALTERNATIVE PROTEIN SOURCES

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Insects can serve as an alternative source of protein for the growing population of the Earth. However, their consumption can also pose food safety risks to consumers. A small number of cases are available on insect allergy but it is likely that people with allergies to crabs, shrimps and molluscs may cross-react due to a similar protein structure. Our research aim was to develop analytical methods for tracing insects in food products and also assess the resistance of proteins during digestion to predict their allergenic potential. Protein extraction methods were optimized to be used for assessment of insect proteins from food matrixes by electrophoresis. PCR methods were developed for DNA based identification of insect from food and feed. Briefly, samples were destructed and homogenized using Minilys homogeniser to facilitate sample detection for whole frozen insect samples. DNA was purified from the homogenized, lysed samples by the Wizard resin-based method after centrifugation. A higher dose proteinase-K and a five hour-incubation time resulted a PCR-pure DNA sample from whole insect samples. Insects and pure proteins (tropomyosin, TM orthologs from shrimp and chicken) were digested using an in vitro, static human digestion model to analyse the bio-accessible amino acid content and composition and to demonstrate the relevance of allergic risk assessment, respectively. The cross-reactive IgE peptides from the digested proteins were identified by immunblot using shrimp allergic patient sera and assessed by MS. Immunoblotting revealed that although the chicken TM had sequence homology with shrimp IgE epitopes, it did not show IgE reactivity with shrimp-allergic patient sera. It was also clear that chicken TM (non-allergenic) was more sensitive to pepsin digestion during simulated gastric digestion, in contrast to uncleaved shrimp TM (allergenic) and insect proteins. However, all partially digested samples were degraded in simulated intestinal fluids.

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OP-18

PHYSICAL, CHEMICAL AND SENSORY CHARACTERIZATION OF CALCIUM FORTIFIED PLANT-BASED MILKS PREPARED IN DIFFERENT FORMULATIONS

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In recent years consumers have an increased awareness of the relationship between diet and health and they have been demanding products with fresh-like nutritional characteristics and attractive sensory properties [1]. Some of the consumers abstain consumption of dairy products for multifarious reasons including some health concerns or lifestyle preferences [2]. Thus, consumers have been demanding new plant-based substitutes alternative to dairy products [3]. Effect of plant types, condiments, calcium fortification and hydrocolloid concentrations [Gellan gum (GG), Locust bean gum (LBG), κ- carrageenan gum (κ-CG) and Sodium salt of Carboxyl methyl cellulose (CMC)] on physical, chemical and sensory characteristics of plant-based milks were studied. In this context, 5 different hazelnut-based milk formulations from raw hazelnut kernels (3 of them with different hydrocolloid concentrations and 2 of them with condiments such as instant coffee and cacao) and pistachio and walnut milks were prepared. It was found that condiments addition to the hazelnut-based milks extremely changed color characteristics of the hazelnut milks. Regardless of the plant type, physicochemical and structural properties of the plant-based milk samples were extremely affected by heat treatments and ultrasound applications. Plant skins, addition of GG and CMC together in formulations adversely affected the particle size distribution results and product stability of the plant-based milks. According to sensory evaluation results, the most liked formulations were hazelnut-based milks, the least liked one was walnut milk.

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OP-19

OLDER CONSUMER FOOD SAFETY PERCEPTION OF READY-TO-EAT FOODS

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Ready-to-eat food (RTE) is food prepared in advance that may be safely consumed without any further cooking or processing step. As they are convenient and quick, their consumption and popularity are growing in the last 20 years. The major concern linked to the consumption of RTE foods is the occurrence of numerous foodborne diseases linked to Listeria monocytogenes. Chilled RTE foods include pre-sliced and prepacked foods sold in the original packaging, and those foods that are produced in bulk and then sliced fresh on spot for each individual consumer, cut-to-order. A higher incidence of L. monocytogenes contamination has been observed in cut-to-order foods than in prepacked foods. The role of final consumer in ensuring safety of food products in domestic settings is wildly recognized. This is especially important for chilled RTE foods. Some countries such as UK and USA published general recommendation to control risks for listeriosis at home such as: i) following “use-by” dates on unopened prepacked RTE foods, (ii) consuming RTE foods within 2 days of opening, and (iii) ensuring the safe operating temperatures of domestic refrigerators. Implementation of recommended food safety practices in domestic settings may reduce the risks associated with listeriosis. This is especially important for at-risk group of consumers, such as older adults >60 years. Therefore, the aim of this study was to determine older consumers’ habits, attitudes and self-practices towards RTE foods in Serbia. Older consumers in this study indicated low awareness of L. monocytogenes and food related products. They mostly agreed that prepacked dairy and meat RTE foods are safer than cut-to-order foods, although majority of them is still regularly buying and consuming cut-to-order RTE foods. Almost 65% of Serbian older adults consume opened package of sliced cooked ham beyond 2 days after opening. The majority of them also believe that taste, smell or appearance is reliable method to determine if food is safe for the consumption. These results emphasis the need for preparing clear recommendation for adequate food safety practices at home to improve specific risky behaviors.

OP-20

THE CONTRIBUTION OF KINDERGARTEN MEALS TO THE DAILY NUTRITION: A RANDOMIZED CONTROLLED EVALUATION

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There is evidence that the adequate intake of vegetables, fruits, whole grains and nuts has beneficial effects on health. Despite the guidelines [1] which encourage the consumption of these foods, kindergartens often do not offer them enough, mainly due to the fear of discards. The aim of our study was to design a prototype kindergarten menu rich in vegetables, fruits, whole grains and nuts (breakfast, lunch, 2 snacks), and test the hypothesis that kindergarten meals can increase the daily intake of those produce in children. The study was completed by 57 participants from 6 kindergartens, randomised into 2 groups–the prototype group (PG), which was served the prototype menu (n=40) and the control group (CG), which was served a standard menu (n=17). An accurate consecutive 7-day dietary record of all foods consumed in and outside of kindergarten by each participant was obtained from parents and kindergartens' staff. All data were analysed using an OPEN dietary assessment tool. A significantly higher average 5-day quantity of vegetables, whole grain foods and nuts ($p < 0,05$) was offered in PG kindergartens when compared to CG kindergartens, which offered a marginally higher amount of fruit. During weekdays (both in kindergarten and outside of it), participants from PG and participants from CG, compared with Recommended Daily Intake, consumed 54 vs 28% of vegetables, 98 vs 100% of fruits, 95 vs 42 % of whole grains and 100 vs 4 % of nuts, respectively. Participants from the PG therefore consumed significantly higher amounts of vegetables, whole grains and nuts during weekdays compared to weekends. Similarly was observed for whole grains intake in participants from CG, but not for other food groups. There were no significant differences in dietary intake outside of kindergartens between the two groups. Our results confirmed the feasibility of kindergarten menus rich in vegetables, fruits, whole grains and nuts, which may lead to improvements to nutritional guidelines kindergartens and beyond.

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OP-21

IODINE STATUS OF BREASTFEEDING MOTHERS IN MONTENEGRO

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Iodine is an essential element whose content in soil and water is significantly reduced. Daily iodine requirements are increased during pregnancy and lactation. Iodine deficiency is the most common cause of reduced mental abilities, slow growth and development of children. The nutritional composition of breast milk is conditioned by the mother's diet, so breastfed children are dependent on the mother's iodine intake. A cross-sectional study investigated iodine intake and iodine status in breastfeeding women in all three regions of Montenegro. In the first and third month of breastfeeding, the content of iodine in the urine was examined. The content of iodine in breast milk and the salt used by breastfeeding mothers in the household were also determined. Median urinary iodine concentration (UIC) in the first month of breastfeeding was 142.77 μg/l (32.40–1284.16 μg/l) and in the third month 154.56 μg/l (30.90–1247.73 μg/l). Out of a total number of breastfeeding mothers, 65 had UIC below 100μg/l in the first month, and 51 in the third month of breastfeeding. There were no breastfeeding mothers with UIC values below 20μg/l. Based on the $\chi 2$ test, there is no statistically significant difference in UIC in the first month of breastfeeding by region. ($\chi 2=1.338$, df=2, p=0.512), but there are statistically significant differences in UIC in the third month of breastfeeding by region. ($\chi 2=7.316$, df=2, p=0.026). The median of breast milk iodine concentration (BMIC) in 281 samples was 108.93μg/l. No statistically significant difference was found in BMIC by region. ($\chi 2=3$, df =2, p=0.223). There was no statistically significant difference between iodine supplement users (n=156) had higher BMIC in the third month of breastfeeding than in the first (167.93 μg/l vs 139.93 μg/l, p=0.683). Out of 302 samples of salt, 17% have less, and 26% of samples have a higher iodine content than the prescribed values. Salt samples from the southern region have statistically significantly lower iodine content compared to salts in other regions ($\chi^2=12.086$, p=0.002). According to the criteria of the World Health Organization breastfeeding mothers in Montenegro have a satisfactory iodine intake.

OP-22

EVOLUTIONARY ENGINEERING OF AUTOCHTHONOUS YEASTS FOR NOVEL BEER-LIKE FERMENTED BEVERAGE

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Today, novel food fermentations are primarily about improving sensory quality, obtaining unique, distinctive flavors, and enhancing the nutritional value of raw materials that help distinguish a product from others on the market. In our study, we developed a new beer-like beverage from buckwheat in which the chemical composition is altered, resulting in an imbalance between the different fermentable compounds. The limited genetic diversity of lager yeasts is reflected in a rather limited influence of yeast on the flavour profile of beer, due to their limited ability to convert alternative substrates into beer. Therefore, we took advantage of the natural yeast diversity and screened a large collection of Slovenian autochthonous strains from traditional spontaneous fermentations. The best strains were found among cider yeasts, which showed improved fermentation characteristics, aroma production, and tolerance to hops, ethanol, and low temperatures. However, their ability to ferment maltose was limited. Therefore, we use the tools of adaptive laboratory evolution, in which yeasts were adapted to novel substrates by re-pitching in 30 consecutive buckwheat wort fermentations under stress conditions. Finally, the advantages of genome sequencing technologies of the evolved clones allowed us to understand the genetic changes that trigger phenotypic adaptations to new substrates. We were able to correlate large structural changes at the chromosomal level and single nucleotide polymorphisms in technologically relevant genes with new phenotypes. Overall, our approach enabled us to obtain a new yeast strain suitable for buckwheat beer production.

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OP-23

VALORIZATION OF FOOD BY-PRODUCTS BY USING SOLID STATE FERMENATIONS

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Huge amounts of by-products are delivered during food processing. Most of them are used as feed. Some by-products have also high potential of using those as human food or at least food supplement. For example 20 MT of spent grain of beer is produced worldwide, it contains about 20 % of protein, 40 % of fiber, 20 % of lignin by dry weight. Our preliminary experiments have shown, that the protein content can be increased and that of lignin decreased by 10 % using solid state fermentation, making it more suitable for human consumption. However, the mass production of spent grain mycelia is a big challenge. Mainly because of contamination of malt with thermotolerant endospore forming bacteria, like *Bacillus subtilis* and spores of fungi. The steam sterilization is effective only in thin layers and measures should be taken to prevent contamination with spores of fungi during inoculation and cultivation. Another challenge is the high moisture content and structure of the spent grain that can also limit fermentation efficiency at large scale. We are developing the computer controlled solid-state fermentation system for mass cultivation of mycelia on spent grain that ensures the sterility of the system and enables the process monitoring and control.

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OP-24

OPPORTUNITIES FOR ETHANOL PRODUCTION BY ENCAPSULATED YEASTS IN FAVOURABLE AND UNFAVOURABLE GROWTH ENVIRONMENTS

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Many food productions systems are based on microbial transformation where product inhibition is severely limiting efficient substrate utilisation, effectively preventing efficient resource use. The confinement of microbial cells within a semipermeable polymeric matrix provides physical isolation from the external environment while maintaining a hospitable internal microenvironment. In order to study the strategies offered by hydrogels for mitigating product inhibition, unfavourable growth conditions for *S. cerevisiae* ZIM 2155 were examined at high temperature (24 °C vs. 37 and 42 °C) and high gravity fermentation (80 g/L vs. 120-320 g/L glucose, i.e. resulting in high ethanol concentrations), as well as adverse conditions for the growth of *K. marxianus* ZIM 1868 were examined at low pH (with/without 10 g/L lactic acid) in encapsulates and suspended cultures. Short-term batch (2-7 days) and fed-batch (28 days) fermentations were performed. Electrostatic manufacturing allowed for the preparation of well-defined alginate microbeads (180–260 μm diameter), high cell-entrapment (95%), viability (90%), and uniform cell distribution. Based on the observed uptake and production dynamics, the optimized cross-linked alginate network did not obstruct internal passage of substrates and products, providing insight into strategies for long-term or repeated microbead usage. In acidified conditions, the alginate hydrogels exhibited characteristic shrinkage [1-3] and enabled double product yields compared to an unfavourable growth environment for freely suspended cells. Our future work will focus on intraparticle diffusion, crosslinking charge and approaches for controlling cell growth.

Acknowledgments
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OP-25

INHIBITORY POTENTIAL OF BETALAINS-RICH PRODUCTS AGAINST DIGESTIVE ENZYMES AND FORMATION OF ADVANCED GLYCATION END-PRODUCTS LINKED TO TYPE 2 DIABETES

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Betalains-rich products are potential candidates for developing functional foods because they are sources of betalains that have been reported to contribute to human health. Studying the biological activity of different betalains-rich products is fundamental in the design of functional foods. Therefore, our study's objective was to assess the ability of six different betalains-rich products (red beetroot, yellow and red prickly-pear, yellow and red pitaya, and swiss chard) to inhibit enzymes and formation of advanced glycation end-products related to type 2 diabetes. Research materials were purchased at a local market in northeast Poland. After lyophilization, the samples obtained were pulverized and stored at -80ºC until analysis. Betalains were analyzed using liquid chromatography coupled with the Ultra-High Resolution Qq-Time-Of-Flight mass spectrometer (LC-TOF-MS/MS). The inhibitory effect against AGEs formation was studied in bovine serum albumin (BSA)-glucose and BSA-methylglyoxal (MGO) systems. The inhibition of α-amylase and α-glucosidase was measured by spectrophotometric assays. Compounds were identified through a comparison of their retention time and MS spectra. In our study, 47 compounds were identified, of which 35 betalains belonged to the red-violet betacyanins, and 12 compounds belonged to the yellow-orange betaxanthin group. The largest number of betalain compounds was determined in yellow and red pitaya (23 compounds), while the lowest number was in Swiss chard (12 compounds). Red pitaya exhibited the highest values of α-amylase and α-glucosidase inhibition, which is ideal for lowering glucose absorption in hyperglycemia management. While Swiss chard presented the highest ability against the formation of AGEs. Betalains-rich products could be considered possible candidates for hyperglycemia management and against the formation of AGEs. Thus, products rich in betalains can be successfully used in functional food design.

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OP-26

BACTERIAL INTERACTIONS OF A POTENTIAL PROBIOTIC STRAIN *BACILLUS SUBTILIS* PS-216 LEAD TO FOODBORNE PATHOGEN CONTROL IN BIOFILMS AND IN POULTRY

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The spread of resistant pathogens in livestock and food are a serious and increasing problem worldwide. Poultry meat is a frequent vehicle for the spread of pathogenic bacteria, with dire consequences for human health and the related industry [1]. Restrictions on antibiotic use have opened the door for focused research into alternative and sustainable solutions to this problem [2,3], such as the use of *B. subtilis* probiotics [4]. In this study, we focused on the interaction of *Bacillus subtilis* PS-216, a potential probiotic, with foodborne pathogens, for their control in biofilms and broiler chickens. We have confirmed a strong inhibition (from 80 to 99,9%) of *C. jejuni, E. coli, S. aureus, Salmonella* Infantis, *S.* Enteritidis, and *L. monocytogenes* by PS-216, *in vitro*. Furthermore, we found that the presence of PS-216 reduces both *Salmonella* and *Campylobacter* biofilms. In vivo, we investigated the efficacy of *B. subtilis* PS-216 in broiler chickens inoculated with *C. jejuni*. as a spore solution in water as a preventive measure, therapeutic measure, and during the whole rearing period (21d). *B. subtilis* PS-216 significantly reduced *C. jejuni* in the cecum content of broilers for 1,3 log CFU/g cecum and the addition of spores to water resulted in a significant weight gain in broilers (up to 130 g increase). We conclude that *B. subtilis* PS-216 has the potential to be used for the reduction of foodborne pathogens.

Acknowledgments
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OP-27

ADVANCES IN MICROBIOME RESEARCH TO UNDERSTAND MICROBIAL DYNAMICS ACROSS THE FOOD CHAIN AND DURING RIPENING

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In food production, the microbial landscape is shaped by the source, facility characteristics and both natural and human interventions. Microbial dynamics in food are of utmost importance, because they influence product properties including shelf life and susceptibility to spoilage. Furthermore, the initial microbial community influences the ripening process of many products. During the last years, we used integrative approaches along processing lines in pork, beef and cheese production to sample the hygiene status, ripening dynamics and microbial dynamics up to the final products. We sampled personnel, equipment, machines and the facility environment and applied high-throughput DNA sequencing methods for a subsequent source tracker approach to link specific taxa to particular environmental sources. A facility-specific transmission map of bacterial flows was created for a pork production plant, indicating microbial dynamics at all major production steps. Furthermore, we found autochthonous fungi to act as central components in microbial community structure in meat-associated products and we will now use these co-occurrence patterns for metabolic interaction experiments. In Austrian hard cheese production, we found *Brevibacterium, Corynebacterium, Halomonas* and *Staphylococcus* species being dominant during ripening. With a metatranscriptomics approach, degradation of residual lactose, lactate, proteolysis and lipolysis was mainly associated with *Staphylococcus* species in 30-day old cheeses, whereas after 90 days of ripening, genes associated with metabolizing smaller compounds derived from this initial degradation process, e.g. fatty acids and amino acids, were significantly upregulated, belonging mainly to *Brevibacterium* and *Corynebacterium*. These late metabolic activities included end products that are important for cheese flavor and aroma, e.g. methanethiol and 2,3-butanediol. Our results suggest that sequencing based approaches have great potential to contribute to food monitoring applications and that future efforts should continue to increase the resolution at which we identity and target microorganisms.

OP-28

EVALUATION OF EFFICACY OF ESSENTIAL OIL AGAINST *PSEUDOMONAS* SPP FROM ARTISANAL CHEESES

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Cross-contamination poses a serious risk of microbiological contamination of foods in the food industry, which requires a major efficacy of the cleaning and disinfection strategies. On the other hand, the new interest in a more sustainable and healthy environment has generated the refusal of the use of chemical products and the acceptability about alternatives from natural origin such as essential oils (EO): thyme, conventional and organic oregano, rosemary and mint. There are currently several studies confirming the antimicrobial properties of EOs, as food preservatives due to the content of antimicrobial substances such as carvacrol and thymol, but there is a gap regarding their application as surface disinfectants in the Food Industry. Therefore, the objective of this work is to determine the effectiveness of 5 essential oils as an alternative to the use of biocides of chemical origin. The determination of the disinfectant capacity of these EOs against Pseudomonas fluorescens and aeruginosa, isolated from artisanal cheese factories in Gran Canaria, was carried out using the minimum inhibitory concentration and the minimum bactericidal concentration methods. These results were compared with those obtained against a conventional disinfectant with quaternary ammonium. The results confirmed that only oregano and thyme had inhibitory capacity on the growth of *Pseudomonas*, at a concentration of 3.5%. The conventional biocide showed results 400 times higher than essential oils. Although the biocide showed better results, it is suggested to limit its use due to resistance and the ecotoxicity it generates. Likewise, the organic thyme and oregano EOs obtained very satisfactory results, however, it is necessary to investigate their composition in search of more effective components, being able to take advantage of the synergy between them and reduce their dose in order to minimize the negative organoleptic effect that cause.

OP-29

HEALTH PROMOTING EFFECTS OF *HELICHRYSUM ITALICUM* AND *H. ARENARI UM* INFUSIONS

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Helichrysum italicum (HI) is a Mediterranean plant with well-reported use in traditional medicine for a variety of applications, including digestive and liver disorders, parasitic intestinal infections, wound healing and stomach pain. Despite its traditional use, there is a lack of scientific data to evaluate its effects. On the other hand, *H. arenarium* (HA), a member of the same *Helichrysum* genus that grows in Eastern Europe, is a recognised medicinal plant. We compared the biological activities of infusions prepared from HI and HA in cell lines and performed a transcriptomic analysis of human colon cells exposed to HI infusion. *In vivo*, the effects of acute and regular consumption of HI infusions were studied. The antioxidant potential of the HI infusion was higher than that of HA. This infusion also showed more effective protection against induced oxidative stress. Transcriptomic analysis where enriched pathways and differentially expressed individual genes were analysed, suggests that the main mode of HI action is in wound healing. In addition to its indirect prevention of diseases resulting from the impaired intestinal barrier integrity, HI also has a direct effect on inflammatory and metabolic processes. In a pilot study with 10 individuals, a single ingestion of HI infusion increased fat oxidation and resting energy expenditure. This was confirmed *in vitro*, where genes involved in beta-oxidation were upregulated in HI-treated hepatocytes. A 28-day randomised comparative intervention showed different effects of HI and HA infusions. Consumption of HI had a beneficial effect on anthropometric characteristics; significant reductions in body weight, body mass index, visceral and total body fat were observed. In the HA group, there was a greater reduction in serum glucose levels and an improvement in the lipid profile. In both groups, LDL levels were lowered and serum antioxidant properties were improved.
Overall, our data show health-promoting effects of both *Helichrysum* infusions, suggesting that their consumption could be a simple and readily available profitable habit for people with increased body mass or a deregulated lipid profile.

OP-30

COMPARISON OF THREE SENSORY DISCRIMINATION TESTS FOR A ROUTINE WORK WITH A 12-MEMBER PANEL IN FOOD INDUSTRY

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Sensory analysis is an important part of food industry and consists of a variety of different methods. Discrimination tests are employed to identify or confirm differences between similar samples. Our goal was to determine the practicality, sensitivity, and repeatability of the three selected discrimination tests for their optimal use in the sensory analysis, given the number of assessors available. In the study, 80 untrained assessors were divided into panels of 12 and three discrimination tests were performed: triangle test, 3-alternative forced choice (3-AFC) and degree of difference (DOD) test. The tests were performed in two replicates with three sessions and longer intermediate breaks in order to provide each panel a different series of samples every time. Series of samples and methods used for their assessment were randomized and controlled for equal distribution. Series of samples were prepared from the apple nectar, which served as a standard, by adding sucrose (A series), citric acid (B series) and apple flavour (C series). The results were statistically processed using the $\chi 2$ test and the Marascuillo procedure of multiple comparisons. In the beginning of our study we have presumed that 3-AFC method would be more sensitive than triangle test. The results showed opposite, as statistically significant difference ($p<0.05$) in favour of the triangle test was found. Possible bias could be the fatigue of the testers at 3-AFC, as this test, theoretically less demanding than the other two, was the last in line in each session. Further, the DOD method was not found to be more sensitive than the triangle test ($p>0.05$). We have also rejected the third hypothesis, which predicted a difference in the sensitivity of the tests according to the substance added. Based on a series of test samples prepared with apple nectar, we may assume that the triangle test is the most sensitive method among the three discrimination tests for routine work with a 12-member panel. The nature of difference did not affect the repeatability or sensitivity of methods, which is important information about the applicability of the selected methods for different samples types in practice.

OP-31

IMPACT OF THE COVID-19 PANDEMIC ON NUTRITION AND LIFESTYLE BEHAVIOUR OF EUROPEAN CONSUMERS

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In relation to the perceived risks of COVID-19 to individuals in different countries around the world, various changes in lifestyle behaviour have been reported during the pandemic. This study focused on examining the relationship between the risk perception of COVID-19 by European respondents, primarily in the higher education sector, and its impact on changes in eating habits, physical activity, alcohol consumption and smoking. The cross-sectional online questionnaire was used to collect data during the first wave of the pandemic from European adult respondents in four selected European countries, in particular the Czech Republic, France, the United Kingdom and Italy. A Kruskal-Wallis test and Pearson Chi-squared test were used to determine the associations between behaviour changes and consumers' COVID-19 risk perception. The findings of the study showed significant changes in lifestyle behaviour of European respondents during the COVID-19 pandemic compared to the pre-outbreak. About half of all respondents reported a decrease in alcohol consumption, smoking, and physical activity, while eating habits among European consumers have shown both trends towards a healthier and unhealthy diet. According to the self-assessment of European respondents, the highest increase in consumption was observed for fresh vegetables (44%), followed by fresh fruit (41%) and sweets (34%). Fear of the COVID-19 outbreak, along with restrictions imposed by national governments in response to the pandemic, has fundamentally affected European respondents' lifestyles. Understanding these aspects is essential for imposing restrictions that may be introduced during the subsequent waves of the pandemic or in similar situations in the future.

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OP-32

CHANGES IN SENSORY CHARACTERISTICS, VOLATILE COMPOUNDS, AND BIOPHENOLS IN OLIVE OILS DUE TO THE OLIVE FRUIT FLY *BACTROCERA OLEAE* (GMELIN) INFESTATION

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The olive fruit fly *Bactrocera oleae* (Gmelin) is a well-known pest in the Mediterranean basin, which negatively influences the quality of the produced olive oils and can cause major economic losses in the olive sector. In 2020, samples of unaffected high-quality extra virgin olive oils and virgin olive oils, produced from olive fruits affected by the attack of the olive fly, were collected and analyzed. Differences in sensory characteristics, volatile compounds, and biophenol content and composition were observed. Sensory defects fusty/muddy sediment, musty, rancid, and grubby were determined in virgin olive oils, due to the consequences of the olive fruit fly infestation. The intensities of the positive attributes fruity, bitter, and pungent were higher in extra virgin olive oils, compared to virgin olive oils. Differences between extra virgin and virgin olive oils were also assayed in the amounts of volatile compounds. Higher content of ethanol, (E)-2-hexenal, (E)-2-heptenal, nonanal, (E)-2-decenal, acetic and pentanoic acids were assayed in virgin olive oils, compared to extra virgin olive oils. Lower amounts of total biophenols, oleuropein, and ligstroside derivatives were determined in virgin olive oils than in extra virgin olive oils. All the assayed parameters were determined in the same samples also after one year of storage in dark at room temperature. A decrease in total biophenols, oleuropein, and ligstroside derivatives, and an increase due to transformation of complex biophenols in more simple ones as tyrosol and hydroxytyrosol was observed.

Acknowledgments
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OP-33

RELATIVE REFRACTIVE INDEX VALUES OF SUGARS, ORGANIC ACIDS, ALCOHOLS, AND THOSE APPLICATION IN QUANTITATIVE CHROMATOGRAPHIC ANALYSIS USING RDI DETECTOR

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It has been found that, for a number of sugars and related compounds, a solution of a given percentage by weight has approximately the same refractive index (1). The respective values of most important acids and alcohols in food are available in CRC handbook (2). The task of this work was to study the possibilities of using Handbook nD20 values for HPLC quantification by using RDI detectors and internal standard method. Three chromatographic systems equipped with RDI detectors were used in parallel refractive index measurement of 25 major food constituents to determine the internal calibration constants kj/i. The results showed that for two chromatographic systems the calibration constants well coincided with those calculated theoretically from nD20 data, while in case of the third system those were different, particularly in case of acid/sugar comparison. The factors limiting the usage of kj/i values as universal constants in LC are under the study.

Acknowledgments
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OP-34

CAN WE VERIFY THE ORIGIN OF SLOVENIAN PORK MEAT ON THE MARKET?

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Proof of provenance has increased in relevance over the past decade because of its positive impact on food safety, quality and consumer protection. This trend has created interest in building local and regional food systems across Europe, including Slovenia. Within this study we present how we can verify that pork meat on the Slovenian market corresponds to its declaration using isotopic and elemental analysis, one of the most powerful approaches for determining geographical origin. In order to evaluate the authenticity of commercial food samples, the isotopic and elemental data must be compared with reference data from a databank of authentic samples and evaluated in terms of their match within statistical limits. For the databank, 70 Slovenian pork meat samples from different breeds and rearing systems (28 krško-polje breed samples and 42 Slovenian breeds, of which 5 samples were Mangulica) were collected from farms in four different regions. The isotopic composition of light elements (δ13C, δ15N and δ34S) was determined using an IsoPrime100 – Vario PYRO Cube Isotope Ratio Mass Spectrometer (IRMS) and the isotopic composition of oxygen (δ18O) in isolated water from the meat using IsoPrime MultiFlow system coupled to IRMS. The elemental content was measured using inductively coupled plasma mass spectrometry (ICP-MS). Different statistical procedures (PCA, LDA, OPLS-DA) were used to distinguish between breeds and geographical origin, while data-driven soft independent modelling of class analogy (DD-SIMCA) was used to verify the correct labelling of Slovenian pork meat. The first evaluation of results indicates a good separation of pork meat according to the breed, region and diet. The overall prediction ability between breeds was 98.44%, with a 100% prediction ability in the case of the Slovenian breed and a 96.43% prediction ability for krško-polje pork samples. The most powerful parameters for differentiating Slovenian and krško-polje pork meat samples concerning the breeds were K, Mg, P, S and Na for the Slovenian breed. However, to specify from which geographical area the pork meat originated, further research is needed, due to pigs' diet variability.

CE-I-FooDay – Central European Inspiration Food day


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OP-35

TACKLING HONEY ADULTERATION PATTERNS IN CURRENT FOOD SYSTEMS

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The adulteration phenomena in the food chain is widespread, especially in products with added value, and honey is an example of it. It is quite evident in the time that we are living, present (post) Covid-19, there is an increase in honey fraud, since it's a natural product, and its use as "medicine" has influenced the demand. Honey, being a food matrix with great variability, poses a great challenge to verify its authenticity, in terms of composition and botanical/geographical origin, especially in cases of sophisticated adulteration. Currently, the official methods of honey analysis, are focused mainly on quality parameters, and there are some attempts to put purity criteria, like it is the case for olive oil. Tackling honey adulteration in current food systems is an urgent need to be done by all actors in the honey chain, starting from honest beekeepers, official control authorities, and the end of the food chain – consumers.

OP-36

FOOD PACKAGING: FOOD QUALITY, SAFETY AND SUSTAINABILITY

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Our food systems place an enormous burden on people and the environment. Accordingly, achieving sustainability in this area is high on the agenda of various stakeholders. In this endeavour research activities in the field of Food Science & Technology are increasingly targeting packaging as it performs important functions such as containment and protection of products along the supply chain. The present position paper takes up this topic, depicts why food packaging can be seen as an important lever in terms of sustainability, outlines current packaging-related research topics and finally discusses possible future focal points.

OP-37

THE CURRENT CHALLENGES FOR SALT IN TECHNOLOGY AND HUMAN NUTRITION

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Daily intake of table salt in most countries exceeds the World Health Organization (WHO) recommendation which is 5 to 6 g per day for the adult population. The main source of excessive intake of table salt is processed food. From a medical point of view, there is a direct relationship between the dose, or the amount of salt ingested, and the reaction to its intake, i.e. the increase in arterial pressure, which reduction reduces the risk of cardiovascular diseases and stroke in the long term. WHO also believes that reducing the excessive intake of table salt is feasible and that it is one of the most cost-effective and beneficial public health interventions. On the other hand, from a technological point of view, table salt has a repeatedly important role, as it serves as a means of extending the shelf life of the product, ensuring the microbiological stability of the finished product and safety of food in general, formation of dough and the development of gluten in the production of bread and bakery products, increasing the ability to bind water and fats in the technology of meat products, the formation of food taste and general acceptability by consumers.

OP-38

ANTIMICROBIAL POTENTIAL OF PLANT VOLATILE AGENTS FOR FOOD SHELF-LIFE EXTENSION

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Microbial food-borne diseases are significant public health concern throughout the world. Antimicrobial active and modified atmosphere is effective way to improve shelf-life of easily perishable food products. Plant-derived volatiles are of great potential for the development of novel controlled atmosphere food packaging and storage due to their high volatility while their constituents produce antimicrobial activity in vapor phase. Since volatile agents don't need to be applied directly to the food product, their application in the vapor phase reduces exposure doses, side effects, and residue amounts of these agents. Although the first products using the vapours of volatiles have already entered the market, the industrial applications based on the volatility of these agents have not been fully developed yet. Therefore, study focused on biological activity and chemical properties of plant volatiles using innovative bioassays and advanced food model systems will help in development of novel food products and technologies.

OP-39

CHALLENGES AND FUTURE PROSPECTS OF GLUTEN ANALYSIS IN FOOD

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Celiac disease is an autoimmune enteropathy of the small intestine triggered by dietary gluten in genetically predisposed individuals. The only available treatment is a life-long gluten-free (GF) diet. Current EU legislation defines a 20 mg/kg gluten threshold for the labeling of GF foods, which requires reliable analytical methodologies. The method-of-choice is the immunoanalytical ELISA (enzyme-linked immunosorbent assay), which is a sensitive, specific, easy-to-use method. However, due to the lack of reference methods and reference materials, there are many gluten ELISA assays available. These methods often provide different results that could lead to the under- or overestimation of the actual gluten content. This is the result of the methodological differences and the complexity and genetic-environmental variability of gluten proteins. Over the years, many new developments appeared both in terms of methodology and reference materials. Regardless of the progress in these areas, ELISA methods will always carry inherent problems that might only be possible to overcome by a paradigm shift towards other methods, such as mass spectrometry.

OP-40

FROM TARGET TO UNTARGET CHEMISTRY TO IMPROVE FOOD SAFETY AND AUTHENTICITY

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Chemical safety of food in EU is nowadays managed through the implementation of national residue plans. Such plans involve the random or risk-driven search of specific molecules. Although, for some categories of contaminants, such approach has evident limitations. For instance, concerning antibiotics, we are dealing with molecules with a very low toxicity. In this case, looking for residues of the molecules in food is no longer sufficient to cover the real endpoint. Therefore, new techniques able not only to look for the specific residue but able to detect past treatments of the animals are needed. These techniques have to be able to take a picture of the whole sample and use, at the same time, all the information that can be gathered. In other words, there is a need to move from target to untarget chemistry. Such step, though very new in the field of chemical contamination, has already been done for the assessment of food authenticity in which many successful examples of applications of untargeted chemistry can be found.

OP-41

POULTRY MEAT PRODUCTION AND PROCESSING – BEYOND THE CHALLENGES

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Poland is a leader in Europe in poultry meat production (in 2021 c.a. 2.5 mt). The average annual consumption of poultry meat increases by about 2%, while in the EU by 0.4%. Poultry meat is healthier, less expensive, and more flexible to operate, which drives the market demand. Intensive automation and modernization of the Polish processing plants guarantee a high degree of safety and quality of products. Since 2015 constant increase in the production of traditional meats is noted, and the rising demand for culinary meat, esp. semi-finished products, and ready meals is facing supply challenges. Poultry meat consumption will continue to grow in the future due to higher production and lower exports. A big challenge is how to achieve high-quality meat while a growing number of defects, i.e. chicken breast myopathies, white stripping, woody breast, and spaghetti meat, are noted due to production intensification. It impairs the meat supply and the final quality of food. It can be reduced by the “Farm to fork” and “green deal” strategies, but it eventually reduces the production yield.

OP-42

NON-ANIMAL PROTEINS SOURCES - NEW STRATEGIES OF VALORIZATION INTO VALUE-ADDED FOOD INGREDIENTS

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The global population is expected to grow by 2050 to near 10 billion people, doubling the food demand in the forthcoming future. In order to keep the global food system in its safe operating limits and to prevent the global food crisis, consumers need to change their dietary style by shifting towards a more healthier and sustainable food diet. There is a burgeoning interest in non-animal food protein sources as more and more evidence is cast upon their sustainability and consumer awareness regarding potential health benefits. On the other hand, many of these non-animal protein sources and resources have been considered unbalanced dietary nutrients, and their functionality needs to be tailored in order to bring value into food products. Thus, this position paper aims to provide a concise summary on the main non-animal protein sources as well as latest strategies for efficient valorization into new value-added food ingredients.

OP-43

THE ADVANTAGES AND DISADVANTAGES OF ACTIVE, BIODEGRADABLE MATERIALS FOR FOOD PACKAGING

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The concept of active, biodegradable food packaging materials arises from global issues directed at the generation of food waste and disposal of plastic packaging. The design of these materials implies active components' incorporation to maintain or improve food quality and safety and extend shelf-life. Thus, the traditional, passive packaging role in protecting and marketing its content expanded to a novel one, being a matrix for the incorporation of actives with an active role against food deterioration. To this end, the focus is on using natural actives as a potential replacement for chemical additives, biodegradable polymers as a replacement for traditional polymers with slow degradation, and novel fabrication techniques. Despite great potential, the development and implementation of active, biodegradable materials face challenges, such as diversity and physicochemical properties of raw materials, technological issues, cost, legislation, and consumer acceptance.

OP-44

TRADITIONAL [UKRAINIAN] FOOD – THE CHALLENGES FOR THE SUSTAINABLE NUTRITION AND A PATHWAY TO SUCCESS

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Sustainability challenges the pathway of traditional food integration from sustainable nutrition to the nutritional sustainability of complex food systems. This is now crucially globally and, in particular within Ukraine because of the devastating consequences of Russian invasion. The multi-dimensional (health, economy, culture, environment) and multi-level (from local to global) contexts that determine approaches to optimise sustainability of traditional foods have been investigated in the Transcarpathian (Zakarpattya) and Bessarabian regions of Ukraine. Integrating data of traditional food and recipes, their ingredients and impact on human health have been examined according to local communities' food perception, recognised taste and organoleptic properties within international and domestic projects "BaSeFood" and "Showcase of Zakarpattya". The development of traditional food-sharing patterns, gastronomic services in tourism, enforced by instruments such as Geographical Indication Slow Food, SafeTravel and others, supported by public/private/civil partnerships, would further contribute to strengthening identity, mobilizing Sustainability Development Goals, facilitating employment, SME development and local community economies and the deliver a healthy environment overall.

OP-45

THE USE OF PLANT GENETIC RESOURCES FOR HEALTHY FOOD END ENVIRONMENT

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Plant genetic resources for food and agriculture are the foundation for sustainable crop production, food security and bioeconomy. They are the building blocks for new varieties of agricultural crops that are adapted to changes in the environment, are resistant to diseases and pests, and meet consumers requests. To preserve them also for the future generations, different policies are in place and programs are run at the global as well as on the European level. In Slovenia, conservation and sustainable use of plant genetic resources is ensured and financed through the Public Service for Plant Genetic Resources. For an efficient plant breeding process, the genetic resources need to be well evaluated. Recent developments in the field of molecular biology, new-generation omics techniques and different analytical methods and strategies enable the identification of desirable traits that are then incorporated in the new crop varieties, either by using conventional or novel breeding methods. Using new breeding methods and techniques the process of plant breeding could be faster and more efficient.


PETER
RASPOR
NADIYA
BOYKO

ROUND TABLE

R-1

EDIBLE INSECTS FOR HUMAN CONSUMPTION: A TREND OR A FAD?

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Although eating insects is still rare in Europe and North America, there has been a rising interest since the turn of the century. However, it is highly unusual to eat insects and not widely accepted by Western consumers. Disgust and neophobia have been the major barriers on the acceptance of insects as food or food source. Why should we still consider insects as an alternative protein source for the European consumers? The effects of food production on the environment, the growing population and other factors led stakeholders to understand the need for more protein from more environmentally friendly and alternative sources and protein products. We need a future-fit food system that produces healthy and sustainable food for all. A sustainable food system is key for future food production. Insect production is gaining momentum, as its potential relies not only on food and feed, but also on the context of a circular economy. Insects have the potential to convert a wide range of organic by-products into feedstuffs, which then go back into the production cycle. Insects can provide high-quality protein and nutrients for humans and animals, comparable with that provided by meat and fish, depending on their species, diet and stage of life cycle. As a source of proteins, lipids, carbohydrates, vitamins and minerals, insects show a great potential as food source, but are subject of a stringent risk assessment process conducted by EFSA in accordance of the EU Novel Food Regulation. Potential food safety hazards should be assessed in a case-by-case approach, including microbiological and chemical contamination, and potential allergenicity. Alternative solutions are being studied to improve processing and to increase the shelf life of insect products, in order to increase availability and consumer acceptance by the isolation of proteins and lipids as food ingredients. Whether insects can form part of a healthy, sustainable and affordable diet for both humans and animals in Europe depends on cultural, behavioural, ethical, food safety, nutrition and other multiply factors and differs by countries.

WORLD CAFÉ on *Food Supplements*

W-1

ANALYSES OF FOOD SUPPLEMENTS – CHALLENGES AND BENEFITS

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The analytics of food supplements is difficult due to the endless possible combinations of the bioactive ingredients (bioactive compounds, vitamins, minerals, plant extracts or even several plant extracts in one food supplement product, etc.) and excipients in different formulations such as hard/soft capsules, tablets, and liquids. What makes analytics even harder is the lack of available reference standards, SRMs, and marker compounds of particular plant materials, plant extracts, or plant extract fractions, as well as a variety of chemical structures, including isomeric compounds. Development and validation of new analytical methods, identification and characterization of biomarkers, and the generation of standard reference materials (SRMs) globally represent a big challenge for analytical chemistry. As a part of method development, the stability of bioactive ingredients during analysis (from the sample preparation step till detection) has to be considered. Frequently the advertised main bioactive ingredient is present in a food supplement as a minor compound together with other bioactive compounds present in much higher concentrations. This should be considered during the optimization of sample preparation. The combined use of different chromatographic techniques and their hyphenation to mass spectrometry and spectrophotometry, as indispensable tools provide support to the manufacturers of food supplements as well as to regulatory authorities. Methods based on these analytical techniques are important from the conception through to the final food supplement product - starting with the selection of the ingredients (plant materials, pure compounds, etc.), selection of plant varieties (giving the best yields), quality control of the raw materials (identification, chemical and biological fingerprint), and final products (purity, uniformity, content, stability testing). In other words, chromatographic techniques are important in quality by design of the food supplements products and also ensuring consumer safety.

W-2

IMPLICATIONS AND CHALLENGES OF FOOD SUPPLEMENTATION IN CHILDREN

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Malnutrition in terms of undernutrition and nutritive deficits are usually mentioned in the context of undeveloped and developing countries. However, unfortunately today we are witnessing the wide range of nutritive deficits in otherwise healthy children in developed countries. As a result of poor lifestyle and mostly westernized diet, the adult population is malnourished, and there are more and more women who are pregnant with nutrient deficiencies like folate, vitamin, iron, calcium, zinc and selenium deficiencies. This is why children experience malnutrition already in utero. During the growth a large proportion of children is consuming an unbalanced and nutrient deficient diet which is why today we know that there are deficits in iron, vitamin D, zinc and other micronutrients in children globally. The term “micronutrient gap” is becoming a hot topic among adult and pediatric health care professionals. It seems that although today we have a global pandemic of obesity among children and young people at the same time this population is deficient in essential micronutrients. Low quality and imbalanced nutrition together with a sedentary lifestyle and high stress environment resulted in low quality of life-. Specific micronutrient supplementation is becoming a part of everyday self care in developed countries, however at this moment there are no recommendations and guidelines for otherwise healthy populations including children.

W-3

IS THERE A DIFFERENCE BETWEEN SUPPLEMENTS AND DRUGS IN LEGISLATIVE AND IN OUR EXPECTATIONS?

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The official definition of food supplements is that they are „foodstuffs the purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination, marketed in dose form, designed to be taken in measured small unit quantities“ [1]. Major reason for using supplements is nutrient deficiency prevention, but also potential health promoting or even therapeutic effects. Increasing consumer interest in health and wellbeing is a driving force behind the global supplement market expansion. In the period 2022-2030 this market is expected to make an annual growth rate of 8.9% [2]. The use of supplements generally is safe and they are usually marketed in a non-prescription mode. Vitamins dominated supplements market in 2021, followed by botanical ingredients, than proteins and amino acids [2]. Beside nutrient-based supplements, there are other non-nutritive specialized supplements containing numerous ingredients of various bioactivity and safety. Beside potential benefits of supplement usage there are several risks that can cause concern and caution. There is a narrow window between requirement and Tolerable Upper Intake Level for some vitamins and minerals that can lead to their excessive intake. Some of the increasingly popular herbal supplements have been associated with more serious adverse effects, and their dosage, or even usage have restrictions and cautions in many national legislations (Serbia, Croatia, Danmark) or in international safety assessments (e.g. EFSA). European legislative also regulates food supplements as foodstuffs from 2002 [2]. In last 20 years just a small segment of supplements' bioactive ingredients, quality and safety aspects was covered with legislation on EU level, and great part of these issues are left to provisions in the specific national legislations.

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WORKSHOPS: “*Challenges for Beer and Wine in Today's Food World*

W-4

DETERMINATION OF THE GEOGRAPHICAL ORIGIN OF HOPS AND TERROIR INFLUENCE ON QUALITY

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A need exists for a reliable method for determining the geographical and botanical origin of hops. For brewers, it is important to know the geographical origins of the hop products (*Humulus lupulus* L.) used in their brewing processes since the contents and compositions of bitter resins and essential oils in them depend not only on the genetic but also on the environmental conditions during their growth. In recent years, especially due to the higher hop dosage rates in beer, the terroir and its influence on hop brewing value become more important. To study that influences the reliable analytical methodology for determination and certification of the geographical origin should be developed. In our research work new approach for that was developed. For this study samples of hops from the 10 world's main growing regions were collected. The samples were analyzed using Isotope Ratio Mass Spectrometry (IRMS) to obtain a range of stable isotope ratios $\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$, $\delta^{2}H$ and $\delta^{18}O$. The $\delta^{15}N$ and $\delta^{34}S$ values proved to be the most discriminating parameters for classifying hops according to geographical origin. Use of stable isotopes ratios of $\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$ could be used as a new powerful tool for differentiating hops according to geographical origin and can be of use to the brewing industry or to the hop traders in resolving issues relating to authenticity. Method is uncomplicated, fast and relatively cheap, comparable to standard GC or HPLC techniques and does not need any special sample pretreatment except weighting [1]. Furthermore the multi-elemental profiles of hop products from each of the world's main growing regions were determined by non-destructive energy dispersive X-ray fluorescence spectrometry covering a broad range of 13 elements (Si, P, S, Cl, K, Ca, Ti, Mn, Fe, Zn, Br, Rb, and Sr). After applying the suitable chemometric methods complete discrimination of samples between different regions was achieved [2].

Acknowledgments
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W-5

WINE QUALITY: YIELD, YEAST OR TERROIR?

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Terroir is about the link between wine and its origin. It has long been understood by sensory evaluation that the taste of wine from a given variety can be related to its origins [1]. Wine production is also a constant process of improving and adapting the quality of wine to market requirements. The positioning in the quality pyramid and the use of trademarks and/or geographical designations of origin play an important role in this process. The possibilities of influencing the quality of wine lie both in viticulture and in the technological processes of winemaking [2,3]. The quantity of grapes harvested and the choice of the type of alcoholic fermentation play an important role [4,5]. Therefore, in our experiment with the Merlot grape variety, we tested two different crop loads and inoculated and spontaneous alcoholic fermentation at two different sites or terroirs. We monitored the quantity and quality parameters of the grapes and the wine. Both the physico-chemical analysis of the grapes and the wine [3,4] and the sensory analysis of the wine [6] confirmed that the production site (terroir) and the type of alcoholic fermentation have a greater influence on the quality of the wine than the quantity of yield per vine.

Acknowledgements
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W-6

THE IMPACT OF NEW TECHNOLOGIES ON BEER QUALITY AND SUSTAINABILITY

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The brewing industry is facing several major changes in the recent period. The fast growth of the craft beer market and the addition of more and more new breweries have put pressure on breweries of all sizes. However, the higher-quality beer and sustainability of the production remain the ultimate goals of each beer producer. The new technologies that are developed and introduced in beer fermentation are trying to answer these requests even in the case of multiple shortening of beer production time. Beer fermentation is the most time-consuming stage in beer production. Therefore, in the competitive market like beer market is, the optimization of fermentation time without changing beer quality and sensory profile is a challenge for all the brewers. Immobilization of yeast cells is one of the approaches for fermentation time reduction as well as continuous process operation without the risk of yest cells washout from the fermenter. Immobilized yeast cells were successfully implemented in industrial scale in continuous beer maturation and the production of beer with low alcohol content. However, primary beer fermentation with immobilized yeast cells is still facing number of challenges in spite of the fact that different approaches were made. The major reason for this fact is linked to the changed conditions for immobilized yeast growth that cause changes in yeast morphology and physiology, and consequently altered aroma and flavor of beer produced. Some of the applied solutions gave good results on the laboratory and pilot scale experiments and have the potential to be spread on industrial scale. The aim of this study is to make a review of the existing knowledge of the methods for yeast immobilization, the carriers used in brewing, fermented design and to summarize their impacts on beer quality and sustainability of production.

W-7 not presented

W-8

LINKING BEER FLAVOUR FINGERPRINTS WITH CONSUMER PREFERENCES IN DIFFERENT BEER STYLES AND TRENDS ON THE MARKET

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High quality products, plus product stability and batch-to-batch consistency are essential requirements for all producers. Beer flavour is not static; it is in a constant state of change requiring human sensory and analytical analysis at each stage. Understanding how the beer sensory profile can be affected, various factors are critical to delivering a consistently fresh product. Therefore, aligning pre- with post-production sensory and analytical best practices will ensure high quality and stability across the market. Linking beer flavour fingerprints with consumer preferences data, provides very powerful information for each producer and supports to secure a leading position on the market. This study describes common flavour fingerprints in different beer styles, detected in descriptive sensory evaluation of 460 different beer brands and styles all around the World. The purpose of this workshop will be to show, real-world practical examples. There will be an opportunity, to allow participants to experience few GMP beer flavour standards and to learn about tasting techniques, flavours origin and importance. This workshop will also allow participants to assess and compare their individual sensory skills.The findings can be used to advise the industry, how to use the best sensory and analytical practices, aiding to detect positive and negative beer flavour fingerprints, prevent and stop problems during and post-production.

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dvorana

WORKSHOP: *“Food and its safety in a fast changing world”*

W-9

MICROPLASTICS IN FOOD SAFETY: FROM TOXICITY TO SHUTTLE EFFECT

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Microplastics contaminate the global marine and terrestrial ecosystems. This environmental contamination can enter the food chain, with MPs found in drinking water, fishery products, plant-based foods, and many other food categories. Consequently, foodborne and waterborne ingestion is considered the critical route of human exposure. Concerns exist on the potential of MPs to act as vectors for pathogenic microorganisms and their toxins, as well as chemical hazards, possibly threatening (microbial) food safety beyond their own inherent toxicity. Starting from the current evidence on food pathogens associated with MPs, the putative role of MPs in enhancing harmful bacterial traits and transporting them to humans is not entirely clear. The latest results of the Horizon2020 project ImpTox (www.imptox.eu) shed new light on these aspects using Cyanobacteria and cyanotoxins, aflatoxins, and fumonisins, *Vibrio* spp., *S. aureus*, and *L. monocytogenes* as examples. Although the role of MP in microbial food safety and the possible health outcomes are intriguing, new research still needs to provide evidence regarding the effect of MPs on microbial virulence and evolution, the attachment of microorganisms and microbial toxins to MPs, and many other aspects. Special attention is to be given to biofilm-coated MPs in foodstuffs and several risks this creates for food safety.

Acknowledgments
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W-10

PLANT ESSENTIAL OILS FOR FOOD SAFETY: FROM RESEARCH TO PRACTICE

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Essential oils (EOs) and hydrolates (HYs) are increasingly investigated for food safety applications. EOs are lipophilic substances containing many active molecules, e.g. terpenes and phenolic compounds [1], while HYs are aqueous solutions derived from EOs distillation. Many Mediterranean plant species were studied for their antimicrobial activity, including *Coridothymus capitatus*, *Cinnamomum zeylanicum* and *Origanum vulgare*. *C. capitatus* HY inactivated *L. monocytogenes* in vitro at 250-500 µL/mL, in conditions often encountered in foods (eg. different carbon sources, 1-8% NaCl, pH 5.0) [2]. The same HY gave promising results when used as a washing solution for ready-to-eat rocket salad (*Eruca sativa*), stored at 4 °C, against *L. monocytogenes*: at 500 µL/mL, it decreased the inoculum (107 CFU/mL) by almost 1 Log CFU/mL. Differences in pH, aw, colour, and sensory characteristics between treated and control samples were not significant. We also investigated the potential of the EO of *C. capitatus* to reduce the biofilm forming capacity of L. monocytogenes. At 0.31 µL/mL, we observed a strong inhibitory effect against L. monocytogenes biofilm on polystyrene, with effectiveness values in the range of 71.2-95.8% [3]. Finally, we evaluated the effect of treatments with *C. capitatus* EO on multidrug-resistant *Salmonella* spp. The results were particularly interesting, as the combination of C. capitatus EO with tetracycline compounds restored the susceptibility of *Salmonella* spp. to treatment, with a minimum inhibitory concentration reduction from 256 to 4 µg/mL [4]. In conclusion, *C. capitatus*, used as EO or HY, demonstrated an excellent potential for different food applications.

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W-11

ANTIBIOTIC RESISTANCE: STILL FOOD SAFETY CONCERN?

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Antibiotic resistance in medical and agricultural fields has become a serious problem worldwide during the last decades. Use or rather overuse or misuse of antibiotics has been deemed the major factor in the emergence of bacterial resistance to these antimicrobials. The spread of antibiotic resistant strains is an increasing threat to animal and human health, including the transmission of pathogenic bacteria through the food chain. Antibiotic-resistant microorganisms from animals are found in food when they survive the production processes. This presentation will focus on the main trends in antibiotic resistance, current knowledge concerning the mechanisms of antibacterial resistance, the possible role of foods as a vehicle for antibiotic-resistant bacteria and some approaches for restoring the effectiveness of antibiotics.

W-12

HOW EFFICIENT IS ELIMINATION OF AFLATOXIN TREAT FROM MILK?

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It is assumed that approximately one-third of humankind is chronically exposed to the carcinogenic aflatoxin M1 contained in milk. There have been numerous attempts to remove aflatoxin M1 from milk, however, practical realisation of them in the dairy is still missing [1]. As β-cyclodextrin is frequently used in the food industry, its effect on aflatoxin M1 concentration was investigated during cholesterol removal from milk. Moreover, the elimination of cholesterol using β-cyclodextrin has been successfully applied in many studies without any substantial effect on the quality of the treated milk and dairy products [2,3]. Milk samples were spiked with aflatoxin M1 within the range from 0.20 to 2.00 μg/kg, and cholesterol removal was carried out by 2.0% β-cyclodextrin addition, as this concentration is enough for the sufficient removal of cholesterol. It was found that the mean cholesterol concentration decreased by 92.3%, while the aflatoxin M1 concentration decreased to 0.53 ± 0.04 μg/kg, i.e., by 39.1% after treatment [4]. This mitigation procedure itself is easy and inexpensive and ready-to-use with a high potential for complete decontamination of aflatoxin M1 from milk after adjustment of technological parameters. This method will therefore considerably improve the food safety issues associated with aflatoxin M1 presence in milk and dairy products and solve the tasks associated with handling over-limited concentrations of AFM1 in traded dairy products.

Acknowledgments

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W-13

DATA SCIENCE; CAN IT BE AT THE FOOD SAFETY SERVICE?

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Food safety is a frequently contested topic in the agricultural industry, which worldwide is estimated to be worth more than $8 trillion; with the advancement of smart farming and the changing attitude towards popularised food trends, maintaining the safety standards of food has never been more important. With populations still predicted to rise, and the demand for higher yields of nutritious food expected to increase proportionally, the AgriTech industry will be relied upon to produce techniques to accurately, non-invasively, and rapidly detect unsafe and inauthentic food samples within the food chain itself. The agri-food industry is nowadays called to successfully cope with multiple challenges, with food business operators, regulatory authorities and consumers sharing the responsibility of ensuring food security, integrity, and safety. Bringing together research, industrial and food authority partners representing the agro-food industry the idea is to develop an integrative approach supported by advanced authentication and traceability technologies, applicable throughout the farm-to-fork continuum. Specifically, the recent need is to provide quantifiable evidence for the effective detection, assessment and mitigation of biological hazards, chemical hazards, and environmental contaminants, using the latest advances in software technologies and high throughput, rapid, non-invasive sensors. Indeed, the AgriTech industry itself relies on data science to model various aspects of the supply chain to identify and improve industry practices which produce unsatisfactory results. Data science is the emerging field that sits at the nexus of data, algorithms, and computing. It is an interdisciplinary field of inquiry in which quantitative and analytical approaches, processes, and systems are developed and used to extract knowledge and insights from increasingly large and complex sets of data. Data analysis has fostered knowledge creation for hundreds of years; the achievement of scientific milestones identified in this report will be spurred by data science.

W-14

FOOD MICROBIOLOGY/FOOD SAFETY EDUCATION AND TRAINING OBSTACLES IN VIRTUAL WORLD?

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Food food microbiology (FM), has been facing extreme development in last 50 years. If a century ago major activities belong to food preservation, today is the key issue food safety. These requests trigger very specific response of the food supply chain (FSC) managers towards legislation and consumers. Education at different levels is what creates basic communication network for transferring knowledge/skills principles FSCs. The question is how much novelty should be introduced into the education to assure relevant and efficient start up learning/teaching. Later lifelong learning/teaching among food workers is relevant as well. Education on food safety experience is based on good practice approach, while education in FM is based on natural science principles. Complexity of food area is asking for a standardized approach. For this reason, good practices entered this field very efficiently, however this is not sufficient to manage all complexity. Not only in food cluster also in education we face new streams and new practices in learning and teaching. In particularly we face strong pressure connected with virtual platforms. This become strong tool in COVID 19 period. To our opinion, traditional and virtual education is reality we have to cope with, but it deserves close assessment.


HOTEL
TERME

WORKSHOP: “*Modern Food: Local vs. Global, Traditional vs. Innovative in the “Healthy” Perspective”*

W-15

EU CONSUMER PROFILING: LOCAL AND GLOBAL FOOD SAFETY PRACTICES

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EU consumers are very diverse in terms of food choice and food practices. Many vulnerable categories as elderly persons, families with infants and/or pregnant women but also high-risk takers as young single men are involved in unsafe practices from food shopping to consumption. In our study [1], a knowledge, attitude and practice model applied by structural equation modeling showed significant correlations between consumers attitude and knowledge. The field observations made by the SafeConsume project in 5 EU countries (Norway, Portugal, France, UK and Romania) endorsed the model findings on proper food shopping attitude and home hygiene practices and urged for interventions to improve EU consumers' food safety practices. It is interesting to notice that consumers from one country can learn from consumers from another countries and contribute together to decreasing the incidence of foodborne diseases generated by the home environment.

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W-16

MODERN HEALTHY FOOD: LOCAL VS. GLOBAL, WHO IS THE WINNER?

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Modern food system is based on global food system. It is true for CEE region as well. Due to social and economical challenges in Europe, especially in Central and Eastern Europe, Balkans the importance of the local food has strengthened. This trend is further developed to local food as a result of the COVID 19 pan epidemic. These processes resulted in market development with associated diversification of local food production, intensification of intra-regional and international food trade, increase in incomes, welfare and sensible improvements in food diversity, food availability and nutrition. Over the last decades, food system became globally-connected, which resulted in reforms all over the world, as well as Central Europe. Through international organizations like FAO, WHO, EFSA new policies and targets were implemented, including the promotion of healthy diets, like low-fat and low sugar diets. However, despite the ever-growing globalization trends, the demand for regional and traditional food is also significant [1]. The innovation links to the trends and demand for healthy and functional food significantly increased across the world due to the COVID-19 pandemic. Other food trends like flexitarian diet, home cooking and plant-based proteins have strengthened, and the importance of local foods has increased. Sustainable packaging and more informative labelling regarding the environment and nutrition becoming more important. Sustainable process chains from locally sourced ingredients to zero waste manufacturing processes got into the focus and became one of the key innovation factors lately. Besides the growing environment consciousness, health and pleasure are the two leading drives of food innovation in Europe. The new trends and new challenges local vs global food systems will be highlighted in the presentation, which give a basis for the further discussion in the workshop.

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W-17

HEALTHY FOOD – HOW TO MEASURE? TO DETECT? TO PROVE?

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The tendency of modern nutrition is turned to "healthy food" determines today the style of life around the world. At first glance, one may say that healthy food is a simple subject still; it is a rather deceptive illusion. To get a sufficient definition for "healthy food" we need to accept the whole complexity, using the comprehensive approach for its investigation. From the consumer's point of view, rather it is the food you can trust, at the same time; it should be tasty, relatively cheap and easily recognized. The young generation will be additionally oriented on "innovative" food/ drinks with attractive "functional" properties. From a scientific point of view, it might be food (plant and animal origin) of safe vegetation and growing conditions providing "healthy" antibiotics-hormones-xenobiotics-free row materials, adequately prepared, packed, transported and preserved. These connected stages of food preparation are opening the "Pandora's box" on the way to achieving high-quality food thus to choose correct and pragmatic methods of its determining is very important. The measurement should be precise and adequate (Raman or Atomic absorption spectroscopy, HPLC, genetic, qRT-PCR (GMO issue and fraud prevention) or immune markers (disease detection). Biological active compounds and other sensitive molecules can be detected with specific techniques based on EU protocols. Their application is dependent of the food type and matter of detection. Application of combined analytical approaches in well-developed countries (Denmark, Belgium, France) allowed to regularly complete their national food composition databases (DB) electronically available at FAO and EuroFIR recourses for different foods and drinks. This DB's missing part is the proven health impact of various food ingredients like antioxidants, anti-inflammation, anti-aggregation, and other healthy properties. The quality of food is influenced by environmental changes, pollution differences in geographical regions and other contaminants that can be detected by GIS. Then finally, we are faced to the final challenge – individual needs and personalized nutrition that can be calculated via AI and MI tools.

FLASH PRESENTATIONS – YOUNG RESEARCHERS


IRENA
VOVK


HOTEL
TERME

FP-1

HOW TO DETECT CONTAMINATION BY ANABOLIC-ANDROGENIC STEROIDS? FOCUS ON TAILOR-MADE MULTIDISCIPLINARY APPROACHES

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Anabolic-androgenic steroids (AAS) contamination of dietary supplements, drinking water, food sources or other environmental components is a concerning topic attracting attention worldwide. The main reasons are clear. AAS are highly biologically active and affect all mammals' hormonal regulation, including humans [1]. In addition to the intentional athletic misuse of AAS, which affects fair competition, another issue is an undeclared enrichment of dietary supplements with such substances. Their deliberate content in food of any type is a severe threat of criminal nature detected worldwide during disclosure of health problems, analytical research or random inspections. Therefore this is the topic we have dealt with [2]. To meet the current requirements for detecting AAS, a part of the scientific community aims to develop new, multidisciplinary tailor-made approaches. They aim to provide time- and cost-effective methods that can be used routinely and in the field [3]. In this work, we present current advances and trends in analytical methods based on antibodies, enzymes, aptamers, oligonucleotides [4], cells or their receptors, and last but not least, chemically designed artificial sensors [5,6].

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FP-2

EXPLORING THE USE OF SALT TOLERANT PLANTS AS SOURCES OF SUSTAINABLE FOOD ADDITIVES: FUNCTIONALIZATION OF YOGURTS WITH *CARPOBROTUS EDULIS* FRUIT EXTRACT

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Carpobrotus edulis L. (Hottentot-fig) is a salt-tolerant (halophyte) invasive species. The commercial use of invasive species is a strategy for their control and is already being used in different invasive organisms, including macroalgae [1]. Hottentot-fig fruits have a balanced nutritional profile, contain high levels of phenolics, and display antioxidant properties [2]. In this work, yogurts were functionalized with water, ethanol, and hydroethanolic extracts from Hottentot-fig fruit peels and evaluated for proximate composition, minerals, color, syneresis, water holding capacity, and antioxidant and anti-inflammatory properties, after preparation (t=0), and seven days of storage at 4°C (t=7). The functionalization of yogurts did not negatively affect physicochemical parameters or nutritional properties. Moreover, functionalized yogurts generally displayed a significantly higher antioxidant activity, when compared to control samples. Our results suggest that Hottentot-fig fruit peels could be used as a source of functional food additives to be used in the fortification of yogurts.

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FP-3

PSEUDOMONAS SPP. – IS IT REALLY JUST SPOILAGE?

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Food spoilage is a major economic burden for the food industry. In addition to the way food is handled, microbiological contamination contributes significantly to the spoilage of perishable foods. Among food spoilage microorganisms, *Pseudomonas* spp. are very widespread and responsible for spoilage of food of animal and plant origin due to their diverse metabolic activity [1]. *Pseudomonas* spp. cause food spoilage through their high and diverse enzymatic activity and the formation of pigments [2] – both of which lead to sensory changes in the food. These properties are even more pronounced in biofilm and at the same time strongly depend on the ambient temperature. We have shown that increase from refrigeration temperature significantly increases the activity of *Pseudomonas* and accelerate food spoilage [3]. But, do all these *Pseudomonas* activities really cause 'only' food spoilage? Food degradation by hydrolytic enzymes also provides nutrients for other bacteria present – even potentially pathogenic. The *Pseudomonas* biofilm provides good protection, better survival, and further contamination with less resistant bacteria in the food industry [4]. Thus, *Pseudomonas* play an important role in the interaction with other microorganisms in food-related environments and their control is important not only from the point of view of reducing spoilage but also controlling of pathogenic bacteria. However, *Pseudomonas* could also pose a direct health risk, as isolates from spoiled fish meat have been shown to grow at 37 °C and produce virulent factors [3]. Therefore, in order to understand the basic mechanisms behind this and to evaluate their potential negative impact on human health, it is crucial to deepen research on spoilage-associated *Pseudomonas*.

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FP-4

THE EFFECT OF MICROWAVE- AND ULTRASOUND-ASSISTED EXTRACTIONS ON THE ANTIOXIDANT POTENTIAL OF SELECTED SEAWEEDS FROM THE ADRIATIC SEA

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Seaweeds are a wide group of marine organisms that produce phytochemicals as a response to the harsh environment they live and grow in. These phytochemicals have shown various biological activities such as antioxidant, antibacterial, antiviral, antitumor, immunomodulatory, antidiabetic, and others. Among bioactive compounds, seaweed phenolics, a group ranging from simple to highly complex compounds that have an aromatic benzene ring and one or more hydroxyl groups, have shown very promising antioxidant potential. This study aimed to determine the phenolic contents and antioxidant activities of brown (*Colpomenia sinuosa* and *Dictyota dichotoma*), red (*Asparagopsis taxiformis* and *Jania rubens*) and green (*Codium fragile* and *Flabellia petiolata*) seaweeds harvested from the Adriatic Sea. Besides, the two novel green extraction methods, ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE), were tested to determine the extraction effect on the antioxidant activity of the seaweed extracts. Three different assays, ferric reducing/antioxidant power (FRAP), 2,2-diphenyl-1-picrylhydrazyl radical scavenging ability (DPPH), and oxygen radical absorbance capacity (ORAC) were used to determine the antioxidant potential of seaweed extracts. The TPC of extracts ranged from 119,17 to 688,89 mg gallic acid equivalents per liter of extract (GAE/L). The highest antioxidant activity measured by DPPH was found in *C. sinuosa*, while *D. dichotoma* had the highest FRAP and ORAC values. The highest TPC and antioxidant activity were found for brown seaweeds when compared to the tested red and green seaweeds. Brown seaweeds' extracts appear to be more promising for further studies and applications regarding their antioxidant potential.

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FP-5

RELATIONSHIP BETWEEN SALT CONSUMPTION, MEASURED BY 24-HOUR URINE COLLECTION, AND SALT-RELATED KNOWLEDGE AND BEHAVIOUR IN YOUNG ADULTS

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High salt intake is associated with hypertension and cardiovascular disease risk, yet salt intake remains well above recommendations. A specific group of young adults, namely students of Biotechnical faculty are supposed to be better educated on adequate nutrition, which includes also salt intake. The aim of this study was to determine salt intake using a 24-hour urine collection in a random sample of 50 students aged 24±4 years and correlate it with their knowledge and behaviour. The 24-hour urine was collected twice in one month according to a standard protocol. Volume and creatinine content were exclusion criteria to ensure completeness of urine collections. Blood pressure was measured twice after each urine collection, and participants also completed a questionnaire on salt-related knowledge, discretionary salt consumption, and salt-related dietary behaviours. Mean sodium levels in both urine samples and questionnaire results were included in the analysis. Based on 24-h urine sodium excretion, 80 % of students consumed more salt than recommended. The average salt intake (7.8 ±3.0 g/d) is statistically significantly higher ($p < 0.05$) than the recommended daily intake. 22% of the students have hypertension, and all of them consume salt above the recommendation. There is a statistically significant difference ($p < 0.05$) in the frequency of adding salt at the table between the group of students consuming salt above recommendations and adding salt more frequently and the group with salt intake within recommendations. When self-assessing their salt consumption, 45 % reported eating too much salt, while the rest rated their salt consumption as "just right." In total, 84% of the students believe that too much salt is harmful to their health, and 77 % know the recommended level for daily salt intake. The salt intake of a random sample of students of Biotechnical Faculty exceeds the population nutrient intake target of 5 g recommended by WHO, although the average intake is significantly lower than the last reported intake of the population in Slovenia in 2010. Students are aware of the importance of salt reduction, but there are opportunities to lower their intake through diet.

POSTERS

P-1

SAFECONSUME – A PROJECT TO SHOWCASE SOLUTIONS FOR FOOD SAFETY

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SafeConsume is built on the hypothesis that in the retail-to-consumption part of the food chain, consumer behavior is both a core problem and solution. To move towards a situation with a lower health burden from foodborne illnesses, all actors and elements that affect consumer behavior and subsequent risk were considered. To understand consumer behavior, a holistic methodology based on Theory of Practices was applied then, to aid the transformation of scientific results into consumer-driven innovative solutions, the principles of Design-Driven-Innovation were integrated with microbial risk assessment. SafeConsume targeted the top five foodborne hazards in Europe (*Salmonella enterica*, *Campylobacter* spp., *Toxoplasma gondii*, norovirus, *Listeria monocytogenes*), which account for about 70% of the health burden related to food-borne illness. To help consumers mitigate risk and reduce the health burden from food-borne illness in Europe, SafeConsume suggested: (1) Tools, technologies, and products (e.g. hygiene concepts, kitchen utensils, and equipment) that stimulate safe practices; (2) Communication strategies that effectively stimulate adoption and market uptake of safer practices and tools/technologies; (3) Education programs to increase skills and knowledge aiding teenagers to handle food safely. The range of free teaching resources developed is available at https://e-bug.eu/. A research game to learn simple steps to safer food handling is available on Android and IOS in ten languages (https://www.scienceathome.org/games/); (4) Dynamic, sustainable and inclusive policy models that stimulate and support national and EU level initiatives. When promoting the new tools, products, and strategies, SafeConsume took into account their impact on risk reduction and documented consumer barriers for change and sustainability as it supports the transformation towards a more healthy population and cost-efficacy by reducing foodborne illness, and a more sustainable community by less food-waste and environmentally friendly solutions.

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P-2

PRESENTATION OF ERASMUS FITNESS PROJECT

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The project (FitNESS 2, 2021-1-FR01-KA220-HED-000023509, from 01/11/2021 to 31/10/2024) relies on creating up-to-date content on food packaging topics with mutual recognition between countries, universities, and prominent research and technological institutions. The material is available on a cloneable platform, FitNESS, https://fitness.agroparistech.fr which has been developed within the project FitNESS version 1, “Food packaging open courseware for higher education and staff of companies” (ERASMUS Programme, contract 2017-1-FR01-KA202-037441). The platform already proposes three months of free teaching and training and was beneficial to maintain the continuity of teaching during the first stage of the COVID-19 outbreak not only for the partners of the project (~800 students, ~150 professionals) but also for external students and trainees (>1500 external trainees from 62 countries used the platform). FitNESS 2 is intended to be more inclusive: specialized content adapted and compiled to the needs of learners. It is designed for blended and flipped learning. For learners outside training programs, an artificial intelligence (AI) will assist the learner in choosing content and priorities based on preferences, test results, or on a preselection of hot topics. For teachers, new content and test generators will facilitate the design and the forking of personalized curricula, the anonymous management of results, and the edition of professional certificates. Project goals are: (1) Academic and professional certifications; (2) Supporting the development of science-based content in an attractive and innovative format; (3) Scaling-up and disseminating FitNESS 2.0 beyond partnering universities and conventional industries; encouraging external contributions, providing assistance with an AI and an online forum.

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P-3

PROMOTING INNOVATION OF FERMENTED FOODS (PIMENTO) - COST ACTION CA20128

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Present in all European diets, fermented foods (FF) hold a strategic place due to the benefits they offer in terms of nutrition, sustainability, innovation, cultural heritage and consumer interest. The potential of FF for improving human health but also driving food innovation and local production in the next decades has become highly relevant. Here, we present the activities of PIMENTO project, a COST Action CA20128 (Promoting Innovation of ferMENTed fOods; https://fermentedfoods.eu/), which started in November 2021 and is supported by COST (European Cooperation in Science and Technology; www.cost.eu). It is conceived to face the challenge to federate the scientific community and key stakeholders working on FF. The aim is to collectively advance scientific evidence of their health benefits, building a benefits/risk approach in order to promote multi-modal innovation and respond to the expectations of European communities. The long-term goal of PIMENTO is to place Europe at the spearhead of innovation on microbial foods, promoting health, regional diversity, local production at different scales, contributing to economical and societal development as well as food sovereignty. The wide variety of stakeholders engaged will enable PIMENTO: i) to map the production and consumption of FF across Europe; ii) to tightly connect and clarify scientific knowledge on health aspects of FF iii) to tackle technical, societal and legislative bottlenecks behind FF-based innovations; iv) to contribute to the establishment of long-term scientific workplaces; v) to disseminate widely define scientific knowledge on FF and define strategic roadmap for future joint research. We invite industrial stakeholders to collaborate: i) subscribing the newsletter, following social media and filling the questionnaire and/or ii) joining the WG4 and help with the creation of an industry cluster on FFs. Please contact: WG4@fermentedfoods.eu.

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P-4

RESISTOMES OF PROBIOTIC AND STARTER CULTURES – PROJECT PRESENTATION

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The recently completed three-year project "Resistomes of probiotic and starter cultures as potential risk factors for the spread of antibiotic resistance" (supported by Slovenian Research Agency, J4-1769) was carried out in collaboration of Biotechnical faculty with Veterinary Faculty (both University of Ljubljana), National Laboratory of Health, Environment and Food, and Faculty of Medicine (University of Maribor). The project addressed the problem of increasing antibiotic resistance (AR) along the food chain, which is a consequence of the intensive use of antimicrobials in human and veterinary medicine in the last 50 years. The fact that commensal bacteria in food may also represent a reservoir of AR genes (ARG) attracted the attention of scientists years ago, but until recently, no powerful molecular methods and technologies were available to reveal whole bacterial genomes and microbiomes of complex samples, including the "resistome" - a collection of all AR genes present in a given environment. The proposed study focused on the bacterial representatives of starter cultures and probiotics intentionally added to the food chain. Phenotypic susceptibility testing (474 strains) and comparative genomic analysis of multiple whole genome sequences (WGS) were used to identify ARGs, mutations, and mobile elements in silico and to determine the matching of in silico AR predictions with phenotypic detection results. ARGs, most common for tetracycline, were detected in 13.8% of strains isolated from starter, protective or probiotic cultures. However, ARGs and mobile genetic elements were not as common as in strains from human intestinal mucosa/faeces. In addition, selected food samples were analysed by metagenomic sequencing. Starter cultures, probiotics, and dairy products produced with starter cultures were less rich in ARGs compared to dairy products made from raw milk without starter cultures. The approach presented in this study allows efficient detection of ARGs in various food-associated resistomes and better assessment of the risk of ARG transmission along the food chain.

P-5

SUSTAINABLE DEVELOPMENT OF TAILOR-MADE FOODS – A NEW WAY FOR UNIVERSITIES COOPERATION

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Tailor-made foods (TMF) are systems with special composition prepared by different methods and with well-known mechanisms of action of the bioactive components [1, 2]. The growing interest in this type of food is the basis for the creation of sustainable partnerships between three European universities Uniersity of Food Technologies, University Lyon 1, University of Zaragoza. The TaiMFoods project [3], aims at increasing the scientific potential of the teams involved in the project in the following areas: 1.) Mechanism of biological activity of biomolecules [4] and microorganisms [5] in the development of TMF; 2.) Development of new TMF by applying raw materials and components with increased nutritional and biological values [1] and investigation of new processing methods (emerging technologies, biomolecules, microorganisms, and their combinations based on hurdle technology) for increasing food safety and shelf life of TMF [6]; 3.) Methods for analysis of the distribution and activity of biomolecules and microorganisms in food matrices [7]. The present publication presents data on how to achieve a synergistic effect and ensure the functional nature of the developed TMF using the listed methods.

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P-6

COMPARISON OF THE ORGANIZATION AND QUALITY OF NUTRITION IN KINDERGARTENS IN BOSNIA AND HERZEGOVINA AND SLOVENIA (KOKIV)

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Adequate nutrition during childhood is essential to ensure optimum health, growth and intellectual development of children, as well as for the prevention of some health problems and nutrition-related chronic diseases in adulthood. The kindergarten environment is a place where children spend a lot of time most days of the week, and they should be provided with healthy meals and healthy choices. Meals should be prepared in accordance with the nutritional and energy needs of children, depending on age, gender and physical activity. For a healthy diet and a healthy growth and development of children, a supportive environment is also needed: optimal hygiene and sanitary conditions, the absence of unhealthy food advertising and regular monitoring of children development. Nutrition in kindergartens in BiH has been managed and organized by cooks or economists, but not professional staff because there was no education in this field until recently. In recent years, BiH has been actively reviewing nutrition policy and standards (HACCP) in kindergartens, which would ensure nutritionally adequate and safe food.
In Slovenia, diet in educational institutions is regulated by law. In planning and preparing meals in kindergartens, professional staff follows the dietary guidelines in educational institutions. The guidelines combine professional and practical guidance and include the educational aspect related to nutrition and the public health aspect. Within the frames of the organized system of kindergarten diet, up to four meals per day are available to children in kindergarten, which provide 70-80 % of daily energy intake. Bilateral project (2021-2023) is designed to analyse and compare the organization and nutritional quality of the daily meals and to gain knowledge about mentioned issue in kindergartens in capital cities of both countries. The obtained results will provide the basis for further research and for possible cooperation between researchers on the project and interested educational institutions in the two countries.

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P-7

NEW MANAGEMENT PRACTICES FOR MITIGATING ABIOTIC AND BIOTIC STRESSES IN MAIZE UNDER CHANGING CLIMATE CONDITIONS

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Maize is the second most important crop in the world, with a global production of more than 1 billion tonnes from 188 million hectares in 2016. In Slovenia almost 40% of arable land is used for crop rotated maize, which is mainly used as animal feed. Various biotic and abiotic stresses affect all stages of corn development and threaten optimum productivity. Integrated management practices aim to mitigate these stresses with minimal use externally applied pesticides, nutrients or water, while retaining current yields or if possible increasing them. The main goal of this project is to introduce new management practices for mitigating selected abiotic and biotic stressors in maize. The ambition of this project is a general reduction of chemical pesticide use without adverse effects on crop yields and agro-economy. In order to achieve the project goals, research is performed in four work packages. A set of functional DNA markers, which are associated with agronomic, quality and abiotic stress traits, was established. The abiotic stress related DNA markers were utilized for the screening and selection of maize varieties, which were used in further experiments. Selected beneficial microorganisms were tested in order to ascertain their effect on plant health and yield. Furthermore, their effects on the western corn rootworm *Diabrotica virgifera* and tropical root knot nematode species *Meloidogyne luci* were also tested. Remote sensing methods using various sensors on different platforms (ground-based, unmanned aerial vehicle, airborne and satellite) were implemented for early detection of pest infestations in open fields and glasshouses.

Acknowledgements
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P-8

A EUROPEAN ACTION ON WHOLE GRAIN PARTNERSHIPS (WHOLEUGRAIN)

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Project WholEUGrain was launched in November 2019 in collaboration with project partners from four countries (Denmark, Romania, Slovenia, Bosnia and Herzegovina). The project will last until October 2022 and is receiving funding from the European Union's 3rd Health Programme. The main aim of WholEUGrain project is to facilitate and get some experiences in transfer of the Danish best practice model for a Whole Grain Partnership (WGP) to other countries, mainly the countries involved in the project – but also by involving other countries and stakeholders, aimed to increase the whole grain consumption among consumers. Overall objectives of WholEUGrain are to promote a good health status through healthy diets, prevent noncommunicable diseases, reduce inequalities regarding the access to healthy food and establish supportive environments for healthy lifestyles by developing country-based whole grain public/private partnerships.

P-9

SMART WINE CLIMATE CABINET

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HGE is a leading global provider of household appliances. The fastest growing market segment are connected household appliances which represent almost 10% of the European market. Connected appliances will dramatically change people's lives and everyday habits, including food preparation and food storage. In the recent year HGE launched unique wine cooler. Detailed market research, benchmark studies, focused on target markets China, Australia, USA, Russia and Europe and user's insights provided guidelines for development of 3-zone Smart Wine Climate Cabinet targeting the most demanding users in the field; professionals and wine lovers, positioned in high-end price range. To achieve the best user experience, development focused on smart technologies – smart sensors, innovative algorithms, intuitive functions, connectivity as well as user friendly design and high-end appearance. Priority was to provide safe environment for storing, aging and serving wine. We have developed the concept of 3 separately regulated temperature zones supported with sensor system to monitor humidity and vibrations. We have applied the 3-layered glass door to protect the wines from UV light and channeled the inflow of fresh air through a carbon filter to ensure interior without unpleasant odors. The most innovative feature is connection to the world's largest wine data base Vivino via smart APP. Together with bottle labels recognition camera user can manage stocks and track his wine collection. User can monitor and control the appliance through user interface with TFT direct touch screen or with smart APP on the phone or tablet. Both are offering a wide range of useful contents. Among others, adjusting the intensity and warmth of the functional illumination in all 3 zones and the ambient illumination in a wide color spectrum in serving zone. Flexible and fully utilized layout offers 2 options - with serving zone or full storage layout. The wooden shelves are equipped with full-extension guides for easier access and soft close mechanism to prevent vibrations. Design follows Scandinavian design approaches with clean lines, use of true, natural and quality materials with precise detailing.

P-10

AGRO-INDUSTRIAL WASTE AS A SOURCE OF BIOACTIVE COMPOUNDS: VALORIZATION OF RASPBERRY FRUIT POMACE BY ULTRASOUND-ASSISTED EXTRACTION

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The reprocessing of waste streams from the agri-food sector is crucial in the value chain of this industry. Large quantities of raspberry fruit loss and wastage occur during juice processing, which may account for up to 20% of the initial fruit weight [1]. Raspberry fruit pomace (RFP), which consists of the pulp/peel and the seeds, has been recognized as a rich source of bioactive ingredients, especially anthocyanins and ellagitannins, with documented biological activities such as antioxidant, antiproliferative and proapoptotic [2,3]. An important step in the use of fruit pomace for the production and supplementation of food and non-food-based products is the extraction process. In order to achieve maximal exploitation of the raw material and obtain high quality extracts from RFP, ultrasound-assisted extraction (UAE) using ultrasonic probe was applied. Conventional solid-liquid extractions (SLE) with 30, 50 and 70% ethanol were performed for 24h in order to select the solvent with the highest efficiency. UAE process was performed with selected solvent (30% ethanol) during 2 min and by varying the sonication amplitude (20-100%). Changes in temperature, energy consumption, and ultrasonic power were observed. After determining the content of total phenols, it was found that UAE had higher efficiency in comparison to SLE, being the highest with sonication of 100% amplitude (266.48±42.19 mg GAE/g DE). The crucial parameter was extraction time, being considerably shorter with the UAE process. In terms of biowaste valorization, RFP has promising industrial potential and may prove to be useful in the development of functional food and dietary supplements.

Acknowledgments
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P-11

GREEN EXTRACTION AND HPLC-ESI-TOF-MS CHARACTERIZATION OF SWEET CHERRY BY-PRODUCT

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Recent trends in extraction technologies have focused on the development of efficient and economical exploitation of natural resources. Pressurized hot water extraction (PHWE) is a versatile extraction technique for the recovery of natural compounds with health promoting properties from various plants and biomaterials. Based on scientific evidence, there is a great potential for valorization of sweet cherry (Prunus avium L.) stems [1,2]. Up to date, key activity-determining constituents of sweet cherry stems have not been completely elucidated. Herein, PHWE was applied for the recovery of phytochemicals from cherry stems. Different extraction conditions were tested, and the PHWE extracts were characterized. The extraction conditions that provided the highest total phenol content in the extracts included extraction temperature of 80oC and pressure of 40 bar during 30 min. A method based on high performance liquid chromatography-mass spectrometry (HPLC-ESI-TOF-MS) was developed to qualitatively characterize natural bioactive compounds in sweet cherry stem extracts obtained by PHWE allowing identification of new compounds reported for the first time. The main compounds detected in the extracts were identified as phenolic acids and derivatives (such as gallic acid, protocatechuic acid glucoside, dihydro p-coumaric acid), flavonoids and their derivatives (such as rutin, naringenin, naringenin-O-glucoside), and fatty acids (trihydroxy-octadecanoic and trihydroxy-octadecenoic acid). According to the results, PHWE has a great potential in exploitation of natural sources of bioactive compounds and application in food and pharmaceutical industry.

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P-12

INVESTIGATION OF THE POSSIBILITY OF *LISTERIA MONOCYTOGENES* GROWTH IN NITRITE-FREE FRANKFURTERS

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Listeria monocytogenes is a Gram positive pathogenic bacteria. It is a cause of listeriosis which is characterized by a high mortality [1]. The bacteria can grow under refrigerated conditions in contaminated after thermal treatment ready-to-eat meat products during storage [2]. The European Commission set limits for *L. monocytogenes* numbers in food individually for products in which it can and cannot grow [3]. To determine a growth potential of *L. monocytogenes* a challenge test should be conducted. This applies to freshly introduced food products such as sausages produced without traditional nitrite curing. Therefore, the aim of the study was to investigate the possibility of *L. monocytogenes* growth in frankfurters produced without the nitrite addition. The frankfurters produced without the use of nitrite addition were inoculated with a mix of three *Listeria monocytogenes* strains (0.1 mL on the surface of each sausage with the mixture containing 6.0 CFU/mL). Products were vacuum packed and stored for 10 days at 6℃ and sampled using ALOA media (Merck). A growth potential (δ) was calculated using the equation: $\delta = \log_{10}$ CFU/g at the end of the test – $\log_{10}$ CFU/g at the beginning of the test. The frankfurters showed a relatively high value of growth potential ($\delta = 0.63$), which indicates that there is a possibility of the pathogen growth on the surface of nitrite-fee products. The δ value higher than 0.5 $\log_{10}$ CFU/g obliges the producer to classify the product as that in which the growth of *L. monocytogenes* is possible.

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P-13

INFLUENCE OF MUSCLE TYPE AND MARINATING ON COOKING LOSS, SHEAR FORCE AND SENSORY QUALITY OF SOUS - VIDE BEEF FROM HOLSTEIN-FRIESIAN BULLS

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Consumers expect tender and juicy beef products with an attractive taste. One of the possible ways to make meat more attractive and increase its quality is marinating [1, 2], therefore the aim of the work was to look for an answer to the question - does marinating applied to two different muscles give the same quality effect in the final product? The experimental materials comprised of longissimus lumborum and semimembranosus muscles obtained from the carcasses of Polish Holstein-Friesian bulls. 2.5-cm thick steaks weighing approx. 200 g were marinated using two marinades, which contained vegetable oil with the addition of pepper, garlic (M1) and additionally red pepper (M2). After 24-hour marinating under refrigerated conditions (4°C), marinated and unmarinated samples (C) were subjected to sous-vide treatment at 60°C for 4 hours. Then the samples were cooled and analyzed in terms of cooking loss, Warner-Bratzler shear force (WBSF - load 500 N, head speed 200 mm/min, Instron 5942) and sensory attributes (structured scale - color, juiciness, tenderness and taste) [3]. A significant effect of marinating ($p < 0.001$) on all parameters tested was found. The type of muscle affected cooking loss ($p < 0.001$) in all tested M1, M2 and C samples, and WBSF ($p < 0.05$), tenderness (0.001) and taste ($p < 0.05$) but only in non-marinated samples. It was shown that marinating resulted in the equalization of sensory quality in longissimus lumborum and semimembranosus muscles, and made the muscles similar in juiciness, tenderness and taste after sous-vide treatment

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P-14

DEVELOPMENT OF A THREE-COMPONENT MIXTURE OF MALTS FOR THE PRODUCTION OF BEER AND WORT-BASED BEVERAGES WITH INCREASED BIOLOGICAL POTENTIAL

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Different malt types used in beer production are responsible not only for beer taste and aroma, but also for its biological value. In our previous research [1] the main brewing and biological (phenolic compounds and antioxidant capacity) characteristics of 20 malt types, which are used in the brewing industry in Bulgaria, were studied. The aim of the present work is the modeling of a three-component mixture of malts (Pilsner, Caramel Munnich type 2 and Vienna), in order to obtain wort with increased biological value. For this purpose, the method for mixtures modelling [1, 2] was used, as the target functions were wort phenolic compounds, determined by Folin–Ciocalteu method and modified Glories method, and wort antioxidant potential, determined by DPPH radical scavenging assay and ferric reducing antioxidant power - FRAP. The proportions of the three malts were determined after ANOVA of the results obtained, in order to guarantee the maximum biological value of the wort. The model was optimized in order to minimize the phenolic compounds content and maximize the antioxidant potential of wort produced and the following composition of the mixture was obtained – 60% Pilsner, 20% Caramel Munnich type 2, and 20% Vienna.

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P-15

PRODUCTION OF LACTIC ACID WORT-BASED BEVERAGES WITH MINT ESSENTIAL OIL ADDITION IN STIRRED BIOREACTOR

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Although their health benefits, lactic acid wort-based beverages are not well accepted by consumers because of their poor sensory characteristics. Therefore, 0.025 and 0.05 % (v/v) mint (*Mentha piperita*) essential oil was added to wort, produced by 60% Pilsen malt, 20% Vienna malt, and 20% Caramel Munich II malt and inoculated with probiotic lactic acid bacteria *Lacticaseibacillus rhamnosus* (*Lactobacillus casei* ssp. *rhamnosus*) LBRC11 at a concentration of 10^7 cells/mL. The fermentation was carried out at 25°C in a stirred bioreactor without aeration. Mint essential oil inhibited lactic acid fermentation but all the beverages produced can be classified as functional. The addition of mint essential oil in concentration 0.05 % (v/v) led to the highest total phenolic compounds concentration, measured by Folin–Ciocalteu and modified Glories method and antioxidant activities, measured by cupric reducing antioxidant power (CUPRAC) and ferric reducing antioxidant power (FRAP). The highest concentration of phenolic acids, flavonoid phenolic compounds and antioxidant activity against the DPPH radical showed the reference sample. The antioxidant activity measured by the ABTS radical scavenging assay was almost equal for the beverages with mint essential oil addition. The tasting panel preferred the reference sample, followed by the beverage with 0.025% (v/v) mint essential oil addition. The results obtained will be used for modeling of lactic acids fermentation with addition of mint essential oil for the production of functional wort-based beverages.

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P-16

ORPHANED CRAMBE SPECIES AS POTENTIAL FOOD CROPS

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Crambe L. genus is one of the most numerous in the Brassicaceae family that is now mainly known and used as an industrial crop due to high oil content in seeds. Only *Crambe hispanica* subs. *abyssinica* is commonly used for this purpose, while other species remain forgotten [1]. Respectively, orphaned species are now considered as useful material for crop diversification. Among wide variety of *Crambe* species there are several species that have long history of being used as food: sea kale (*C. maritima*), giant colewort (*C. cordifolia*), tartar bread plant (*C. tataria*). Sea kale has the longest history of cultivation grown commercially during the 19-20th centuries in UK and France for consumption similarly to asparagus (young sprouts), broccoli (young inflorescences) or spinach (fresh green leaves after blanching). Chemical composition of *Crambe* plants is quite beneficial for human health and has dietary potential. Green mass is low in calories and nitrate content and, at the same time, it has high protein and fiber content with high levels of potassium and low levels of sodium, as well as good calcium/phosphorus ratio. Leaves also have high content such vitamins as B1 and C. *Crambe* green mass is rich in omega-3 (linolenic acid) and omega-6 (linoleic acid) fatty acids. Plants have shown antioxidant, antimicrobial and hemolytic activities, and also contained neohesperidin, rutin with chlorogenic, ferulic, caffeic, p-coumaric, syringic, sinapic, cinnamic, hydroxyphenyl acetic and quinic acids. It should be mentioned that glucosinolates are present in *Crambe* species as in most of the Brassicaceae. These compounds are responsible for a slightly bitter taste of green mass, can be harmful for human health, but after the leaves disruption they are released and undergo hydrolyzation by myrosinases to form isothiocyanates that are associated with cancer-protective effect. Taking into account good dietary characteristics orphaned *Crambe* species should be considered as an alternative vegetable with great potential.

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P-17

EFFECTS OF ULTRASOUND AND HYDROTHERMAL TREATMENT ON DIGESTIBLE AND BIOACTIVE PROPERTIES OF WHOLEGRAIN WHEAT FLOURS WITH DIFFERENT AMYLOSE CONTENT

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The consumption of wholegrain flours contributes to an increased intake of dietary fibers and phenolic compounds beneficial to human health. However, there are some downsides to wholegrain flours, such as poor baking performance and lower technological quality. The application of ultrasound and hydrothermal treatments may provide new possibilities for the modification and improvement of the baking- and bio-functionality of flours as well as the quality of baked goods [1]. Furthermore, waxy and high-amylose wheat varieties are considered novel raw materials due to their unique properties in bread making, such as improved bread texture and increased dietary fiber content [2]. The main focus of this study was to investigate the changes in enzymatic in vitro dry matter digestibility, antioxidant capacity, and the content of total free phenolic compounds before and after the individual treatments of the whole-wheat flours with different amylose content. Hydrothermal treatment positively influenced the digestibility of the whole-wheat flours, especially in waxy genotypes compared to high amylose ones, which can be explained by the formation of resistant starch. Ultrasound positively affected the total free phenolic compounds content. Moreover, the hydrothermal treatment had an overall negative effect on the antioxidant capacity. The amylose content was in high negative correlation with digestibility after hydrothermal treatment. Starch content was negatively correlated with digestibility after ultrasound treatment. Protein content was very strongly correlated to digestibility after ultrasound treatment. These findings can provide valuable guidelines in the formulation of new wholegrain wheat foods.

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P-18

OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF PHENOLIC AND ANTIOXIDANT COMPOUNDS FROM A RAPESEED MEAL ETHANOL-WASH POWDER

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Rapeseed meal ethanol-wash powder, which was obtained by washing 4-times the rapeseed meal with a 70% aqueous-ethanol solution, was previously characterized. Considering the presence of phenolic (TPC) and antioxidant (AOA) compounds, the aim of this work was to optimize their recovery by using ultrasound. The extraction of phenolic compounds was carried out with water at a ratio 1/50 (m/v) for 20 minutes. Then, ultrasound-assisted extraction (UAE) was performed. The independent variables studied have included the amplitude (10-35%) and time (2-8 min). The final extract was obtained and the TPC and AOA were assessed. A response surface methodology based in a Central Composite Face full factorial was conducted to optimize the extraction method. The experimental designs and statistical analyses were performed with Statgraphics® Centurion XIX. Both factors (amplitude and time) affect the extraction of phenolic compounds when applying UAE ($p<0.05$). The values of TPC and AOA were within 75.18 - 96.64 mgGAE/mL and 92.26 - 125.81 mgTE/mL, respectively, while the values without UAE were 79.25 mgGAE/mL and 99.28 mgTE/mL. Previous research reported the positive impact of the UAE on the bioactivity of some vegetable matrix [1]. The optimize TPC value (97.18 mgGAE/mL) was obtained with 10% of amplitude and 9 min while the optimum AOA value (147.09 mgTE/mL) with 15% of amplitude and 0.76 min.

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P-19

NUTRITIONAL CHARACTERISTICS AND GENETIC DIVERSITY OF TARAXACUM OFFICINALE L. ECOTYPES FROM DIFFERENT NATURAL HABITATS IN SLOVENIA

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Dandelion (*T. officinale* L.) has been consumed in various forms since ancient times as a valuable source of nutrients, minerals and vitamins [1]. It includes a group of sexual diploids and apomictic polyploids with a complicated reticulate development [2]. The leaves are eaten raw in salads and used along with the roots as a traditional medicine to alleviate and treat various diseases [3]. The aim of the study was to analyse the nutritional properties of leaves and roots of dandelion ecotypes sampled from ten natural habitats in Slovenia. Genetic variability was evaluated on eight individual plants from each habitat together with *T. officinale* standard from Ljubljana Botanical Garden and Cicoria di catalogna (*C. intybus* var. foliosum) as outgroup. For genotyping, a set of nine species-specific nSSR markers with different repeat motifs covering 2n, 3n, and/or 4n of the dandelion genome was used [2]. The following characteristics were determined in the dandelion samples: dry matter, protein, fat, macro- (Mg, P, S, K, Ca) and micro-elements (Na, V, Cr, Mn, Fe, Co, Cu, Zn, Mo). Here, Cicoria di catalogna was included in the analyses, since the appearance of its leaves strongly resembles that of dandelion. The results showed a high variability in determined parameters between different plant tissues (leaves vs. roots) and between different natural habitats. Genetic evaluation showed a high level of genetic diversity between genotypes within ecotypes sampled in different natural habitats. The Taraxacum plant could be an important player in the herbal medicine and/or nutraceutical industry in the future.

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P-20

NUTRITIONAL CHARACTERISTICS AND POTENTIAL CULINARY USE-VALUE OF LOCAL APPLE VARIETIES (*MALUS DOMESTICA* BORKH.) AND THEIR GENETIC BACKGROUND

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Cultivated apple (*Malus domestica* Borkh.) is a major crop of economic importance, both globally and regionally or locally [1]. Due to its excellent storability, apple fruits are available throughout the year and are highly valued for fresh consumption or as raw material for further processing [2,3]. The aim of the present study was to analyse nutritional parameters (e.g., fruit hardness, degree of oxidation, vitamin C content, total soluble solids) and to assess potential culinary use-value (dried apple slices, suitability for apple strudel) of 12 Slovenian local apple varieties (Ananasova reneta, Jonatan, Rdeči boskop, Majda, Beli zimski kalvil, Carjevič, Kanadska reneta, Šampanjska reneta, Bobovec, Goriška sevka, Navadni kosmač, Mošancelj). In addition, DNA markers were used for genotyping several pairs of local apple varieties where the problem of common origin in terms of varietal denominations (e.g., synonyms, homonyms) occurred. Significant differences were found between fruits of different varieties in the analysed nutritional parameters and the degree of oxidation after grating fresh apples. The varieties differed considerably also in their suitability for further processing, such as drying, and for the speciality food products, such as apple strudel. Knowledge of varietal differences in local apple varieties is important to growers and consumers because of the potential for producing higher value-added foods.

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P-21

REGULATING α-AMYLASE ACTIVITY IN WHOLE GRAIN RYE FLOUR

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One of several important enzymes in bread making is α-amylase because it is included in the breaking down of starch to provide an adequate supply of fermentable sugars and reduce dough's water-holding capacity, which significantly impacts the baking quality of bread. Although flour does contain some amylase, the level is typically too low to be of many benefits, which is why amylase is sometimes added to flour by the miller. In order to prevent fewer additives in the bakery industry, this paper presents a new food processing technology with supercritical CO_2, which presents a non-thermal treatment in which α-amylase enzyme activities can be regulated depending on pressure and time. Our study performed the experiments at 35 °C, so the temperature would not affect the flour quality. Green $scCO_2$ technology allows us to easily regulate the enzyme activity, which was detected using a UV-spectrophotometer by the dinitrosalicylic acid (DNS) method [1]. Also, a protein concentration was determined in whole grain rye flour protein extract by the Bradford method [2]. It was shown that the quality of flour exposed to $scCO_2$ does not change and thus retains the characteristics of untreated flour. It has even been proven that $scCO_2$-treated whole grain rye flour was appropriate for the bread baking process.

Acknowledgments
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P-22

DETERMINATION OF THE ANTIBACTERIAL ACTIVITY OF SELECTED FRUIT SPECIES

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The growing problem of common antibiotic drug resistance of pathogenic bacteria has led to an increased demand for natural antimicrobials, especially medicinal plants. Plants have been used as medicines for centuries and thus offer a source of biologically active substances that can be used as antimicrobial agents [1,2]. Different types of fruit contain important bioactive compounds that can kill and inhibit the growth of numerous pathogenic bacterial species. In addition to antimicrobial activity, fruits have many other positive and beneficial medicinal properties, especially antioxidant, anti-inflammatory, anti-allergic, anticancer, and antihypertensive properties [3]. The antibacterial efficacy of lyophilized flesh of selected fruit species, such as mango (*Mangifera indica*), plum (*Prunus domestica*), and cherry (*Prunus avium*), were determined. The inhibitory activity of samples was studied using a qualitative disk diffusion method on the growth of selected bacterial species, namely Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, and *Pseudomonas fluorescens*) and Gram-positive bacteria (*Bacillus cereus*, *Staphylococcus aureus*, and *Streptococcus pyogenes*). The inhibition efficiency was determined by the size of the diameter of the inhibition zone. The results showed that all tested samples possess good antibacterial properties against selected bacterial species. The largest diameters of the inhibition zone of bacterial growth were achieved with a sample obtained from cherries.

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P-23

MAGNETIC CROSS-LINKED ENZYME AGGREGATES FROM ENZYMES ISOLATED FROM *PLEUROTUS OSTREATUS* CULTIVATED ON DIFFERENT AGRICULTURAL WASTES

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Pleurotus ostreatus is the second largest cultivated mushroom commercially across the globe, mainly in Asia, but as well as in Europe due to its cheaper production technology and simple and high biological efficiency [1]. Following the principle of "zero waste economy", wastes and residues are used as raw materials for new products and reutilization of such lignocellulosic materials. Enzymes that are present, are involved in the ligninolytic process [2]. The growth medium for *P. ostreatus* consisted of a mixture of wheat bran and different vegetable waste materials. After 8 days of cultivation, enzymes were isolated from P. ostreatus and protein concentration and activity of cellulase and laccase was determined. The most favourable greowth medium for *P. ostreatus* with the highest production of these enzymes was wheat bran mixed with pear. Enzymes cellulase and laccase isolated from *P. ostreatus* were successfully immobilized into magnetic cross-linked enzyme aggregates (mCLEAs), using carboxymethyl dextran modified magnetic nanoparticles (CMD-MNPs).

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P-24

ANTIMICROBIAL POTENTIAL OF OREGANO, WINTER SAVORY AND FRENCH MARIGOLD ESSENTIAL OILS, IN VITRO AND ON A FRESH MEAT

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In recent years, various alternative methods for antimicrobial food protection have been researched and developed around the world due to the possible harmful effects of synthetic additives, higher microorganisms resistance, as well as consumer demands for food that is minimally technologically processed. For this purpose, natural antimicrobial compounds derived from plants, such as extracts, essential oils and their components, are being investigated [1,2]. Therefore, the aim of this work was to examine the antimicrobial effects of wild and greek oregano, winter savory and french marigold essential oils in vitro and on a fresh pork meat. In vitro assays were performed by microdilution method and the following microorganisms were tested: *Salmonella Typhimurium*, *Escherichia coli*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Bacillus cereus*, and *Candida albicans*. Major component of the wild oregano, greek oregano and winter savory essential oils was carvacrol, and of the french marigold essential oil was α-terpinolene. *C. albicans* was the most sensitive to the tested oils. In the case of bacteria, the lowest MIC value (0.45 µL/mL) had greek oregano essential oil against to *L. monocytogenes*, while the french marigold essential oil was the least effective against *S. Typhimurium* and *E. coli* (MIC value 56.82 µL/mL). A mixture of greek oregano and winter savory essential oils showed synergistic effects against *B. cereus*, *S. Typhimurium*, *S. aureus*, and *E. coli*, and was applied to the surface of fresh pork meat, the number of already present aerobic mesophilic bacteria and enterobacteria, was reduced.

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P-25

EFFECT OF PULSED ELECTRIC FIELD (PEF) TREATMENT ON STABILITY OF BIOACTIVE COMPOUNDS IN STRAWBERRY JUICES

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The effects of PEF technology on the content of anthocyanins (ANT), hydroxycinnamic acids (HCA) and flavonols (FL) in strawberry juices from the strawberry (*Fragaria x ananassa* Duch.) cultivar 'Albion' harvested at 75 % maturity (J1) and 100 % maturity (J2) and stored at +4 °C for 7 days were evaluated. The parameters of the PEF treatment were: (i) electric field strength (40 and 50 kV/cm), (ii) frequency (100 and 200 Hz), and (iii) treatment duration (3 and 6 min). All results were analyzed by multifactorial analysis of variance ($p \leq 0.05$). The untreated juice J2 had higher ANT, HCA and FL values than the untreated juice J1. After 7 days of storage at 4 °C, the control samples showed decreasing values of FL and increasing values of ANT and HCA. The treated juice samples of both maturity levels stored at 4 °C for seven days had significantly lower FL, while the values of ANT and HCA were significantly higher on the first day of storage. The electrical strength of 50 kV showed a statistically significant effect on the increase of ANT, HCA and FL content compared to the 40 kV strength. In contrast to the electrical strength, increasing the frequency from 100 Hz to 200 Hz resulted in a statistically significant decrease in ANT, HCA, and FL. Treatment duration did not show a statistically significant effect on ANT and HCA, with the exception of FL, where an increase in treatment duration resulted in a decrease in the levels of FL. PEF-treated J2 samples had significantly higher ANT, HCA and FL than J1. Regardless of maturity, storing treated samples at a temperature of 4 °C for seven days resulted in a statistically significant increase in ANT, HCA, and a decrease in FL. In general, it can be concluded that PEF technology positively affects the stability of ANT and HCA in strawberry juices during seven days of storage at 4 °C. Among the PEF process parameters, electric field strength and frequency had a statistically significant effect on the content of ANT, HCA and FL in the juices.

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BIOLOGICAL ACTIVITY OF STRAWBERRY TREE FRUIT

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The strawberry tree (*Arbutus unedo* L.) is one of the most common species with fleshy fruits in the Mediterranean region [1]. In local agricultural communities, the mealy and sweetish but not very aromatic fruits are mainly used for the production of jams, marmalades and alcoholic beverages. Also, the chemical composition indicates that the fruits are a good source of minerals and have high content of phenols and antioxidant capacity [2]. The aim of our work was to investigate the antioxidant and cytotoxic potential of *A. unedo* fruits on human squamous cell carcinoma cell line (CAL 27), human gastric adenocarcinoma cell line (AGS), colorectal adenocarcinoma cell line (Caco-2) and hepatocellular carcinoma cell line (HepG2). Furthermore, the DNA-protective effect and antimicrobial activity against *Escherichia coli* were investigated. A concentration range of 0.01-100 mg/mL was used in the experiments, with 1 mg/mL and 10 mg/mL being the recommended daily dose of polyphenols based on human blood volume and average human weight, respectively. Strawberry tree fruits at the recommended daily doses had a proliferative effect on AGS and CAL 27 cells without recovery and with 24-hour cell recovery, respectively. In CAL 27 cells, antioxidant activity was shown during 24-hour cell recovery. In Caco-2 and HepG2 cells, *A. unedo* fruit was shown to induce reactive oxygen species (ROS). The concentrations tested showed no antimicrobial activity against *E. coli*, but a dose-dependent protective effect on DNA was demonstrated. Additionally, further studies on individual bioactive compounds from strawberry tree fruit are needed to provide more detailed information on their potential use.

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P-27

CHARACTERIZATION OF *LIMOSILACTOBACILLUS FERMENTUM* MC1, THE EXOPOLYSACCHARIDE-PRODUCING STRAIN OF HUMAN MILK MICROBIOTA

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Lactic acid bacteria (LAB) produce a wide variety of exopolysaccharides (EPSs), high-molecular-mass carbohydrate polymers that are classified as homopolysaccharides or heteropolysaccharides, depending on the sugar composition. LAB-derived EPSs are used as texturizing agents in fermented dairy products. However, novel perspectives are emerging because of their potential functional properties such as protective effects on producer cells, immunomodulatory, anticancer or cholesterol-lowering effects in the host or prebiotic potential among the intestinal microbiota. Therefore, among the 100 bacterial strains isolated from human milk microbiota, we searched for EPS-producing LAB to further characterise their probiotic properties. Only MC1 strain, identified by 16S RNA sequencing as *Limosilactobacillus fermentum*, showed a ropy phenotype typical for EPS synthesis. Whole-genome analysis of the MC1 genome confirmed the identification, while functional annotation by RAST revealed the genes responsible for EPS production. EPSs were isolated from *L. fermentum* MC1 strain grown on MRS agar plates for 4 days at 30°C under anaerobic conditions, purified using affinity chromatography and subjected to 1D and 2D NMR spectroscopy for structural analysis. It was shown that MC1 strain produces EPSs that consist of two polysaccharides. The main polysaccharide is composed of β-1,6-linked galactofuranoses with α-glucopyranosyl branched on the second carbon of the main chain, while the determination of second polymer structure is still in progress. *L. fermentum* MC1 has shown ability to survive under simulated gastrointestinal tract (GIT) conditions. Adhesion of *L. fermentum* MC1 to the Caco-2 cell monolayer was confirmed by fluorescence microscopy, as well as the potential to reduce adhesion of *Escherichia coli* 3014 via competitive exclusion mechanism. Further studies will be directed towards the determination of EPS functions related to probiotic effects of MC1 strain.

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NUTRITION AND SPORTS NUTRITION KNOWLEDGE OF CROATIAN YOUNG ELITE SWIMMERS

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Sports nutrition education is necessary for sports nutrition specific principles understanding important for achieving better sports performance, good recovery and avoiding illness and injury. Young athletes are particularly susceptible because of their specific needs while additional sports activities require proper nutrition. The assessment of nutrition knowledge (NK) and sports nutrition knowledge (SNK) of Croatian young elite swimmers was the study aim. A cross-sectional descriptive study among 16 Croatian young elite swimmers (mean age 18 years) assessed actual and self-perceived NK, attitudes, and information sources. They self-filled online a 60-item general NK and 10-item SNK questionnaire [1]. A total score was 70 points, where a score ≥ 50 points meant adequate NK and SNK knowledge. Mean NK and SNK were 38.9 points, and only 38% of swimmers had adequate knowledge ($p<0.001$). Mean general NK was 32.2 and SNK 3.3 points. Slightly more swimmers had adequate SNK than general NK (44% vs 38%, $p=0.718$). Swimmers scored proper nutrition as more important for better sports performance than taking dietary and sports supplements (68 vs 51 points, $p=0.001$). They significantly higher scored a nutritionist (88%) as the most important for counselling on nutrition and dietary supplements, followed by a sports doctor (81%) and a coach (63%)($p<0.001$). Two-fifths of swimmers (44%) considered searching the Internet a more important source of information about nutrition and dietary supplements than reading scientific literature (31%, $p=0.413$). Although conducted among a small number of participants, there isn't a similar Croatian study so far. It identified inadequate nutrition and sports nutrition knowledge among Croatian young elite swimmers. It is necessary to provide evidence-based nutrition education to all athletes, for better health and sports performance that focused not only on proper nutrition but also on dietary and sports supplements.

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P-29

THE MOST COMMON REASONS FOR CHOOSING AN ENERGY DRINK AMONG CROATIAN UNIVERSITY STUDENTS

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Public health risk of increased caffeinated energy drinks (ED) consumption among young people arises from negative health effects, especially if drunk in combination with alcohol, meaning that these drinks are used for the wrong reasons, compared to what they are declared for. There is still little available data on this topic but showing that frequent ED consumers are more likely to have unfavourable dietary habits, including consumption of sugar-sweetened beverages and ultra-processed foods [1]. This study examined the most common reasons to choose an energy drink among university students in Croatia. The questionnaire on knowledge, attitudes and perceptions of ED consumption, physical activity and dietary habits was conducted among 350 students (average age 20 years; men 39%, women 61%) of all academic years at the University of Rijeka, Croatia, where 261 (75%) of them reported their most common reasons for choosing an ED. Almost half of all students (46% total, men 50%, women 43%) were frequent ED users, with an average daily intake of 79.49 ml. Frequent ED users were statistically more non-smokers (80% vs 62%, $p<0.01$), and more physically active (80% vs 51%, $p<0.01$) compared to non-users. Among 15 offered reasons for choosing an ED, the most common reason was liking the taste (36%), followed by mixing it with the alcoholic drink (32%), and alertness and concentration (31%), with no found statistical difference ($p=0.81$). An energy drink's taste and the effects when combining them with alcohol prevailed over the reason for choosing an energy drink for alertness and concentration effect, which means that young people mostly choose energy drinks for other reasons than what is declared. The public health authorities should discuss and provide a scientific opinion, and then implement a national program to raise awareness of the use of energy drinks, especially aimed at the young populations.

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CHARACTERIZATION OF MUFFINS REFORMULATED WITH CHIA AND LYOPHILIZED PEACH POWDER

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There is an increased interest of foods with added nutritional value [1]. This study presents the opportunity for the reformulation of muffins using chia seeds and lyophilized peach powder. Two new formulations were created eliminating the presence of eggs and altering the flour content and type. Physical characteristics, texture analysis, microbial profile, antioxidant potential, and sensory profile aided in the evaluation of the newly developed products. The results indicate an inversely proportional relationship between the relative weight of the dough, and physical parameters (density, volume, water absorption capacity, and height) for all muffin formulations. The addition of chia seeds and peach powder led to positive sensory changes. The alteration of the original recipe resulted in significant effect on the color, making the muffins darker and less yellow than the control sample. In terms of texture characteristics the new formulations had a profile closer to the control. The study concluded that a potential for the reformulations of muffins exists without deteriorating important quality attributes. Future reformulation could target the sugar content of the muffins.

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P-31

COMPARISON OF THE GROWTH OF DIATOM SKELETONEMA GREVILLEI IN A BIOREACTOR AND AN INCUBATION-SHAKING CABINET

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Diatoms have been recognized as an excellent source of various bioactive compounds with different applications in the pharma, food, and cosmetic industries. The big challenge in the exploitation of this microorganism is small biomass accumulation during the growth. To increase biomass production, it is important to establish optimal growing conditions that will ensure the highest yield in the shortest time period. The aim of this investigation was to compare the growth rate of diatom *S. grevillei* in two systems: i) bioreactor; ii) incubation-shaking cabinet, and to determine the growth curves in the systems. Firstly, 50 mL of inoculum (same cell density) was added to the volume of 2 liters of F/2 medium. Inoculated cultures were incubated for 13 days at 17°C. The growth was monitored in regular time intervals in each system using both the Sedgwick Rafter method and the flow cytometry method. In the first growth phase, the lag phase, the results of flow cytometry in both culturing systems gave similar results to the Sedgwick Rafter method. The largest deviations between these two methods were observed in the exponential growth phase for both systems. Finally, during the last two days of cultivation, the results significantly differed between the culturing systems. In the bioreactor, there were minor deviations between the growth results determined by the Sedgwick Rafter method and flow cytometry, while in of these two methods were observed in the bioreactor, which is not the case with the incubation-shaking cabinet. A deviation of 30% was recorded on the 12^{th} day of cultivation, while on the last day of cultivation the deviation was 40%. Both methods confirmed that the bioreactor system should be used to obtain higher yields during the same culturing period. The results of this study contribute to the improvement of the cultivating protocols for microalgae needed for better exploitations of their metabolites.

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PREVENTING COGNITIVE DECLINE WITH NATURAL NOOTROPICS

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As the population ages, the prevalence of neurodegenerative disorders with symptomatic cognitive decline increases [1]. These pose a personal, economic and social burden. As we do not yet have effective treatment methods, we focus on preventative measures, which include our diet with the potential role of nutraceuticals. The purpose of our paper was to investigate the impact of diet and some plants with known beneficial effects on cognitive abilities that are classified as natural nootropics [2]. Additionally, we wanted to explore the Slovenian market of these previously studied nootropics. Initially, we reviewed the literature on the impact of diet on preventing cognitive decline. We then performed a meta-analysis of clinical studies that examined the effect of *Panax ginseng*, *Ginkgo biloba*, Ashwagandha and Lion's mane on preserving brain health. We classified the studies according to their strength. Afterwards, we reviewed the market and examined the forms and recommended doses of nootropics. First, we came to the conclusion that the MIND diet is the most effective dietary intervention to delay neurodegeneration [3]. We found that the most studied natural nootropic with the best-designed clinical studies and statistically significant results is *Ginkgo biloba*. A review of the Slovenian market showed that natural nootropics mainly appear as nutritional supplements, but their forms and recommended doses often don't match those used in clinical studies. We also found a product with a standardized extract of Ginkgo biloba leaves, which is registered as a medicine to relieve symptoms of dementia. We conclude that nutrition plays a key role in delaying cognitive decline, and that research shows the potential of natural nootropics for the preventative as well as therapeutic use for cognitive decline.

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P-33

EVALUATION OF BARRIER PROPERTIES AND OVERALL MIGRATION IN POLYMER BUCKETS INTENDED FOR PASTRY FILLINGS PACKAGING

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Barrier (gas and water vapour) and migration properties of polypropylene (PP) round bucket with cover bi-foil made of oriented poly(ethylene-terephthalate)/polypropylene (OPET/PP) used for packaging of pastry fillings were evaluated in this study. Barrier performance can significantly impact the stability of packed product and whenever a food is in a direct contact with packaging material, a risk of chemical contamination into food might occur [1]. The gas permeability (O_2 and CO_2) was measured in OPET/PP films at 3 temperatures (20, 40 and 60 °C). Solubility (S), diffusivity (D) and permeability coefficients (P) of O_2 and CO_2 were estimated based on the time lag values. Foils were also tested for their water vapour permeability (WVP) at two relative humidity differentials (Δ70% and Δ20%). The total amount of chemical migrants (the overall migration, OM) from buckets and foils was evaluated. Since this packaging is aimed for packing of pastry fillings, 20% (v/v) ethanol (EtOH) and 3% (w/v) aqueous acetic acid (HAc) were chosen as food simulants [2]. Possible structural changes on polymer surface after exposure to food simulants was measured by FTIR. Gas permeability measurements showed higher permeability for O_2 than for CO_2 with important impact of temperature for both tested gases. Even though at 60 °C P-value was slightly higher, this parameter remained below 100 $cm^3 m^{-2} d^{-1} bar^{-1}$ at 20 and 40 °C confirming that used OPET/PP foils presented an adequate gas barrier for the intended use. The OM values from buckets were below the overall migration limit set by EU legislation.

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P-34

THE EFFECT OF ADDITION OF OLIVE OIL ON THE SENSORY AND AROMA QUALITY OF DRY-RIPENED LAMB SAUSAGES

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The aim of this paper was to replace traditionally used pork and lard with meat from specially reared lambs and olive oil, in order to produce a dry sausage with a preferable fatty acid composition while retaining positive sensory characteristics. Lička pramenka lambs were fed with a specific feed supplement containing various percentages of *Agaricus bisporus*. Three recipes of dry sausages were produced – 1 Beef/Lamb/Lard; 2 Lamb/Beef/Lard/Olive oil/Bread; 3 Pork/Beef/Lamb/Pork backfat. All three sausages underwent the same technological production process. The pH decreased with ripening time, ranging from 5.54 to 5.92 depending on the sausage, while water activity decreased to 0.756 and 0.824 respectively. Sensory analysis was performed by professional evaluators. The parameters that were evaluated were: appearance (0-15), cross-section (0-20) and smell and taste (0-25) with a possible maximum number of 60 points. The results of the sensory analysis were as follows: sausage 1 - 52.36; sausage 2 - 56.06; and sausage 3 - 56.32 points. Volatile aroma compounds were identified by the solid-phase microextraction (SPME) combined with gas chromatography-mass spectrometry (GC-MS). A total of approximately 60 volatile compounds were detected by GC-MS, of which nearly 50 per cent were major volatile compounds mutual for all sausage samples. The most of identified compounds are complex terpenoids like aroma compounds such as α-Phellandrene, Linalool, γ-Terpinene, p-Cymene, D-Limonene, 3-Carene and Humulene. These compounds are characteristic volatile aroma compounds of numerous herbs and spices and contribute to the overall aroma profile of prepared lamb sausages. The cholesterol level was affected by the raw material composition of sausages. The lowest value was 64 mg/100 g in the sausage sample 2. To conclude, the substitution of meat and pork/lard with lamb and olive oil enhanced the sensory of the dry sausage, and at the same time, it successfully improved the fatty acid composition of the product.

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P-35

LIQUID MATRIX VOLATILIZATION METHODS FOR SUSCEPTIBILITY TESTING OF FOOD MICROBIAL PATHOGENS TO VOLATILE AGENTS IN VAPOUR PHASE

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Since foodborne diseases are public health concern throughout the world, the food preservation is important in ensuring food safety. Plant volatile products (e.g. essential oils) occurring in spices and culinary herbs are commercially important as food flavours and fragrances. Because of antimicrobial properties and high volatility, these products have strong potential to be used in food preservation, especially in protective atmosphere packaging. However, lack of knowledge on antimicrobial activity of their vapours is a main obstacle for their practical use. Due to the high volatility and hydrophobicity of plant volatiles, conventional laboratory methods of antimicrobial susceptibility testing face specific problems in the research of volatiles. In the past decades, several methods have been developed with aim to study the potential of vapours of volatile agents to inhibit growth of pathogenic microorganisms. Methods based on the solid matrix volatilization principle (e.g. disc volatilization assay) are simple to carry out but they also have many disadvantages, such as high consumption of material and labour [1]. Recently, broth micro- and macro-dilution volatilization assays based on the liquid matrix volatilization principle have been developed for the evaluation of the antimicrobial potential of volatile agents in vapour phase in our laboratory [2,3]. These assays are suitable for simple and rapid susceptibility testing of food bacterial pathogens to volatiles in the liquid and the vapour phase and allow a cost- and labour-effective high-throughput screening of volatile agents using commercially available microtubes or microplates. Both methods have been validated for research and development of applications and technologies for preservation of food that are based on volatile antimicrobials.

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P-36

FRACTAL IMAGE ANALYSIS OF SKIM MILK POWDER PARTICLES PRODUCED WITH THE ADDITION OF TRANSGLUTAMINASE

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When studying the microstructure of natural or biological objects, especially under a microscope, irregularly shaped objects are very common. They are difficult to describe and compare, but it is possible with fractal geometry. The paper presents a possible method of image analysis, which allows to determine the fractal dimension on the basis of SEM micrographs. In this study, low and high-heated skimmed milk powders were produced with or without transglutaminase addition and their microstructures was compared. The highest value of the fractal dimension was obtained for the low-heated powder, while the lowest for the low-heated powder with the addition of transglutaminase. The low value of the fractal dimension proves the smooth surface and the most spherical shape of the particles. The obtained values of fractal dimensions indicate differences in the degree of surface irregularity of the tested powders, although these differences were practically imperceptible during the observation of the micrographs. These differences can be reflected in the different functional properties of the powders. The presented method of analysis enables the determination of fractal dimensions and a direct quantitative comparison of irregular structures using a mathematical tool. This method can be used to analyse the morphology of any structures with distinct structural features that are difficult to verbally describe and compare.

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EFFECT OF DIFFERENT WHOLEGRAIN MAIZE FLOUR ON ACRYLAMIDE FORMATION IN COOKIES

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Acrylamide is one of the most flagrant problems facing the food industry worldwide as it presents potential health risks. Widely consumed thermally processed maize-based food can have a great contribution to acrylamide dietary intake thus bearing a high public health risk and require attention and application of strategies for its reduction. As it has been well established that the amount of asparagine in the presence of reducing sugars during Maillard reaction is proportional to the formation of acrylamide in most of the food products, one key strategy is to select an ingredient with lower levels of free asparagine. The asparagine content in cereals is affected by the genetic basis, growing conditions, time of harvest and storage conditions. The highest free asparagine accumulation in cereal grain occurs when the plant has a plentiful supply of nitrogen but is unable to maintain a normal level of protein synthesis because of deficiencies in other nutrients. In this study, effect of wholegrain flour of maize genotypes with different content of free asparagine (white-, yellow-, red-colored standard seeded maize and blue-colored popping maize) on acrylamide formation in the cookies was investigated. All genotypes were grown in the field at the Maize Research Institute, Serbia and standard cropping practices were applied. Maize cookies were baked at 180^{o}C for 7, 10 and 13 min. The content of free asparagine in wholegrain flour of blue-, yellow- and white-colored maize ranged from 387.9 to 470.5 mg/kg. The lowest content of free asparagine (189.7 mg/kg) was measured in wholegrain flour of red maize. At 180^{o}C, acrylamide was detected at all baking times, reaching a final content of 95.2 up to 320.5 µg/kg after 13 min of baking in red maize cookies and white maize cookies, respectively. Data indicated that acrylamide in maize cookies fully correspond to free asparagine in flour. The regression coefficients between free asparagine in flour and acrylamide in the cookies baked for 7, 10 and 13 min were 0.91, 0.82 and 0.72, respectively.

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P-38

EFFECT OF ANTHOCYANIN-RICH BRINE ON TECHNO-FUNCTIONAL AND SENSORY PROPRERTIES OF PICKLED BABY CORN

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Pickling is one of the oldest preservation methods of food by fermentation. Pickled vegetables are good sources of natural antioxidants such as vitamins, carotenoids, flavonoids and other phenolic compounds. However, in the phase of cob development before fertilization in maize grain, the synthesis of bioactive compounds that affect its final color has not yet taken place. Many studies showed that black soybean seed coat, rich in polyphenols and dietary fibres, can be used as bioactive ingredients in functional foods and pharmaceutical products targeting different health problems. Having in mind the great potential for the use of black soybean seed coat as an ingredient in food products the objective of this study was to investigate the effect of anthocyanin-rich brine from black soybean seed coat on techno-functional properties of pickled baby corn, as well as their sensory properties. The experimental material consisted of three maize hybrids (*Zea mays* L.) and one soya genotype recently developed at the Maize Research Institute, Zemun Polje, in the vicinity of Belgrade, Serbia. Since the high content of soluble-free phenolic compounds (in total 40762.2 mg CE /kg), primarily anthocyanins (in total 11882.9 mg CGE /kg), was detected in the black soybean coat a very high antioxidant capacity (399.54 mmol Trolox Eq /kg) was expected. The addition of black soybean coat had a positive impact on anthocyanin content in Baby corn samples and its color. In this study, we observed three anthocyanins in Baby corn samples. The major anthocyanin was cyanidin 3-glucoside which ranged from 184.62 to 247.47 µg/g. It was followed by delphinidin 3-glucoside, which ranged from 12.24 to 34.93 µg/g and pelargonidin 3-glucoside, which ranged from 12.50 to 17.61 µg/g. The addition of anthocyanin-rich soybean coat changed the baby corn cobs color to a red range. Baby corn samples had CIE a* values more than 16-fold higher than the control Baby corn sample. In addition, the control Baby corn sample had yellow color values CIE b* higher by 86.3%, 79.8%, and 85.0% than popping, semi-flint, and sweet Baby corn samples with salt and sugar, respectively.

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DRIED APPLE SLICES, A GREAT POTENTIAL OF SLOVENIAN APPLE CULTIVAR 'MAJDA'

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A modern consumer demands healthy snacks with as little processing as possible. Cultivar 'Majda' is a non-browning cultivar [1], the trait that is rear in natural crosses and greatly appreciated, since browning is a major problem of various apple products [2, 3]. The use of this cultivar for dry slices not only sidesteps the addition of antioxidants, which reduces costs and is consequently more appealing to the consumers, but also offers the preservation of Slovenian heritage. In this work we made a sensorial evaluation of dried slices of three cultivars, 'Majda', 'Golden Delicious' and 'Topaz'. The analysis of sugar, malic acid and phenolic content and colour measurement at two different periods during shelf life were performed in order to evaluate the suitability of 'Majda' for drying. All three cultivars differ in colour parameters (a*, b* and L) sugar and phenolic content. Cultivar 'Majda' and 'Topaz' did not differ in acidity, having higher acidity than 'Golden Delicious'. There were no significant differences between two different times of sampling, except in malic acid content. Sensorial analysis reveals that 'Majda' and 'Topaz' are too acidic in taste while 'Golden Delicious' lacks acidity and freshness. Regarding colour, 'Majda' achieved the highest score [4] followed by 'Golden Delicious' [3,5] and 'Topaz' that clearly shows browning disorder. Results confirm the suitability of 'Majda' cultivar especially for consumers who prefer sourer flavours.

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P-40

IDENTIFYING FACTORS INFLUENCING CONSUMERS PREFERENCE FOR HEALTHY NUTRITION AND FOOD PRODUCTS WITH IMPROVED NUTRITIVE QUALITY

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This study aims to analyse young consumers' preference for healthy nutrition, their intention to purchase food products with improved nutritive quality and to identify factors influencing their attitudes. The structured questionnaire and scientific methodology were used for the research with representatives of target consumers. The data were grouped and analysed using descriptive statistics and correlation tests with aim to investigate relationship between variables included in the research and to identify factors that influence consumers' preference. Answers on specific questions are analysed for 720 respondents, average 20 years old. The results are grouped based on consumers' sex and body mass index (BMI) crossing (i) consumers' interest in healthy diet with (ii) individual need for a special diet because of health problems; and each of them with (iii) knowledge on nutrition and health risks; food labelling; labels use in food choice; purchasing products enriched with vitamins, minerals or dietary fibres; products with improved nutritive content but lower sensory quality. The results show respondents high interest in healthy nutrition, high knowledge on nutrition and health risks, food labelling, high preference for products enriched with vitamins and minerals, but less with dietary fibres. The correlation confirmed very high positive relationship ($p<0.01$) between interest in healthy nutrition and analysed variables, their significance as factors influencing attitudes of all respondents, males, females and normal-BMI groups, but not for inadequate-BMI respondents. Some differences in correlation intensity or existence were identified for analysed data sets regarding consumers' health-related special diet needs and interest in products with dietary fibres or lower sensory quality. Identified consumers' preference for healthy food products and nutrition are important positive data for producers on target market. Applied research methodology could be used as a model for design and reformulation of different food products which have quality harmonised with recommendations for target consumers' healthy nutrition, but they should have acceptable sensory quality.

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FOOD SAFETY STATUS OF MUSSELS FROM BULGARIAN COAST IN REGARD OF MARINE BIOTOXINS

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Seafood such as mussels is rich of essential nutrients, but it could be also a source of contaminants that may cause adverse health effects. This article aimed to identify safety status of mussels harvested from Bulgarian coast. Wild and cultivated mussels (N = 17) were collected from their breeding sites in the period throughout 2021 along the Bulgarian coast of the Black Sea. Among all six regulated marine biotoxins (domoic acid, dinophysis toxin -1, dinophysis toxin -2, azaspiracid-1, pectenotoxin-2 (PTX2) and yessotoxin (YTX)) were determined via high performance liquid chromatography tandem mass spectrometry. Safety of investigated samples was assessed by calculating the human exposure to detected toxins and comparing it with the legislated acute reference doses. For calculations the average body weight for Bulgaria (74 kg) according the National Statistics and mean portion size of 400 g recommended by EFSA were used. The presence of only pectenotoxin-2, yessotoxin and some of their analogues (PTX2-sa and hydroxy- YTX) was confirmed in all samples. Highest calculated exposure was to YTX – 0,00013 μg/kg bw which is much lower than the accepted acute reference dose of 25 μg/kg bw. Calculated exposures to pectenotoxins were more than thousand times lower than the acute reference dose of 0,8 μg/kg bw. Estimated results indicate that no human health risk could be expected if studied mussels were consumed. Although no human health risk was identified, a running monitoring of marine biotoxins is important. Thus, high levels of yessotoxins and pectenotoxins might be a certain danger to consumers. The insidiousness lies in the mechanism of action of these toxins, as it is still unknown and does not allow us to have reliable information on the symptoms and problems that it develops in humans.

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POLYCYCLIC AROMATIC HYDROCARBONS CONTAMINATION LEVELS OF DRIED HERBAL TEAS AND THEIR INFUSIONS

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Medicinal plants are commonly used for preparing teas as water infusions but they may be contaminated with environmental pollutants such as polycyclic aromatic hydrocarbons [1, 2]. The aim of the study was to assess the contamination levels of polycyclic aromatic hydrocarbons in dried herbs and their transfer into water infusions. Five brands of herb teas were purchased from Bulgarian markets. The PAHs concentrations were determined in dried tea from five plant species: *Matricaria chamomilla* L., *Thymus serpyllum* L., *Tilia tomentosa* Moench, *Sambucus nigra* L. and *Achillea millefolium* L. Detection of PAHs was performed using gas chromatography coupled with mass spectrometry. In dried plant samples, PAHs with 2 and 3 aromatic rings were predominant with a contribution over 90%, whereas 5–6 rings PAHs were not detected. Benzo[a]pyrene was found below the limit of detection in dried teas and their water infusion. The total content of PAHs ranged from 108.5 to 176.6 ng/g dw in dried herbs and from 5.89 to 60.32 ng/g dw in infusions. The mean transfer rates of sum 14 PAHs from dried herbs into water were found in the range 5.4 – 31.8%. The potential health risk by tea consumption was assess by evaluation of daily intake of PAHs.

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P-43

EFFECT OF ENZYMATIC PRETREATMENT PRIOR ULTRASOUND-ASSISTED EXTRACTION OF SAGE POLYPHENOLS

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Sage (*Salvia officinalis* L.) is rich in biologically active compounds, among which the most important are polyphenolic compounds. It is a growing interest in efficient and environmentally acceptable extraction methods with low solvent consumption, short extraction time and high extraction yield. The ultrasound-assisted extraction employing an ultrasonic device with direct cavitation using lower solvent consumption and short extraction time can result in higher recovery of polyphenolic compounds. Enzyme-assisted extraction has been intensively studied in the last years, enzymes can degrade and disrupt plant cell wall components, thus enabling better release and more efficient extraction of bioactive compounds from plants. We hypothesized that enzymatic pretreatment prior ultrasonic extraction can improve the recovery of polyphenols from sage. The aim of this study was to optimized extraction time of ultrasound-assisted extraction (ultrasonic output power of 200 W, a probe diameter of 14 mm). Furthermore, enzymatic pretreatment with addition of 5 mg and 50 mg of each enzyme (celulase, pectinase, xylanase and mixture of celulase-pectinase-xylanase) was performed at 40 ˚C for 1 h prior ultrasound-assisted extraction of polyphenols. Ultrasound-assisted extraction of polyphenols from sage was performed after enzymatic pretreatment with ultrasonic device for 5 minutes with aqueous methanol (1:1, v/v). The mass fraction of polyphenols (35.5 mg/g) extracted with ultrasound-assisted extraction under optimal extraction time of 5 minutes using methanol (1:1, v/v) was higher than mass fraction of polyphenols after enzymatic pretreatment (6.2-12.9 mg/g). However, enzymatic pretreatment prior ultrasonic extraction did not increase the mass fraction of total polyphenols compared to ultrasonic pretreatment. This suggests that the enzymatic pretreatment prior ultrasonic extraction has to be carefully re-evaluated. We have demonstrated the valuable effects of ultrasound-assisted extraction for only 5 minutes on the recovery of polyphenols from sage. In our case, ultrasound-assisted extraction of sage was enough to disrupt the cells and addition of enzymes was redundant.

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THE HYGIENE CONDITIONS OF THE SURFACES IN HOUSEHOLD KITCHENS

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Contamination of food with pathogenic microorganisms can occur at all stages of its processing, including food preparation by consumers in their households.The aim of the study was to determine the cleanliness and microbiological suitability of surfaces in the household kitchens of selected consumers. We were interested in whether the group of pregnant women observed, aged 25 to 33 years, handled food more safely than the group of older consumers, aged 35 to 65 years. The hygiene conditions of the work surfaces and various utensils in their kitchens were determined by taking swabs for microbiological examinations, while the adequacy of cleaning was determined by measuring ATP bioluminescence. According to ATP bioluminescence results, 41.25% and 12.5% of 80 tested surfaces in consumers' kitchens were adequately and acceptably cleaned, respectively, while 46.25% of surfaces were according to the manufacturer's criteria inadequately cleaned. In the kitchens of pregnant women, 22.5% of the surfaces tested were clean, compared to only 18.75% in the older age group. The total microbial counts exceeded normatives in 45% of the samples. These limits were exceeded in 25% of the samples from the kitchens of older consumers and in 20% of the samples from the kitchens of pregnant women. According to the results of both methods, the highest levels were found on the surfaces of the sink, the countertop, and the rubber seal inside the dishwasher. The cleanest surfaces were the utensils for mixing the salad. No statistically significant difference in total microbial counts on kitchen surfaces between the two consumer groups was observed. *Enterobacteriaceae* were found in 26.25% of the collected surfaces, most frequently in the dishwasher, where their average count was 9.5 × 102 CFU/20 cm2. *E. coli* was detected in 2.5% and *L. monocytogenes* in 3.8% of the samples. Temperatures in the refrigerators ranged from 4.8 to 12.8 °C and were higher than the recommended value of 4 °C in all cases. The results show, that the consumers are not aware that the way for prevent foodborne diseasses is through proper food handling practice. Education in this area would be necessary for consumers.

P-45

FOX PROJECT: THE POTENTIAL OF ON-SITE MILDLY PROCESSED FRUIT AND VEGETABLES AS HEALTHY SNACKS,

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Mild processing technologies can be used on fruit and vegetables to produce innovative food. European HORIZON2020 research project “Food processing in a box” (FOX) is focused into bringing such technologies directly very close to farms, supporting short food chains [1]. Such technologies enable production of more sustainable and healthier food products, which could be also marketed as alternative to traditional snacks. Snacking is a part of the dietary pattern, representing eating outside the three main meals. Snacks often present foods prepared with detrimental components like saturated fats, sodium, or sugar. Consequently, snacking has been linked with obesity, diabetes, cardiovascular diseases, and hypertension. On the other hand, snacks with favourable nutritional composition can help to prevent a rapid increase in hunger, reducing daily energy intake, and supplying beneficial nutrients [3]. Selected foods developed within the FOX project with a potential for healthy snack, have been evaluated and compared with traditional snacks. The challenge of such evaluations is to identify parameters, enabling relevant and meaningful assessments. Such comparisons could be focused in beneficial and detrimental food constituents, or into whole food ingredients and their effect to health, i.e. using measures of overall disease burden, such as disability-adjusted life year (DALY). Such an approach has been applied to develop Health nutritional index [4,5], which we used for our evaluations. A comparison has been made for variety of snacks, including FOX dried apples, and series of comparative snacks.

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SHELF-LIFE OF FRESH-CUT POTATOES TREATED WITH LAUREL ESSENTIAL OIL DURING REFRIGERATED STORAGE

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This study investigated the effect of application of laurel (*Laurus nobilis*) essential oil (LEO) on the shelf-life of fresh-cut potatoes (FCP). Peeled and sliced potatoes were dipped (15 min) in the aqueous solution of 25, 125 and 250 mg/L LEO (P25, P125 and P250) and water as control (PC), drained, vacuum packaged and stored at 7 ^{o}C for 14 days. During storage, firmness, color by CIELAB method and aerobic mesophilic bacteria count (AMBC) of raw FCP were determined, while raw, boiled and fried FCP were sensory evaluated. Mostly, PCs were mildly firmer than LEO FCP, before and during storage without clear trend caused by conc., or time. With the increase of LEO conc. AMBC decreased and this trend persisted during storage. Till the 6th day the increase was slight, but on the 9th day in PC and P25, as well as on 14th day in P125 and P250 AMBC almost doubled vs. the 6th day. It seems that antibacterial efficacy of LEO decreased with storage time, at a slightly slower rate with higher applied conc. LEO treatment caused a slightly brighter color of FCP (>L*). Although color was mostly stable according to CIELAB parameters, sensory evaluation showed a browning appearance with storage, where LEO treated samples (especially P25) were better evaluated until the 9th day. The distinctive laurel taste and odor were evaluated as pleasant and they increased in raw and boiled FCP with the increase of LEO while they slightly decreased during storage. LEO aroma was not pronounced after frying. The antibacterial activity of LEO was effective till the 9th day in a dose-dependent manner and at that day AMBC was below recommended values. LEO treatment almost completely suppressed AMBC growth and browning till the 6th day, and in spite of some changes, according to all obtained results, FCP were acceptable at the 9th day, too (especially P25) but not longer.

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CO-FERMENTATION WITH *LACTOBACILLUS PARAPLANTARUM* BPF-2 AND *PEDIOCOCCUS ACIDILACTICI* ST-6 FOR IMPROVING QUALITY AND SAFETY OF SPANISH SALCHICHóN

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In the food sector there is a growing demand for new cultured foods providing good technological properties that improve quality and safety against pathogens. This work aimed to evaluate the potential of 2 lactic acid strains *Lactobacillus paraplantarum* BPF2 and *Pediococcus acidilactici* ST6 isolated from traditional Spanish spontaneous fermented sausages isolated and that have been previously characterized for their bioprotective features, for being used in co-fermentation of Spanish dry-cured sausage salchichón. During the fermentation process, pH, % humidity, color parameters and microbial counts have been evaluated. In addition, the volatile compound profiles were studied by SPME-GC MS technique. Furthermore, a sensory evaluation focused on color, mouthfeel, flavor, texture and overall acceptability, among other parameters was performed. In order to mimic the consumers' evaluation more objectively, 20 untrained panelists (10 females and 10 males, aged 20–50 years) were randomly recruited. Finally, a Challenge test with sausages of salchichón co-fermented with BPF2 and ST6 strains previously inoculated with L. monocytogenes (104UFC/g) was assessed. The results obtained showed that, compared to natural fermentation, the double-starter culture increased acid lactic bacteria concentration and reduced the number of Enterobacteriaceae. Besides, there were no significant differences among the technological properties during the process. However, co-fermented dry sausages had better acceptance from the panelists, particularly with regard to the flavor intensity and seasoning smell attributes. Finally, challenge tests against *L. monocytogenes* showed a significant count reduction of up to 3.5 Log units with respect to control. These results proved that the inoculation of double-starter cultures can improve the quality and safety of salchichón. This double-starter culture could be a great potential for application to the manufacture of Mediterranean fermented meats.

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A NOVEL PISCICOLIN FROM *CARNOBACTERIUM MALTAROMATICUM* IN EDIBLE COATINGS TO IMPROVE THE QUALITY AND SAFETY OF FISH PRODUCTS

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Several authors reported a high prevalence of *L. monocytogenes* in raw fish and seafood. In addition, in recent years, the consumption of raw fish has increased enormously due to the great popularity of some foods such as sushi or sashimi, increasing the associated microbiological risks. The application of edible coating (EC) added with antimicrobial agents is a good strategy to prevent the contamination of food surfaces improving their quality, safety and shelf life. In the present work, we assayed the effectiveness of piscicolin 126 from *C. maltaromaticum* CM-22 in edible coatings to improve the quality and safety of fish products. The bacteriocin was incorporated in two ECs based on chitosan and fish gelatin, to inhibit pathogen and spoilage bacteria in raw tuna and salmon slides. During the storage at 4 ºC, pH, % humidity, color parameters and microbial counts were evaluated. In addition, a challenge test against *Listeria* (3 log CFU/cm2) was assessed. The results obtained showed that, compared to control, the ECs combined with piscicolin 126 increase the shelf life of raw fish, being EC based on chitosan and bacteriocin the most effective with significant reduction of Enterobacteriaceae. In fillets of raw fish, Listeria counts reached 8 log CFU/cm2 at the end of storage. Treatment with both ECs had a significant effect ($P < 0.01$) as the treated samples showed reductions with respect to the untreated control. Combined treatment with piscicolin and chitosan coating produced a drastic effect from the first day of storage since the *listeria* population was kept below detection levels at least between days 1 and 3. However, a slight regrowth was observed in samples from 3 to 5 days at the end of storage. Finally, there were no significant differences among the technological properties during the storage. These results proved that safety improvement and extension of shelf life of fish products could be achieved by incorporating bacteriocins, such as piscicolin 126 in edible coatings.

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SENSORY CHARACTERISTICS OF WHITE CHOCOLATE WITH RESISTANT STARCH

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Much attention has been paid to dark chocolates with high amount of fat-free cocoa particles which are extremely rich with polyphenols, minerals and dietary fibers [1]. Milk chocolates contain less cocoa liquor and therefore less functional fat-free cocoa particles, and, on the other hand, in white chocolate the cocoa liquor is left out completely [2]. White chocolate is produced of only cocoa butter originating from cocoa bean, powdered sugar, milk solids, lecithin and vanillin. Thus, white chocolate does not contain fat-free cocoa solids and lacks of nutritionally valuable components [3]. Resistant starch (RS) is a special type of dietary fiber that can be added to different food products. Our objective was to investigate the influence of different amounts (5,10, and 15%) of RS on sensory characteristics of enriched white chocolate with increased content of dietary fibers. RS did not impair the color and sensory characteristics of enriched white chocolates, where color uniformity, glow and surface damage did not differ significantly ($p>0.05$) among the chocolate samples. All samples had a uniformed color surface without damage, good gloss, with clear engraving. The increase of RS caused the reduction of hardness and appearance of a mild floury taste due to the reduced amount of cocoa butter in enriched chocolates. The addition of 15% of RS significantly influenced chocolate smoothness, however, it did not have significant influence on the chocolate melting. RS did not contribute to a foreign taste of enriched chocolates, however, it decreased cocoa flavor, milk powder flavor and sweetness intensity in accordance with added amount.

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P-50

CAN MEDITERRANEAN PLANT DERIVATES AFFECT GROWTH KINETICS, VIABILITY AND BIOGENIC AMINES ACCUMULATION OF *ENTEROCOCCUS FAECIUM?*

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In this study the antimicrobial effect of phenolic extracts (PE) or essential oils (EO) obtained from Rubus fruticosus leaves and Juniperus oxycedrus needles, collected in the Mediterranean maquis, was assessed. The strain *Enterococcus faecium* FC12, known to produce considerable amounts of biogenic amines (BAs), such as tyramine and 2-phenylethylamine, was used as target microorganism. Indeed, these toxic molecules can be accumulated in significant concentrations in several fermented foods by decarboxylating bacteria, and an excessive intake can cause severe effects on human health. Among BAs, tyramine is often detected in considerable amounts in cheeses and fermented sausages, being enterococci one of the main producers. For this reason, the control of this microbial group and of its amino-biogenic potential, also using green solutions such as natural preservatives, is crucial to guarantee the quality and safety of the final product. Thus, we tested the antimicrobial effect of phenolic extracts (PE) or essential oils (EO) from Rubus fruticosus leaf and Juniperus oxycedrus needles, used at sublethal concentrations, against Enterococcus faecium FC12. The growth kinetics in the presence of these plant derivatives were first assessed through plate counting and data modelling. Then, at defined sampling times the accumulation of BAs (by HPLC) and the viability (by flow cytometry) were monitored. The results showed that EOs (mainly from blackberry leaves) were more effective: indeed, an initial decrease of cell counts was observed, even if afterwards cells were able to recover culturability, although with different growth rates. These differences were reflected in slower accumulation of tyramine and 2-phenylethylamine. This study contributes to increase the knowledge on the metabolism of this spoilage microorganism and to exploit plant derivatives as new green preservative strategies for food industry.

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FOOD SAFETY GAPS AMONG FOOD HANDLERS IN SLOVENIA

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The authors present and discuss the results of nation-wide survey on food safety knowledge among food handlers in Slovenia. Data were collected via telephone survey using the questionnaire developed by Pichler and coworkers (2014) with some modifications. Altogether 601 respondents from hotels, restaurants, catering and confectionery units completed the questionnaire. More than half of (57.4%) food handlers attended previous Slovenian “hygiene minimum” training course, while 94.2% attended current food safety training. Among all respondents (n = 601), there are also 35 who handle food, but did not attend any training in the field of food safety. Additionally, there are statistically significant differences (albeit very small) between persons who have completed once compulsory “hygiene minimum” education course, who achieve on average better scores (35.80) compared to those who did not (35.22). It was observed that respondents are aware of microbiological risks, but with some gaps of food safety knowledge. Lack of food safety knowledge was identified among food handlers concerning the optimal temperatures for cooling and cooking, defrosting, and preventing the cross-contamination. Food handlers in food establishments are rec-ognised as a risk factor if they are not properly educated and trained on food safety field as re-quired by EU regulation. Therefore, periodic food safety training by qualified food safety profes-sionals and targeted educational material regarding the type of food establishments are recom-mended. The human factor in food supply chain has a significant role in ensuring food safety, therefore it should have to become more important part of food safety system.

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P-52

TRADITIONAL FOOD PREFERENCES OF INTERNATIONAL TOURISTS IN CAMBODIA

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Traditional food represents a significant aspect of the experience of tourists in a particular destination and is one of the essential factors in helping tourists in a country selection [1]. Tourist behaviour thus plays a crucial role in preserving and developing the cultural and natural heritage and supporting economic development [2,3]. The study analyses tourists' traditional food preferences in Cambodia and factors influencing their consumption and purchasing intentions. In total, 1,271 international tourists in major spots in Cambodia were interviewed. The Analytical Hierarchical Process Model [4] identified the tourists' preferred traditional plant food products and gained insight into the different food choice determinants (personal motivation, awareness and expectations, previous experience, average spending, and socio-demographic factors). The most well-known and preferred was Kampot pepper (54.5%), followed by Cambodian palm sugar (52%) and Rumduol rice (40%). Product familiarity was the most crucial determinant of predicting purchasing intention, and tourists reported a relatively positive intention to try and purchase traditional plant food products. Based on pairwise ranking, Kampot pepper, palm sugar, and Rumduol rice were local food products with the highest willingness to buy by foreign tourists. The associations between the frequency of tourists' consumption and purchasing intention of traditional food were documented. Country of origin, education level, and religion significantly influenced tourist preferences. Findings provided more insights into tourists' consumption and preferences for local food. Higher knowledge and willingness to pay for local food from international tourists' will contribute to the preservation and development of a promising market of food-interested visitors.

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THE INFLUENCE OF DIFFERENT DRYING TREATMENTS ON THE QUALITY OF SPIRULINA BIOMASS (*SPIRULINA PLATENSIS* (NORDST) GEITL)

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Spirulina platensis is a cyanobacteria with therapeutic and nutritional properties, a valuable source of proteins and amino acids, polysaccharides, phospholipids, pigments, including phycobiliproteines, antioxidant enzymes, and other antioxidant molecules, trace elements and vitamins. To preserve the Spirulina biomass properties, drying is required. The amount of biologically active compounds which are susceptible to a drying temperature higher than 40°C determined the necessity of the present study. The biomass is represented by *Spirulina platensis* (Nordst) Geitl CNMN-CB-01. Experiments were carried out in a hybrid drying oven using (convection simultaneously with microwave). The monitored parameters of biomass were the content of proteins, lipids, polysaccharides and malonic dialdehyde. The effects of microwave drying method at different powers (525 and 420W) and microwave assisted of forced convection (100°C + 525W and 100°C + 420 W, 40°C + 525W and 40°C + 420 W) on biochemical composition of Spirulina biomass were analyzed. Analysis of drying parameters and biochemical compounds were performed using hybrid artificial neural network (ANN) algorithm.

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BENEFICIAL ALTERNATIVE OF ELDERBERRY FRUITS PROCESSING

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Generally, elderberries are considered by the consumers useless or just wild and improper to be consumed. Even like this, the elderberries are full of bioactive compounds such as anthocyanins, polyphenols and flavonoids. The elderberries are seasonal, so the preservation methods are extremely important to prolong the consuming time of the raw material. That's why preservation by converting into jam is a very useful. The aim of this study was to obtain and characterize some jams with sugar and sugar substitute (Stevia sugar 1:8). Phytochemicals, textural, color and sensorial analysis were involved to developed the experiment. The anthocyanins have registered a decreased reported to the control sample represented by the raw material, but by using Stevia sugar, the results were higher than the other samples with sugar or without any addition 1.43±0.16mg/g. Several correlations were highlighted by the results between textural and sensorial analysis. As a conclusion, the sugar partial or total substitute could contribute to a more valuable matrix than the original one.

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TRIZ METHODOLOGY FOR INNOVATION IN FOOD PRODUCTION

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The innovation process defines the management of an idea from strategic opportunity search, concept creation, validation of solution development concepts to their introduction that represents the value, and is successfully launched in the market. All activities are performed iteratively, in accordance with the decisions made by the team after the completion of each phase. We present a method for improving creativity in innovation in the field of novel food development, based on the ISO 56002 standard [1], the use of the TRIZ method [2] and teamwork. The general steps are: (i) identifying opportunities for innovative products; (ii) defining concepts with their validations; and (iii) solution development and their introduction [3]. When developing the method, we followed the 70-20-10 rule. It states that individuals tend to learn 70% of their knowledge from challenging experiences and assignments [4], 20% from developmental relationships, and 10% from coursework and training. Therefore, the emphasis is on using the knowledge and experience gained by team members in their previous work in the field of food, 20% of the knowledge needed to find an innovative solution is provided by the application and 10% of the team gained by pre-training to use the application. The proposed method will enable the development of new products that will meet the quality criteria, requirements and expectations of customers throughout the food supply chain. Consumer preferences will be evaluated in order to meet their expectations.

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ELEMENTS IN BROWN AND WHITE RICE SAMPLES (*ORYZA SATIVA* L.) FROM THE CROATIAN MARKET

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Rice (*Oryza sativa* L.) is one of the most important and widely grown staple crop. It represents a major part of the diet for more than a half of the world's population. Due to its high carbohydrate content (mainly starch) it represents important source of energy, but it is also a valuable source of micronutrients, including minerals. It`s usually recommended as wheat alternative for persons who suffer from various allergies, intolerances and diseases such as celiac disease. Despite its high nutritional value, rice may contain undesirable levels of toxic elements, mainly As and Cd. In this study, aim was to determine the elemental composition of 58 rice samples (20 brown, 31 white and 7 parboiled) purchased from the Croatian market using ICP-MS method, and to investigate effects of processing type, cultivation method and the origin on element levels. Additionally, the consumers benefit and health risks from element exposure were quantified based on mean consumption of one serving of cooked rice. Elements in rice were estimated in the order: P > K > Mg > Ca > Fe > Mn > Zn > Cu > Mo > As > Se > Cd > Co. Brown rice contained 2 to 4-fold higher levels of essential elements Mg, P, K, Fe, Mn, Co, Zn and Se compared to white rice. Mean toxic element level in all samples were 0.142 ± 0.057 mg/kg for As and 0.038 ± 0.035 mg/kg for Cd, with highest values observed in conventionally produced brown rice sample (As: 0.259 mg/kg; Cd: 0.207 mg/kg). Only one sample exceeded the European Commission limit for Cd of 0.20 mg/kg. Rice originated from the European Union had higher As but lower Se than those from Asia. Among brown rice, non-organically grown rice contained more P, K, Mg, Fe and Zn compared to organic ones. Moreover, negative relationship (r=-0,47, p=0.0002) between As and Se in rice was found. According to data obtained in this study, rice, especially brown one, may be considered as an important source of P, Mg and Cu. Observed low toxic element levels in all rice samples along with the latest recorded consumption rate of 2.7 kg rice per capita among Croatian population indicate that rice is, with regard to toxic element, safe for consumption.

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SACCHAROMYCES CEREVISIAE AS SOURCE OF CARRIER MATERIAL FOR BIOACTIVE COMPOUNDS ENCAPSULATION

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The encapsulation of bioactive compounds from cornelian cherry juice using two different strains of *Saccharomyces cerevisiae* as sources of encapsulating material was investigated. The autolysed cells of baker's and brewer's spent yeast and their extracts were used as carrier materials for getting four variants of microcapsules through freeze-drying. The four microcapsule powders were characterized in terms of anthocyanins encapsulation efficiency, water activity, hygroscopicity, and colour. Regardless of yeast strain, the highest encapsulation efficiency was obtained for powders prepared with protein extract. On the other hand, the baker's yeast cells were able to encapsulate significantly higher amounts of bioactive compounds from cornelian cherry juice (~ 53%), compared to the brewer's spent yeast cells (~ 22%). The water activity of all tested microcapsule powders was less than 0.3, whereas hygroscopicity ranged between 13.75 and 26.5 g/100 g, suggesting that samples stability during storage was dependent on yeast strain. The colour measurements performed in the CIE Lab colour space indicated important differences among samples. The lowest luminosity was calculated for microcapsules powder obtained with dried baker's yeast cells, whereas, the most intense red colour (a value) was registered for the microcapsules sample obtained with brewer's spent yeast extract. Overall, the results showed that both strains of *Saccharomyces cerevisiae* are promising wall material for bioactive compounds encapsulation, However, additional studies are necessary to identify the optimum conditions to obtain powders with good stability and high bioaccessibility.

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THE EFFECT OF BARRIQUE OAK BARREL ON THE ESTERS CONCENTRATION DURING AGEING OF CABERNET SAUVIGNON GRAPE BRANDY

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Grape brandies are one of the most popular alcoholic beverages in the world, and the most popular are Cognac and Armagnac. Besides these two brandies, which are subject to stricter regulations, grape brandy is produced all over the world, Spanish brandy from the Jeres region, South American brandy Pisco from Peru and Chile, German brandy called Weinbrand and so on. According to the European Union legislation, brandy is a spirit drink (alcoholic beverage) produced from wine spirit and aged for at least six months in oak casks smaller than 1000 litres in capacity or twelve months with oak receptacles. Esters represents one of the most important group of volatile compounds influencing brandy aroma. During ageing, the content of esters increases as a consequence of the slow esterification of different organic acids with ethanol. The predominant esters in Cognac and Armagnac are isoamyl acetate, hexyl acetate, ethyl hexanoate, ethyl octanoate, ethyl decanoate, and ethyl laurate. Accordingly, the aim of this study was to investigate the effect of 3 L barrique oak barrel on the predominant esters during six months of ageing of Cabernet Sauvignon grape brandy. The esters were analysed by gas chromatography with a mass spectrometer (GC/MS). The highest concentration of investigated predominant esters during ageing is determined for ethyl octanoate (95.41 - 135.67 mg/L), followed by ethyl decanoate (51.61 - 106.86 mg/L) and ethyl hexanoate (38.99 - 104.39 mg/L). Together these three esters accounted for 78.36 - 82.55 % of investigated esters.

P-59

TEXTURE AND RHEOLOGY OF HAZELNUT COCOA SPREADS WITH COCOA SHELL AND DIFFERENT EMULSIFIERS

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Hazelnut cocoa spreads are very popular among children and adults, but known for their high contents of sugar and fat. In recent years, consumers' awareness of health problems linked to the consumption of foods rich in sugar has been raising. Because of that, many researchers have been trying to replace sugar in different food products while maximally retaining the characteristic texture and rheology. In addition, the food industry strives for sustainable production and utilization of by-products generated in the food industry. One of the main by-products generated in the confectionery industry is a cocoa shell, which is rich in dietary fibers and bioactive compounds. The aim of this study was to produce cocoa hazelnut spreads without sugar, using the cocoa shell as a partial replacer. Spreads were produced in a ball mill with xylitol, cocoa shell and stevia as replacers of sugar. Used ratios of cocoa shell and xylitol were approximately 50:50, 40:60, 30:70, 20:80, 10:90, 0:100, respectively. In addition, spreads were produced with different emulsifiers: lecithin, polyglycerol polyricinoleate (PGPR), and citrem. A control sample with sugar was produced as well. After the production of cocoa hazelnut spreads, the rheology (Casson yield value and Casson viscosity) and texture (spreadability and firmness) properties were determined using rotational rheometer and texture analyzer, respectively. Results showed that spreads with PGPR had the lowest and those with citrem had the highest Casson yield value. In addition, an increase in cocoa shell share caused an increase in Casson viscosity. Lecithin had the best effect on lowering the values of texture parameters in all spreads and increase in cocoa shell content caused their increase.

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P-60

SHAPING THE QUALITY FEATURES OF RYE BREAD USING A DIVERSIFIED SHARE OF SEA-BUCKTHORN FRUIT POMACE

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The aim of the study was to evaluate the influence of sea-buckthorn fruit pomace addition on the formation of selected quality features of light rye bread, with particular emphasis on the texture and color of the crumb, which mainly determine consumers' purchasing choices. The experimental material consisted of four baking variants, differing in the share of sea- buckthorn pomace in the recipe (5%, 10%, 15% and 20% + control: 100% rye flour type 720). The bread was produced in laboratory conditions using the three-phase method, in two separate series. The influence of the addition of sea-buckthorn fruit pomace on the shaping of the quality features of experimental baked goods was determined, i.a., on the basis of the color of their crumb (CIELab system) and texture, characterized by: bread volume and roundness; porosity (Dallmann's method and with the use of edible oil) and crumb compressibility (Instron). At the same time, the organoleptic assessment of the bread was carried out, taking into account: external appearance, characteristics of the crust (color, thickness) and crumb (elasticity, porosity) as well as taste and smell. The increase in the share of sea-buckthorn friuit pomace in the production of a new type of baking significantly differentiated the texture parameters and the color of the light rye bread crumb. The addition of 10% sea-buckthorn fruit pomace had a positive effect on the tested quality characteristics of the bread, both in the instrumental and consumer assessment. The production of this variant of bread in practice may expand the range of the market offer, along with the option of waste management (pomace). In terms of production economics, increasing the share of pomace (5-20%) in bread also positively influences the efficiency of dough and bread.

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P-61

PLUM (*PRUNUS DOMESTICA*) SEED VALORIZATION IN TERMS OF SOURCE FOR BIOPOLYMER FILM SYNTHESIS

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As time goes, fruits production is growing widely, as well as the amount of by-products which remain mostly underused. Improper collection and disposal of these by-products, may generate serious environmental and ecological problems and a significant loss of nutritional valuable biomass, which could be utilized in various fields. In Republic of Serbia, the most represented fruit crop is plum (*Prunus domestica*) - the member of Prunus family (peach, nectarine, donut peach, plum, cherry, and apricot). Plums can be consumed differently: fresh, dried or used in different foodstuffs production, after which significant amount of plum stones are left behind. In the native form, plum stone itself can be considered as a favourable source for energy, bio-chemicals or bio-fuels production. Furthermore, plum seed (placed inside the plum stone) is characterized as highly nutritious, because of the significant amounts of oil that contains various bioactive compounds (phytosterols, phenolic compounds, carotenoids, and squalene tocols,), proteins, and lipids. Due to its low price and rich chemichal composition, the aim of this study was to valorize plum seed, after plum seed oil extraction, in direction of biomaterials production. After removing plum seed from plum stone, plum seed was defatted to a certain extend in order to produce source suitable for making composite biopolymer films. In this way, residue plum seed oil could contribute to the biopolymer film properties improvement, because of the lipofilic nature and its antioxidative capacity. Other direction of defatted plum seed (DPS) utilization is to isolate plum seed protein and obtain protein-based biofilm. Obtained films (composite and protein-based) are homogeneous, coherent, smooth and non-transparent, so that they present great potential for further development and optimization, but composite biopolymer films are prefferd in terms of low-cost and zero waste process.

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INFLUENCE OF PROCESS PARAMETERS ON MECHANICAL PROPERTIES OF BIOPOLYMER FILMS OBTAINED FROM FLAXSEED OIL CAKE

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Natural, degradable materials, available from renewable sources are the subject of numerous studies aimed at expanding their application in the packaging sector. Some biopolymer materials could be obtained from biomass and/or agro-industrial waste. This paper deals with the examination of the material obtained from flaxseed oil cake (FlOC), a by-product of the oil processing industry, which remains after oilseeds cold pressing. Filmogenic solution was prepared from 10% FlOC suspension with the addition of glycerol in concentrations: 10%, 20% and 30% (relative to the oil cake). The pH of the solution was then adjusted to values: 8, 10 and 12 and solution was heated to temperatures: 60 °C and 90 °C for 20 minutes. By varying process parameters 18 samples were obtained and visually described. Basic mechanical characteristics were determined to the samples: the thickness, tensile strength and elongation at break. The obtained films have very similar visual characteristics: they are dark brown, opaque, firm, non-flexible and brittle, with granular surface. With the increase of the applied pH, a color gradient was observed: the films were becoming darker. The thickness values of the examined biopolymer films ranged from 107 to 149 mm. Based on the obtained results for tensile strength, it was noted that the application of higher temperatures and pH during film synthesis had a significant impact on increasing the tensile strength values. On the other hand, higher temperature during processing caused lower values for elongation at break. By varying the process parameters, it is possible to influence the properties of biopolymer films. Since the mechanical properties improvement of the biopolymer material based on FlOC implies increase in tensile strength and elongation at break values-it can be concluded that it is necessary to direct the process parameters to higher pH values and higher glycerol values.

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INFLUENCE OF FLASH THERMAL TREATMENT ON ANTIOXIDANT ACTIVITY OF VIRGIN OLIVE OIL

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Innovative technologies are being widely studied for their application in the production of virgin olive oil. Flash thermal treatment is one of these techniques, since the regulation of temperature allows control over complex enzyme systems that affect the nutritional value, oxidative stability and sensory profile of virgin olive oil [1-3]. The aim of this study was to determine the effects of flash thermal treatment (both cooling and heating) on the antioxidant activity of virgin olive oil from four different varieties (Oblica, Rosulja, Istarska bijelica and Levantinka). Flash thermal treatment was applied at 6 different temperatures in the range of 15-40 °C. It was used as a malaxation pretreatment for the production of virgin olive oil on a laboratory scale using the Abencor system. The antioxidant activity of the produced oils was determined using the DPPH method previously described in Ref. [4]. The results show a significant influence of the variety and pretreatment on the antioxidant activity of virgin olive oil, as well as their interaction. Rosulja had the highest antioxidant activity (90.8% on average) compared to the other three varieties (84.3, 75.6 and 74.8% for Oblica, Istarska bijelica and Levantinka, respectively). In relation to the applied flash thermal treatment, Oblica, Rosulja and Levantinka showed significantly higher antioxidant activity at the highest temperature (40 °C), while Istarska bijelica responded better to mild temperatures (20-30 °C).

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P-64

CLEAN DRINKING WATER: THE KEY TO A SAFE FOOD INDUSTRY IN THE FUTURE

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Water is the foundation of earthly existence and the driving force behind human development. At the same time, however, humanity's need for water is growing, and industrial and social development has caused serious damage to the Earth's water supply. Perhaps due to large-scale development and industrialization, it is becoming increasingly difficult to obtain drinking water of the right quality and quantity. Drinking water problems are very different in developed and developing countries. While in the case of the latter, unfortunately, many people are still affected by water shortages and water-borne diseases, in the case of the former, the population is threatened by completely different dangers arising from modern lifestyles. In the case of developed countries, water disinfection by-product compounds (DBP) pose a real and growing threat to the health of the population. Food industry uses a large amount of drinking water, which of course appears not only as technological water, but also as a component of food, it is of utmost importance that this drinking water be as clean as possible, not only microbiologically, but also chemically. Although many publications related to DBP have been published in recent years, this topic still receives little attention, especially in relation to the food industry. This poster presentation focuses on the by-products of drinking water treatment, the problems they can cause and the possibilities of testing.

P-65

PHYSICAL PROPERTIES OF MUFFINS FORTIFIED WITH GRAPE POMACE

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The high quality food has been main topic of research in the last decade. Consumers are becomming more aware of the benefits of good nutrition and are in constant demand of better and more nutritional food products. Food products that address different health issues, social and cultural trends etc and that can be suitable for a variety of consumers. Among the pool of newly developed functional foods, great part belongs to alternative bakery products produced with composite flours, containing wheat flour but also some amount of flour made from other grains, or biowaste from fruits or vegetables processing. There is a growing interest for valorisation of by-products generated within the food industry. The aim of using composite flours is to improve the nutritional value of bakery products. One of the big biowaste producers is the winemaking industry ending the process with large quantity of grape skin, stalks and seeds, that contain bioactive compounds (polyphenols, anthocyanins, and flavonoids), dietary fibres and free monoterpenes, and can be obtained for free or at very low prices. These by-products in a form of powder can be used as partial substitution of the wheat flour without changing the calorie value of the product. Muffins are sweet bakery desserts that are easy to make and are consumer's favourites because of their fine taste and soft texture, but they cannot be categorized as a healthy snack. The aim of this research was to determine the impact of different concentrations of grape skin, stalk and seed flour, as a replacement of conventional flour in a muffins, considering their physical characteristics. The new muffin formulations were compared with control recipe, prepared with wheat flour. It was noticed that the diameter, height, mass and porosity increased with the gradual addition of grape pomace. The water content was decreasing with higher percent of added pomace and the water activity did not changed. The color of the fortified muffins turned darker and the red and yellow tones have also decreased. The water activity of the muffins was between 0,81-0,84, leaving them prone to microbiological deterioration if not packaged properly.

P-66

CONTROL OF *PSEUDOMONAS* BIOFILM BY THYME AND OREGANO

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The ability of *Pseudomonas fluorescens* and *P. aeruginosa* to adhere to surfaces and to form biofilms has significant importance in cheese industry, due to biofilms create a persistent source of contamination and are responsible of blue pigment onto the fresh cheese isolates in a cheese farm in Canary Island. This work was focused about the *P. fluorescens* and *P. aeruginosa* biofilm evolution onto coupon (2 cm^2) stainless steel. The initial inoculum contained was 5 106 cfu/ml. The efficiency of two essential oil from thyme (*Thymus vulgaricus* CT6 organic) and oregano (*Origanum compactum* organic) was probed in well multidish against biofilm for 1, 2, 3, 7 days. A wide range of chemical disinfectants is used in the food industry, which can be divided into different groups according to their mode of action, (oxidising agents as chlorine, hydrogen peroxide and PAA; surface-active compounds including quaternary ammonium compounds), nevertheless all can be pollutants to the environment and these conditions need a more natural alternative. Variance analysis results did not show a significant difference ($P<0.05$) among the two essential oils used in the formation biofilm. The number of viable cells adhered onto the coupons surfaces were reduced in the order of 6-7 log cycles for thyme and oregano. These results show the efficacy of thyme and oregano against to *Pseudomonas* and the use of them in the formulation of used disinfectants in the food industry.

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ANTIPROLIFERATIVE AND ANTIMICROBIAL ACTIVITIES OF ESSENTIAL OIL AND EXTRACT FROM *TROPAEOLUM MAJUS* L. ALTUM SEEDS VS. THEIR ISOTHIOCYANATE CONTENT

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Tropaeolum majus L. is a plant belonging to the Tropaeolaceae family, and is rich in benzyl glucosinolate [1]. The degradation product of benzyl glucosinolate, benzyl isothiocyanate (BITC), exhibits various biological activities, such as antiproliferative and antimicrobial activities [1]. Two modern extraction techniques (microwave-assisted distillation (MAD), and microwave hydrodiffusion and gravity (MHG)) were used to prepare essential oil (EO) and extract from *T. majus* seeds, afterwards their chemical composition of volatile compounds was investigated with GC-MS/MS present in. The biological activity of samples (EO, extract and pure compounds) was focused on the antiproliferative effect against different cancer cell lines: cervical cancer cell line (HeLa), human colon cancer cell line (HCT116), and human osteosarcoma cell line (U2OS), while antibacterial activity was evaluated by determination of minimal inhibitory concentration (MIC) and anti-adhesion effect on polystyrene surface of *T. majus* samples against *Staphylococcus aureus* and *Escherichia coli*. EO of *T. majus* enriched with BITC showed higher antiproliferative activity (IC50 < 5 µg/mL) than *T. majus* extract (IC50 < 27 µg/mL) against three cancer cell lines: HeLa, HCT116, and U2OS. BITC showed significantly higher inhibitory effect on the proliferation rate of all tested cancer cells compared to BCN. T. majus EO and extract showed strong antibacterial activity against *S. aureus* and *E. coli*, with MIC values ranging from 0.06 mg/mL to 1 mg/mL, respectively. Among tested formulations, BITC had the best anti-adhesion activity, even in subinhibitory concentration against both bacteria. Studies on the antiproliferative and antimicrobial activities of EOs and extracts rich in isothiocyanates, are of great importance as they have the potential to target different types of carcinomas or to extend the shelf life of food as natural preservatives in the food industry.

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MICROBIOLOGICAL CONTAMINATION OF FRUITS AND VEGETABLES IN MAJOR SLOVENIAN GROCERY CHAINS

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The aim of the study was to: (1) monitor the behaviour of employees and consumers in the handling of fruit and vegetables and (2) determine the microbiological contamination of selected fresh fruits and vegetables on the shelves of the selected retail chain. Sampling and observations were performed at each branch three times during the summer period. The handling of fruit and vegetables in the store was observed in 12 employees and a total of 120 consumers. At the opening of the store and before closing, we collected three pieces of conventionally grown apple, peach and grape fruit, vegetables; peppers, tomatoes and lettuce from the same shelves and determined the total number of aerobic mesophilic microorganisms and psychrotrophs on their surface by counting colonies on solid media, number of bacteria of the family Enterobacteriaceae with *E. coli*, *Staphylococous* spp., *Micrococcus* spp., *Bacillus* spp. and fungi. In total, 41.4% of consumers used gloves. As many as 95.3% of the observed consumers picked up and squeezed fruit and vegetables while shopping. Among the employees, only one wore protective gloves. Filling the shelves with fruit and vegetables with the shaking out technique was performed by one employee. The rest of the individual produce was placed on the shelves by hand. *Salmonella* was present on the surface of 6 (8.3%) samples, *Listeria monocytogenes* was not detected. *E. coli* at a concentration above 102 CFU / 100 cm^2 was confirmed in 5 (6.9%) samples, *Staphylococci* and *Bacillus* in 94.4% and moulds in 98.6% of samples taken from fruit and vegetables. The average total number of aerobic mesophilic microorganisms was 6.25 log CFU / 100 cm^2 area, the least on apple and the most on lettuce. We found a statistically significant higher number of all groups of microorganisms in the evening compared to the morning samples of produces ($p < 0.001$). Consumers are not aware enough about the proper handling of fruit and vegetables. Employees did an outstanding work at handling and removing damaged fruits and vegetables. The number of all groups of microorganisms in most samples was higher than their number in the morning samples.

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EFFECT OF *DUNALIELLA SALINA* AND *SPIRULINA PLATENSIS* ON GROWTH OF LACTIC ACID BACTERIA AND THEIR ADHERENCE

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Algae and lactic acid bacteria have been used in human and animal food supplements and fermented foods for decades. They represent a rich source of nutrients and bioactive compounds with positive effects on human and animal health. *Spirulina plantesis* and *Dunaliella salina* produce a whole range of bioactive compounds, such as phycobiliproteins or carotenoids, and are approved for use in the food industry. To find the best combination of algae and bacteria for developing new functional foods combining algae and bacteria, we aimed to assess the effect of *Dunaliella* and *Spirulina* on growth of lactic acid bacteria and bifidobacteria. The synergistic effect of algae and bacteria on adherence to the cell lines Caco-2 and HT29 was also investigated. The growth ability of selected strains from family Lactobacillaceae and genus Bifidobacterium were evaluated in basal medium enriched by 1.0 % (w/v) *Dunaliella* or *Spirulina* commercial powders. The evaluation was based on production of lactic and acetic acids, viable cell counts (CFU/ml) and change of pH of the cultivation media. Addition of *Spirulina* promoted the growth of most of the tested bacteria more compared to *Dunaliella*. The addition of algae together with bacteria led to a decrease of adherence to Caco-2 and HT-29, except the commercial strain Bifidobacterium animalis subsp. lactis BB12, in which increased adherence ability to human cells after algae enrichment was noted. These results demonstrate that various types of algae and bacteria may have specific synergic effect. For the development of new fermented products, it is necessary to find the right combination based on the functional properties of individual combinations of algae and bacteria, their applicational form, as well as their right concentrations for acceptable sensory quality of the final products.

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UTILIZATION OF WASTE ACID WHEY FROM DAIRY INDUSTRY IN THE PRODUCTION OF MICROORGANISM-ENRICHED HYDROGELS

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Acid whey, which is in particular a by-product of curd, is considered a waste product of milk processing in the dairy industry. Its use is very limited. Its main use is to fatten livestock, but its application as a soil fertiliser is also possible. In our research, we focused on the use of this interesting material for the production of hydrogels, i.e. cross-linked hydrophilic polymeric materials capable of binding and then releasing water. Hydrogels with these properties help to keep the soil naturally moist, which, especially with the ongoing climate change, is important for the sustainability of crop production. For this purpose, hydrogels based on carboxymethyl cellulose and whey acid with a crosslinking agent citric acid have been produced. To improve biodegradability, the possibility of enriching these hydrogels with yeast (*Saccharomyces cerevisiae*, CCDM 281) or lactobacilli (*Lactobacillus plantarum*, CCDM 182) was proposed. Mainly yeasts thrived in the given matrix and their numbers were 6,5.105 KTJ/g even after 6 months of storage at laboratory temperature. The absorption capacity of hydrogels was studied with their dried version called xerogels. These were soaked in a defined amount of distilled water for 24 h in 3 cycles. The water absorption of the hydrogels was found to be 113.5%, 194.5% and 307.9% in the respective cycles. After the first cycle of soaking, a significant content of phosphoric acid (232 g/100 ml), Na+ (1251 mg/l), Ca2+ (519 mg/l), Mg+ (46 mg/l), K+ (915 mg/l) and non-protein nitrogen (0.31 g/100 g) was detected in the xerogel extracts. The tested hydrogel is made of fully biodegradable materials and it is promising as a reversible source of water and nutrition for sustainable agriculture.

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POLYPHENOLIC COMPOUNDS COMPOSITION AND ANTIOXIDANT ACTIVITY OF THE SELECTED HERBS

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This study aimed to determine the composition of phenolic compounds and antioxidant activity in ten different herbs (bogbean leaves, sage leaves, Indian hemp, heartsease, horsetail, blessed thistle, thyme, chamomile, corn silk and pine buds). Free polyphenolic compounds were extracted from samples using 24 h extraction with a mixture containing water/methanol/formic acid. However, conjugated polyphenolic compounds (released from soluble esters and soluble glycosides) were isolated from the obtained extracts using acidic and alkaline hydrolysis, according to the method described by Płatosz et al. [1]. Phenolic compounds were analyzed using the HPLC-TOF-MS/MS method, total phenolic (TP) and flavonoid (TF) contents, and antioxidant activity by ABTS and DPPH assays. The highest content of free TP was found in thyme, while sage was characterized by the highest range of these compounds released from ester and glycosidic bonds. While, the highest values of TF in non-hydrolysis extracts were found in Indian hemp. The highest TF values were observed in extracts obtained from sage leaves as with bound phenols. Analyzed herbs contained thirty-three phenolic compounds, constituting sixteen phenolic acids, nine flavonoids and eight stilbenes. In addition, the compounds analyzed appeared mainly in the bound forms than in the free form. Herb extracts antioxidant activity differed significantly across varieties. The research showed that each tested herb possesses its unique fingerprint of phenolic compounds and antioxidant properties.

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IN VITRO NUTRITIONAL VALUE RESEARCH OF POMEGRANATE JUICE (PUNICA GRANATUM).

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Pomegranate juice produced by crushing the arils, theoretically is a new drink for many consumers. However, in recent years has begun to gain ground over classical juices available commercially for many years. Pomegranate juice is a great source of various valuable macronutrients, micronutrient and phytochemicals, which are necessary to promote human health. The purpose of this research is to determine the in vitro antioxidant, anti-atherogenic, anti-inflammatory, and antithrombotic activity of pomegranate juice from arils. For the requirement of that research, was obtained pomegranate juice by used pomegranates (Punica granatum L.) from seven different areas of Greece. We used pomegranates from the area of Thrace, Thessaloniki, Laconia, Limnos, Repanidi-Limnos, Troizenia, and Hermione. The juicing from each pomegranate arils performed in laboratory by simple pressing. The seven different samples of pomegranate juice were analyzed for their content of total phenolic by Folin-Ciocalteau method and for their content of total flavonoids by spectrophotometry. Antioxidant capacity was assessment of all samples through assays DPPH, ABTS, FRAP, and CUPRAC. In vitro antiatherogenic activity was evaluated by measuring human blood oxidation inhibition, caused by ions Cu^{2+}. The in vitro anti-inflammatory activity was evaluated by determining the inhibition of the lipoxyganase (LOX) and PAF-acetyl hydrolase (PAF-AH) enzymes. Finally, the antithrombotic activity of samples was determined by the inhibition of the thrombotic lipid mediator known as Platelet Activating Factor (PAF) in human Platelet Rich Plasma (PRP). All samples of pomegranate juice exerted in vitro antioxidant and antiatherogenic activity. Six of the seven samples showed antithrombotic capacity, whereas no sample exhibited anti-inflammatory activity with the specific methods.

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A CUP OF GREEN TEA A DAY KEEPS THE DEMENTIA AWAY

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Ageing is associated with many changes in various areas of life. Cognitive abilities, which decline with age, mainly include the areas of executive functions, attention, working memory and the speed of information processing. In older people, cognitive abilities decline after a certain age. In most cases, these are normal processes of gradual decline in cognitive abilities that accompany the ageing process, and in more extreme cases, it is already a case of dementia or Alzheimer's disease. Dementia, Alzheimer's disease, and Parkinson's disease are the most common neurodegenerative diseases that lead to a gradual decline or even complete loss of sensory, motor, and cognitive abilities. A balanced diet is a key component of a healthy lifestyle and appears to play an important role in preventing neurodegenerative diseases. A balanced diet rich in bioactive compounds can reduce the risk of dementia. Polyphenols form a large group of bioactive phytochemicals and are also found in true tea, which contain almost 4,000 bioactive compounds, a third of which are polyphenols. Studies have shown that tea polyphenols, especially EGCG, have antioxidant, anti-inflammatory, antimicrobial, anti-cancer, and neuroprotective properties. Studies suggests that green tea consumption may slow the development of cognitive impairment in later life. By drinking green tea in combination with a balanced lifestyle, it can be contributed to better well-being and health. Also, the quality of the entire diet and following the recommendations for a healthy lifestyle are crucial.

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WORKPLACE HEALTH PROMOTION - CULINARY TEAM BUILDING

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At the Secondary School of Nursing Ljubljana, a culinary team building was organized for the employees, where they got to know the Mediterranean diet more closely. The Mediterranean diet encompasses more than just food - it encourages social interaction. It is more than just a diet, as it is a whole lifestyle in which physical activity plays an important role, as well as the pleasure of jointly preparing and eating food with others. The word "Mediterranean" is of Latin origin and means "sea in the middle of the earth". Together with the participating employees in the culinary team building, a piece of the Mediterranean was created in the school kitchen. A demanding project was undetaken with the aim of raising awareness of healthy eating in the workplace. We also fulfilled the wishes of our employees for relaxed socializing and connecting in a slightly different, simple and carefree way. We are convinced that such gatherings contribute to even greater motivation and work zeal, not only that, but also to a healthy lifestyle. In Slovenia, the research shows that the active working population belongs to the endangered group in terms of eating habits. Low intake of vegetables, unregulated diet, high energy intake and intake of salt and sugar are among the key dietary problems that significantly affect many chronic non-contagious diseases of modern times. The goal of the project is to have healthy and vital teachers who will skillfully cope with everyday challenges through their lifestyle and diet.

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NUTRITIONAL VALUE OF SUGAR BEET LEAVES

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Sugar beet leaves represent a by-product of sugar industry and are usually used as animal feed. However, with growing popularity of plant based meals, green biomass has gained a lot of attention as a plant protein source. Green parts of sugar beet (leaves) represent efficient sources for protein extraction, which could later be used in food products. Valorization of sugar beet leaves would decrease amount of waste products from sugar industry, positively affecting the environment. In order to effectively find use of sugar industry by-product, nutritional value was determined. Results have shown that sugar beet leaves could be valorized as protein sources, with protein content of 4.75%. Fat content of raw sugar beet leaves was 0.22%. Sugar beet leaves have high amounts of dietary fiber (4.79%), out of which 31.52% are water soluble fiber. Total amount of sugars was 4.38%, while the sucrose content was 2.39%. Amount of reduced sugars in the sample was 1.67%. Proteins from sugar beet leaves could be extracted and separated into two fractions (white and green fraction). White protein fraction consists of essential amino acids that benefit human health and can be used in human nutrition. Green fraction has great amount of impurities and, therefore, is used as animal feed [1]. However, further research is still required to completely understand characteristics and content of sugar beet leaves and proteins.

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P-76

DIETARY HABITS AMONG CHILDREN AND ADOLESCENTS IN SLOVENIA AND VOJVODINA – A COMPARATIVE STUDY

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In cooperation between higher education institutions in Slovenia (SI) and the Autonomous Province of Vojvodina in Serbia (APV), a survey was conducted in the 2017/2018 school year, with the aim to analyze the eating habits of children and adolescents from different geographical and cultural backgrounds. The associations between demographic variables, body mass index (BMI), eating habits and nutritional knowledge were investigated. In total, 1483 correctly filled in questionnaires (657 from SI and 826 from APV) were analyzed - 768 from primary and 699 from secondary level of education, 44.4% from male and 55.6% female respondents, 46.3% from urban, 16.7% from suburban and 37.0% from rural area. Most of the respondents in both countries had normal BMI considering their age and gender. However overall, 17.4% were classified as overweight and 6.1% as obese (girls more frequently than boys), with the overall proportion decreasing with age from 11 to 18 years ($p < 0.001$). Children and adolescents often skip meals, most frequently breakfast. Only 45.6% of respondents in the APV have breakfast daily, from SI only 34.4% ($p = 0.002$). Respondents who reported eating breakfast more often, had in general lower BMI. A weak and statistically significant ($p = 0.043$) relationship was found also between frequency of visiting fast food establishments and BMI of respondents. The knowledge of the respondents was mostly related to their age, and to a lesser extent to geographic region or place of residence. However, overall majority (58.3%) reported no attention to the information on the food declaration. Self-assessment of the amount of food consumed was different – in SI sub-sample, 28.6% of respondents believed that they eat too much, in APV only 16.8% of APV respondents share this opinion ($p < 0.001$). However, overall dietary habits among children and adolescents were not confirmed as different in SI and APV for the period before Covid 19, but the impact of pandemic consequences are urgently needed to study.

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PEANUT ALLERGENS IN ICE CREAM

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Peanut allergy is one of the most common food allergies. Peanut ingredients can have specific characteristics which make it a perfect allergen, and exposure to which can be a risk factor for life-threatening food-induced anaphylaxis [1; 2; 3]. Peanut is often added to various food products, it is a good source of energy and protein with very distinctive and pleasant flavour [4]. For the identification of relevant allergens and protection of consumers from unintentional intake of "hidden" food allergens, very important is food labelling [5]. Therefore, the aim of this study was to examine thirty-nine ice cream samples purchased in pastry shops and also supermarkets on presence of potential peanut allergens. According to the results obtained by ELISA (Enzyme-Linked Immunosorbent Assay) method, peanut allergens were detected in fifteen of nineteen ice cream samples purchased in pastry shops, and in positive samples the content ranged from 0.15 $mgkg^{-1}$ to 12.22 $mgkg^{-1}$. Peanut allergens were detected also in samples of ice cream purchased in supermarkets; in twelve between twenty analysed, and the content was between 0.20 $mgkg^{-1}$ to 5.44 $mgkg^{-1}$. Analytical results of peanut allergen determination obtained by immunoenzymatic ELISA method were also compared with the food informations or labelling informations of the analysed samples regarding the presence of peanut. Accordance in analytical results and food informations was observed in four out of nineteen non-prepacked ice cream samples from pastry shops and eleven out of twenty packed ice cream samples from supermarkets.

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LUPIN DERIVED HYDROLYSATES WITH ANTIOXIDANT AND ACETYLCHOLINE ESTERASE INHIBITORY ACTIVITIES

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In our study enzymatic hydrolysis of lupin proteins was performed using Alcalase. Three enzymes:substrate ratios were set for three different duration times (at pH and temperature optimum for the enzyme). A total of 9 hydrolysates were generated. The degree of hydrolysis (DH) was studied according to orthophtalaldehyde method. Each hydrolysate was studied for antioxidant activity (AOA, according to DPPH, CUPRAC, ABTS, and FRAP methods), as well as for acetylcholinesterase inhibitory activity expressed in concentration in μg/ml that inhibits 50% of the enzyme. SDS-PAGE was also performed. The deepest DH of 32 % was obtained when 2% enzymes was used for 2h hydrolysis. According to the results, the AOA decreases with increasing duration of hydrolysis. The best AOA was measured using ABTS method resulting in 2.26±0.04 – 4.38±0.04 MTE/100g protein. For all the three other methods the activity ranged between 0.51±0.66 – 3.47±0.14 mMTE/100g protein. For the best of our knowledge this is the first report of acetylcholinesterase inhibitory activity of lupine proteins hydrolysates. All the hydrolysates possessed such activity. It varied between 216.57±3.07 and 304.63±5.52 μg/ml. According to our study the Alcalase hydrolysates of lupine proteins can be considered a good source of biologically active peptides. Further studies for purifications and structural analysis of the active peptides are needed.

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IDENTIFICATION OF ANTIHYPERTENSIVE PEPTIDES FROM LUPINE USING A MACHINE LEARNING APPROACH

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Bioactive peptides with antihypertensive action, isolated from natural sources, have been the subject of growing interest in recent years. This is due to their widespread use in medicine for the treatment and prevention of various diseases, as well as dietary supplements for athletes or their inclusion in diets for overweight people. One such source is lupine. An extensive review of bioactive lupine peptides and their properties is [1]. The approaches to screen antihypertensive peptides, based on information technologies and more concretely on machine learning, doubtlessly have higher throughput and rapid speed than the in vivo and in vitro procedures. Therefore, the scientific literature abounds with papers, offering various artificial intelligence algorithms for predicting of food-derived antihypertensive peptides [2-4]. In this study an Adaptive Boosting (AdaBoost) algorithm was developed for this purposes. The obtained results showed that the AdaBoost model as a new supplementary tool is feasible to screen for antihypertensive peptides derived from food, with high throughput and high efficiency.

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EFFECTS OF HYBRID DRYING ON DRYING KINETICS AND COLOUR OF PUMPKIN PULP

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Drying is well-known as an effective process for food preservation. The main benefits of the drying process are restricted growth of microorganisms, reduced degradation reactions related to moisture content, and decreased mass during transportation [1]. Among the advantages of using microwaves in drying, two of them stand out. First, an increase in drying rate with a reduction in time of processing, due to faster diffusion and better heat transfer. Second, the ability to improve quality, including eliminated case hardening and better sensory attributes, appearance, colour, and texture [2]. This study aimed to examine the effect of convective drying combined with microwaves on drying kinetics and the colour of pumpkin pulp (*Cucurbita maxima*). Hybrid drying of pumpkin pulp were performed at five microwave powers (119 W, 336 W, 462 W, 595 W, 700 W) for 2 minutes coupled with hot air drying (60 °C, air velocity 1 ms^{-1}). The results show that microwave-assisted hot air convective drying significantly affects drying kinetics and colour. Higher microwave power shortens the drying time. Total colour difference is increasing due to the increase in microwave power. Increasing the microwave power results in a decrease in lightness (L*) and yellowness (b*). The hybrid drying can be accepted as an alternative drying process for pumpkin pulp.

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ACRYLAMIDE CONTENT IN DIFFERENT TYPES OF BREAD DURING TOASTING

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Industrial food processing as well as home cooking results in many benefits such as microbial inactivation, destruction of toxins, improved bioavailability of nutrients and formation of desired colors, textures and aroma compounds. However, the formation of undesirable compounds such as acrylamide can be also obtained. The aim of this study was to determine the increase in the concentration of acrylamide due to the different toasting time of different types toast breads. Toast bread samples of wheat, wholemeal wheat, spelt, protein and rye were toasted for 60, 75 and 90 seconds. After toasting, instrumental measuring of texture and color of toasted samples was performed, and dry matter determination. The amount of acrylamide was determined by liquid chromatography (UPLC / MS-MS method), and the concentration of the amino acid asparagine, which is known as a precursor for the acrylamide formation in cereal-based products, by HPLC method. According to the obtained results, longer thermal treatment produces more acrylamide, but the values of acrylamide concentration in samples are within the reference values prescribed by the European Commission Regulation, except for rye toast toasted for 90 seconds (119 μg kg^{-1}). Longer toasting time increases the hardness of the samples, and rye toast (1.71 N) has the highest hardness. In comparison to untoasted bread, in wheat toast after 90 s of toasting the biggest color difference was determined. The most important precursor of acrylamide formation in bakery products is asparagine. A statistically significant linear correlation was found between the concentration of asparagine in untoasted samples and the concentration of acrylamide formed in toast samples after toasting.

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PHENOLIC COMPOUNDS IN BEEBREAD SAMPLE EXTRACTS

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Beebread represents collected pollen with the mixture of honey and bee enzymes, which has passed the fermentation process and is stored in the comb. It is a valuable food for bees, as well as for humans. Beebread, like bee pollen, is characterized by its nutritive richness, which is based on phytochemicals [1]. Besides the similarity between beebread and bee pollen, the remarked differences were also summarized in the literature [2,3]. The botanical origin is also crucial for the beebread composition [3]. Moreover, the phenolic content of beebread is directly dependent on the botanical origin of the pollen found in beebread [3]. Using modern analytical techniques such as ultra-high performance liquid chromatography (UHPLC) connected to the triple quadrupole mass spectrometry (MS), with a diode array detector (DAD), compositions of phenolic compounds in beebread samples were analyzed. It has been quantified 16 phenolic compounds (5 phenolic acids and 11 flavonoids and glycosides). The most dominant phenolics were quercetin and derivatives. Furthermore, compared to all phenolic compounds, the glycosides were the most abundant. The profuse content of isorhamnetin agrees with the literature data [3]. The results of phenolic compounds in beebread samples could be useful to reveal their nutritional value and increase health-promoting properties. Thus, this type of research provided the connection of the polyphenols with the botanical origin, as well as with the medical impact of these products. Considering the positive effects of polyphenols on human health, beebread has high potential as a natural and functional ingredient.

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SURVIVAL AND GROWTH OF *SALMONELLA ENTERICA* IN DATE PASTE AND SYRUP AT DIFFERENT STORAGE TEMPERATURES

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Contamination of low water activity foods including palm date with pathogenic bacteria is a major concern worldwide. The objective of the current study was to investigate the behavior pattern of *Salmonella enterica* in processed date paste and syrup at different temperatures. Processed paste and syrup of date palm were purchased from the local markets and divided to 50 g samples which were inoculated with approximately 6.0 log CFU/ml of a cocktail culture of five-serotypes of *S. enterica* and stored at 4, 10 and 24°C for 90 days. At 4°C, *S. enterica* was able to survive till the end of storage period and the numbers were reduced by 2.1 and 3.4 log CFU/g, respectively; however, a complete elimination of *S. enterica* was attained at 10 °C by 90 days although the pathogen survived in date paste and syrup for 50 days with reductions of 2.4 and 3.8 log CFU/g, respectively. While at room temperature, *S. enterica* showed lower ability to survive in both products and the bacterial numbers were sharply reduced to reach the undetectable levels by 14 days. The initial pH values of date paste and syrup were 4.7 and 4.8, respectively; and remained stable until the end of storage period. *S. enterica* survived well in date products under refrigeration temperatures and it is obvious the necessity of preventing the post-processing contamination of date products during the storage to reduce the potential the risk associated with *S. enterica* in date paste and syrup.

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EFFECT OF SELENIZED *STREPTOCOCCUS THERMOPHILUS*, *ENTEROCOCCUS FAECIUM* AND *SACCHAROMYCES CEREVISIAE* ON CYTOTOXICITY AND ADHERENCE TO CACO-2/HT29 CELLS

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Selenium, as one of the essential microelements for the human body, is important for the proper functioning of organisms, maintenance of the immune system and antioxidant activity. Some bacteria and yeasts are capable of accumulating inorganic selenium form (selenite, selenate) from the environment and transforming them into organic forms, such as seleno-amino acids. Organic forms are less toxic, more bioavailable and utilizable by the human body. Therefore we decided to evaluate the ability of inorganic Se to accumulate and biotransform in *Streptococcus thermophillus* CCDM 144, *Enterococcus faecium* CCDM 922A and *Saccharomyces cerevisiae* CCDM 272. Tested MOs were cultivated in medium enriched with sodium selenite at concentrations of 10 and 30 mg/L. Subsequently, cytotoxicity of selenized strains to human adenocarcinoma Caco-2 and HT29 cells and their ability to adhere was determined. Strains selenized with 30 mg/L of sodium selenite significantly reduced the viability of Caco2 and HT-29 cells by 40–75 % compared with the lower (10 mg/L). The effect of selenium enrichment on adherence is strain-specific. Higher concentration of accumulated selenium by *Saccharomyces cerevisiae* CCDM 272 led to increase of adherence ability. The opposite result was determined in case of Streptococcus thermophilus CCDM 144. The results indicate that 10 mg/L sodium selenite is a suitable concentration for balance between tested strains tolerance to Se and their potential cytotoxic effect on the cell tissue model.

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PY-GC-MS APPLICATION FOR MICROPLASTICS IDENTIFICATION AND QUANTIFICATION IN WATER SAMPLES

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It is estimated that about 300 million tons of plastics is produced annually worldwide. Almost 9% (25 million tons) of the total amount ends up as post-consumer plastic waste, out of which it is estimated that 38% ends up in landfill. In the environment, plastics are transformed into microplastics (MPs, size range of 1 μm–5 mm) and nanoplastics (NPs, <1 μm) by weathering, UV radiation, and biological degradation. Fragmentation of plastics into smaller particles has adverse environmental and health effects. Characterization of MPs is of great importance as MPs are detected in terrestrial and marine environments. While the research on marine MP is more advanced, there are immense gaps of knowledge regarding freshwater MPs. Pyrolysis gas chromatography-mass spectrometry (Py-GC-MS) is a common technique used in polymer science. Although Py-GC-MS does not allow the determination of size and morphology of MPs, Py-GC-MS can be used for identification and quantification of commonly used polymers that make MPs or NPs, i.e. polyethylene - PE, polypropylene - PP, polystyrene - PS, polyvinyl chloride - PVC, polyamide - PA, polymethyl methacrylate - PMMA, Polycarbonate - PC, and polyethylene terephthalate - PET. There are scarce data related to the analysis of MPs in water by Py-GC-MS and this paper summarizes them. The total amount of PE, PP, PS, PVC, PA, PMMA, PC and PET in drinking water ranged from 6.1 to 93.2 μg/m^3. In the effluent water of the wastewater treatment plant, the concentration of PS was 60 μg/m^3. The most abundant polymers found in surface waters were PE, PP, and PS. Despite of advantages of Py-GC-MS, for full characterization of MPs new analytical tools and a combination of available technologies are needed to complement the respective limitations of each technique for reliable characterization (morphological, physical, chemical) and quantification of MPs.

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DETERMINATION OF SEMI-VOLATILE ORGANIC CONTAMINANTS IN SUGAR BEET AND SUGAR BEET PRODUCTS

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Sugar beet is one of the most cultivated crops but because of the ubiquitous environmental presence of organic contaminants such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and pyrethroids (PYRs), its products can be one of these chemicals' entry points into the food/feed chain with effect on human health. The aim of this study is to analyze the presence of 16 USEPA PAHs, 6 indicator (non-dioxin like) PCBs, 18 OCPs, and 6 PYRs in samples of sugar beet, white and brown sugar, and dried sugar beet pulp collected in Serbia. Preparation of sugar samples for analysis of OCPs, PCBs, and PYRs was performed by AOAC 970.52, while for PAHs extraction from sugar and dried pulp, liquid-liquid and Soxhlet extraction were used, respectively, followed by solid-phase clean up on silica gel. The analysis of PCBs, OCPs, PYRs, and PAHs was performed by using gas chromatography (GC) coupled with a micro-electron capture detector or with mass selective detector (MSD). The performances of the applied methods were validated taking into consideration all validation parameters (blank, replicate, spike samples). The obtained recoveries were in the range: 67.0-94.1 % for OCPs, 88.3-98.4 % for PCBs, 72.5-88.2 % for PYRs and 63.7-112 % for PAHs. Only in dried pulp sample some of the considered contaminants were detected at levels above the limits of detection. The PAHs and PCBs were detected in the range of 1.39-8.32 μg/kg and 1.32-2.02 μg/kg, respectively. The detected PCB levels were similar to the average values reported in the summary of available data on the PCB occurrence in feed and feed components of plant origin in the EU [1]. The presence of PAHs and PCBs in the dried pulp could be attributed to their ubiquitous presence. Additionally, drying system of the pulp where gases from a combustion chamber are in direct contact with the pulp might be a source of detected PAHs.

Acknowledgment
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P-87

MICROBIOLOGICAL STABILITY OF READY-TO-EAT EGGPLANT SPREAD WITH BIOACTIVE EXTRACT ADDED IN THE PRODUCT AND IN A PACKAGING COATING

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There are many versions of Ready-To-Eat (RTE) eggplant spread, but generally consists of roasted eggplant, oil and spices. Once made, it is stored in the refrigerator and eaten directly without further preparation. Microbial spoilage of this product can be caused by various psychrotrophic bacteria, but pathogens such as *Listeria* can also be present. To prolong the microbiological stability of RTE eggplant spread, preservatives are added either to the product itself or as a packaging coating. Possible sources of natural preservatives include agricultural by-products and secondary metabolites of lactic acid bacteria (LAB). In this study, we evaluated the antimicrobial potential of polyphenolic extracts from blackberry and juniper by-products, *Lactiplantibacillus paraplantarum* cell free spent medium (CFSM), and active polylactic acid (PLA) packaging foil with chitosan and the mixture of the extracts in RTE eggplant spread during cold storage. We evaluated the effects of: a) the mixture of blackberry leaf and juniper by-product extracts in a 1:1 ratio, b) CFSM, c) functionalized foil, and d) the combination of all three on the natural microbiota of RTE eggplant spread – so the total mesophilic and psychrotrophic counts were determined, as well as the activity against *Listeria innocua* and *Pseudomonas fragi* strains in the challenge test. No reduction of mesophilic bacteria count was observed, however, their numbers did not increase during storage. Also, the functionalized foil did not improve the microbiological stability of RTE eggplant spread compared to the control. Psychrotrophic bacteria were not detected in the spread. CFSM showed pronounced anti-listerial activity, which was not enhanced by the addition of the extract mixture. The opposite was observed for *P. fragi*, where the extract mixture alone or in combination with CFSM showed the best anti-pseudomonal effect in RTE eggplant spread. Therefore, combination of CFSM and extracts has potential to prolong the microbial stability of RTE foods.

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P-88 Canceled

P-89

EVALUATION AND USE OF FIBER-RICH CO-PRODUCTS OF THE COCOA AGRO-INDUSTRIAL CHAIN

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Cacao shell (CS) and cacao pod husk flour (CPHF), two high-fiber co-products of the cacao agro-industrial chain, were evaluated to determine their potential incorporation into food products [1]. We found that CS is rich in protein, lipids, dietary fiber (48.1%), epicatechin (1.10 mg g-1) and isoquercetin (1.04 mg g^{-1}). In this study, CS (0, 1.5, and 3.0%) was incorporated into a meat burger and its effect on the properties of the raw and cooked hamburger was evaluated. CS significantly increased the cooked hamburger fiber (0.13 to 1.78%) and lipids (10.74 to 13.42%) content, increased hardness but with a better chewiness, whereas a lower decrease in weight and volume loss was observed during cooking [2]. CPHF resulted equally rich in dietary fiber (37.4%) and flavonoids (2.9 mg RE g^{-1}); in CPHF, the rapid enzymatic inactivation by thermal treatments was essential to obtain the highest antioxidant activity. Moreover, CPHF had high hydration capacity. The effect of adding different CPHF levels as a starch replacer in frankfurters was also investigated. Results showed that the addition of 1.5 and 3.0% CPHF proportionally increased the frankfurter fiber content. However, textural properties and sensory characteristics were affected. Although these samples had higher water content, hardness and adhesiveness increased [3]. In conclusion, in formulated meat products, like meat burgers or sausages, cacao co-products could be a valid new ingredient to improve technological parameters and functional characteristics.

Acknowledgments
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P-90

ADHESION OF BACTERIA ESCHERICHIA COLI, PSEUDOMONAS AERUGINOSA, STAPHYLOCOCCUS AUREUS AND YEAST PICHIA MEMBRANIFACIENS TO WOODEN SURFACES

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Microbial adhesion and biofilm formation on wooden surfaces is present in many different environments. In the food industry, biofilms can be a source of contaminations, causing food spoilage and reducing quality of products. Therefore, the aim of this study was to evaluate the potential of bacteria *Escherichia coli* ATCC 35218, *Pseudomonas aeruginosa* ATCC 27853, *Staphylococcus aureus* ATCC 25923 and yeast *Pichia membranifaciens* ZIM 2417 to adhere to wooden surfaces such as poplar (*Populus sp.*), Norway spruce (*Picea abies*), European beech (*Fagus sylvatica*) as well as European beech coated with commercial Belinka oil food contact and disinfectant P3-oxonia active 150. In order to better define the factors that could influence the adhesion of bacteria and yeast to European beech surfaces, temperature (10°C, 20°C, 27°C/37°C) and relative humidity (RH; 65%, 75%, 85%, 98%) were also examined. Adhesion was determined by the number of colony-forming units per mm^2 of sample (CFU/mm^2). The results showed that gram-negative bacteria *E. coli* and *P. aeruginosa* exhibited a much better ability for adherence to wooden surfaces than gram-positive bacteria *S. aureus* and yeast *P. membranifaciens*. It was evident that adhesion of *S. aureus* and *P. membranifaciens* was lower on spruce compared to poplar and beech, indicating that this wooden species possesses substantially better hygienic characteristics. In addition, noteworthy is the fact that a drastic decrease in the number of adhered cells for *E. coli*, *S. aureus* and *P. membranifaciens* became apparent when the beech wood surfaces were coated with oil and disinfectant, while in the case of *P. aeruginosa* adhesion was significantly stimulated. Our data also indicated that the lowest relative humidity and temperature had a repressive effects on the adherence of all tested bacteria and yeast, suggesting that these findings offers a great potential applicability in food-processing industry for the purpose of controlling the possibility of biofilm formation.

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BACTERIAL ADHESION RATE ON FOOD CONTACT SURFACES

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Here we present a research of bacterial adhesion to most often used food contact surface in modern kitchen: ceramics, Teflon, wood, granite and melamine faced chipboard [1]. The surfaces were characterized by measuring the contact angle, roughness and streaming potential. To measure the bacterial adhesion on surfaces Escherichia coli, Pseudomonas aeruginosa and Campylobacter jejuni were used as the most common foodborne contaminants. Scanning electron microscopy and crystal violet staining were applied for bacterial adhesion analysis. The measured bacterial adhesion extent shows strong dependence of specific surface properties.

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P-92

TOMATO BROWN RUGOSE FRUIT VIRUS IN AQUEOUS ENVIRONMENTS – SURVIVAL AND SIGNIFICANCE OF WATER-MEDIATED TRANSMISSION

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Tomato brown rugose fruit virus (ToBRFV), an emerging threat for tomato and pepper production was first found in tomato in Israel around 2014, causing mild to severe mosaic on leaves and strong brown rugose symptoms on fruits. Following its emergence ToBRFV has caused outbreaks in many countries worldwide with significant yield losses. The most important means of ToBRFV introduction into new countries and regions is via infested seeds and infected planting material. Due to its physical and biological properties, once ToBRFV is established in the greenhouse it can be easily transferred to other plants by mechanical transmission and it is very difficult to eradicate it using available disinfection techniques. Due to its extreme virion stability, ToBRFV can persist on various surfaces for long period and consequently it can be found in different environmental samples. We detected ToBRFV RNA in wastewater samples (1), in rivers, and in irrigation waters. The results of our study confirmed that infectious ToBRFV particles may be released in irrigation water from the roots of infected plants and that virus can survive in water stored at room temperature for at least four weeks. The objective of our current studies is to investigate the efficiency of ToBRFV transmission to plants via roots with irrigation water in different growing systems such as soil and hydroponics. Our preliminary results have shown that viral RNA can be detected on the surface of greenhouses and on the surface of plants in the presence of heavily infected plants without direct contact, therefore further studies will be conducted to investigate whether this can be a source for plant infection. The results of our studies will fill the knowledge gaps in the epidemiology of ToBRFV and provide a reliable risk assessment to identify critical points for monitoring and control. In addition, our results will significantly contribute to better control of this currently the most important tomato and pepper pathogen.

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P-93

DIET, HEALTH, AND THE GUT MICROBIOTA

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The dynamics and diversity of the human gut microbiota can significantly affect host health. The aim of the present study was to determine to what extent long-term dietary patterns can influence microbiota composition and how this relates to inflammation. A total of 89 asymptomatic healthy adults adhering to four popular diets (vegetarian, vegan, omnivore, and low-carbohydrate high-fat (LCHF) diet), homogeneous by age, gender and BMI were recruited in the study. Dietary intake and a set of demographical and clinical data were collected. Fecal microbiota composition was characterized using 16S rRNA gene amplicon sequencing and SILVA reference database. Hierarchical clustering was performed to analyze the microbiota data set. The agglomerative clustering algorithm - based on microbiota at the genus level - suggested the presence of five distinct community types. *Prevotella* was the most abundant in the cluster with the most favorable inflammatory profile, where only vegans that consumed high amounts of carbohydrates, legumes, fiber and folic acid were found. In addition, the beneficial inflammatory profile was also found in cluster in which the relative abundance of *Bacteriodes* was the highest; in this cluster, most participants were omnivores and vegetarians and consumed diet with high healthy eating index. On the other hand, the unfavorable inflammatory profile corresponded to the cluster with the higher relative abundance of *Oscillospirales, Dialister, Clostridia,* and *Bacilli* in comparison to other clusters. Interestingly, participants with different dietary patterns were almost equally represented in this clusters. 50 % of participants following LCHF diet were assigned to the cluster with the highest abundance of *Alistipes*. The gut microbiota composition can be considered as useful biomarker of consumption of healthy or unhealthy diet, but not of distinct dietary patterns. Indeed, in four out of five clusters participants with different dietary patterns were observed. Therefore, more research is needed to clearly understand the relationship between diet and gut microbiota.

P-94 NOT PRESENTED

TOMATO CUTIN ISOLATION USING ACID HYDROLYSIS AND SUPERCRITICAL WATER TREATMENT

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Tomato pomace is one of the wastes that is widely used in the field of chemical engineering. In the pulp part of the tomato, the skin contains a macrostructure called cutin. Cutin is a polymer that contains long C12-C19 chains that are used as a biopolymer or an active compound for pharmaceutical synthesis [1] [2]. The purpose of the study is to isolate the structure of the cutin from macromolecules and other elements through physico-chemical methods such as acid hydrolysis and extraction with supercritical water. As a reference weight, 1 kg of *Solanum Lycopersicum* tomato pulp has been taken, which is composed of 30% skin and 70% pulp. After the skin is separated by the sedimentation method, chemical methods such as acid hydrolysis with H_2SO_4 72% wt and extraction with supercritical water are used to evaluate the most efficient combination to obtain the purest cutin [3].

Acknowledgments
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P-95

PRODUCTION OF NISIN IN ACID WHEY AND ITS PURIFICATION

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Byproducts from the food industry can have a significant impact on the environment. One such byproduct is acid whey, which is produced during the fermentation of milk in the production of Greek-type yoghurt or fresh curd cheese. Although highly nutritious, it contains lactic acid, which hinders further processing. Therefore, with an annual global production of millions of tonnes, new solutions for acid whey are needed, both from a nutritional and environmental point of view [1]. In this study, we developed methods for the reuse of microfiltered acid whey from which proteins were partially extracted by chromatography. The resulting whey contains unchanged concentrations of lactose, lactic acid, minerals, individual whey proteins, peptides, and other growth factors that microorganisms can use for their metabolic activity. For nisin production, we have enriched whey with yeast extract and inoculated it with our own Lactococcus lactis isolates from traditionally manufactured fermented milk. We optimised the production of nisin in 1 L- and 2.5 L-bioreactors. Nisin production was improved when the pH was adjusted above 6 during fermentation, but almost 50 % of the nisin was bound to the pelleted bacterial cells. The nisin could be partially recovered from the pelleted cells by lowering the pH below 3. We also tested different methods of concentration, purification, and analytical determination of nisin. RP-HPLC was the best method for small-scale purification and quantification, while the microdilution method using the indicator strain Lactobacillus sakei ATCC 15521 was best for detecting antimicrobial activity and for rapid semi quantification. When scaling up, ultrafiltration combined with pH adjustment provided the best production yield. We were also able to effectively concentrate nisin by foaming the fermentation broth with detergent and further purifying it with a combination of methanol and acetone.

Acknowledgements
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P-96

ANALYSES OF ORGANOCHLORINE PESTICIDES AND PCB IN FATTY AND NON-FATTY FOOD MATRICES USING GC/ECD TECHNIQUE

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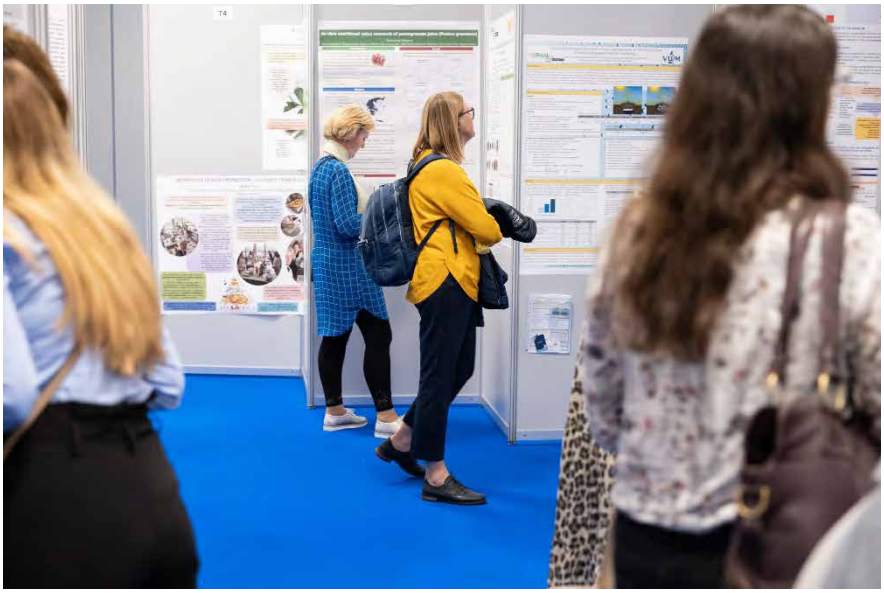
This study presents data on determination of organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) in fatty and non-fatty food matrices from Albanian market and their method validation. Characteristic of these pollutants is their high toxicity. These compounds are found in environments such as soil, water, air, biota and in food chain. Human exposure to chlorinated organic pollutants primarily occurs through food contamination. Fish, meat, fruit, vegetables and other dairy products are the most important dietary sources of pesticides and their metabolites for humans. GC/ECD is the technique used. Pesticides and PCB analysis was monitored in the non-fatty food and fatty food samples for a five years period (2017-2021).The organic pollutants monitoring in food products, especially for the chlorinated ones is a legal obligation. EN12393 method is used for organochlorine pesticides and PCBs in non-fatty food matrices while EN1528 method for fatty food matrices. Samples were taken in random at different domestic markets in Albania. Diversification of samples (liquid and solid fatty foods, liquid and solid non-fatty foods) analyzed in this study make it a valuable guide for analytical laboratories that perform these tests especially for laboratories where GC/MS/MS is missing.Organochlorine pesticides and PCBs were detected in a large number of samples as a result of their previous uses or because of other factors (atmospheric deposition, degradation processes, water irrigation, feed, etc.). OCP levels were found in higher level in fish samples for fatty food samples and in vegetable samples for non-fatty one. Endosulfanes were found higher than other organochlorine pesticides. Pesticide degradation products were found higher than their primary substances because of their previous use. PCB concentrations were found in higher level for chicken (fatty food samples) and wine (non-fatty food samples). Volatile PCBs (PCB 28 and PCB 52) were found in higher level because of atmospheric deposition. OCP and PCB levels for all analyzed samples were lower than accepted levels conform EU and Albanian norms but their monitoring must be continuous.

P-97 Canceled



P-98

CHARACTERISATION OF BOLUS OF BISCUITS ENRICHED WITH GRAPE POMACE

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Food industry nowadays generates a substantial amount of by–products that can be used as an excellent source of nutrients in the functional food production. Functional food market has become very popular and it is rapidly expanding due to the increased consumer awareness and promotion of healthy lifestyle. Foods with special functional properties or increased nutritional value are very trendy among the consumers. The aim of this research is to create functional biscuits using red grape pomace as by–product of wine industry in order to increase the levels of edible fibers and antioxidants in the final product. Red grape pomace, dried and milled, was sieved and used as a substitute for the wheat flour. Functional biscuits were prepared by replacing the wheat flour with grape pomace at different levels. Grape pomace with three different granulations: 1, 0.5 and 0.25 mm was added in four different concentrations: 2.5, 5, 7.5 and 10% substitution in respect of the flour mass, resulting in 12 new formulations plus the control biscuit samples. The main focus was set on the oral processing of the biscuits starting with the initial digestive processes i.e. salivary uptake during mastication. Further characterization of biscuits' bolus was followed through determination of dry mass and texture. It was determined that the rheological properties of biscuits differ between the formulations. Formulations in which grape pomace was added needed less saliva during mastication and lower number of bites. Furthermore, the addition of grape pomace increased the brittleness and hardness of the biscuits and there were changes in the bolus as well.

P-99 Not Presented

MICROSCOPIC ANALYSIS OF STARCH DIGESTION DURING MASTICATION

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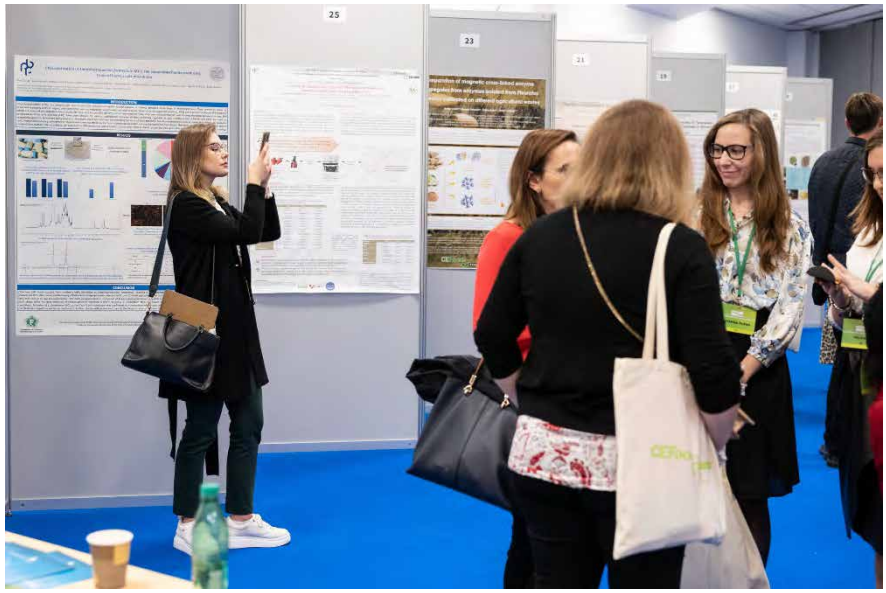
Food industry is constantly developing over the years. With the busy lifestyle, healthy snacks rich in nutrients have become the most convenient way of getting energy on the go. Zero waste from the industries is also becoming more and more popular among producers and consumers. Following the newest trends, cookies, where part of the flour is replaced with grape pulp, a waste product from the wine industry, were made. Grape pulp is known to be rich in bioactive compounds such as: dietary fibres, antioxidants, phenolic compounds, flavonoids and additionally it gives sweetness, colour and flavour to the cookies. In order to assess and compare the structure of the starch and the composition of the granules in the cookies with different percent of grape pulp, pieces of cookies' bolus were placed in glass jar and fixed with glutaraldehyde. After the fixation step, the solution was discarded and the samples were dried in series of ethanol solutions. Then samples were analyzed in bright (light) field microscopy. Additionally the kinetics of starch digestion during mastication was analyzed by examining the bolus at different time intervals. Staining the cookie samples with Lugol's solution enabled identification of the amylose and amylopectin branches.

P-100 Canceled



P-101

COMPARISON OF TWO DEHYDRATION PROCESSES FOR COOKED BEANS AT MATERIAS PRIMAS DE ZACATECAS SPR DE RL DE CV: FORCED CONVECTION AND CONDUCTION.

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Dehydration is a unitary operation widely used to preserve food, and since there are several dehydration methods, guaranteeing the quality of the product and ensuring the yeild of the process becomes essential when selecting the best method to implement in a company. Therefore, the present work was carried out with the objective of evaluating the proposal of a new dehydration process through a rotary drum dryer (RDD) to replace the forced convection dryers (FCD) with which the company MATERIAS PRIMAS DE ZACATECAS SPR DE RL DE CV works to dehydrate cooked beans. The evaluation was carried out through the comparison of both dehydration processes and physical-chemical characterization studies of the finished product. As a result, the RDD is more convenient for the company since its feeding is continuous, compared to the batch feeding of the FCD, increasing the product obtained by 344.8%. Energy consumption decreases by 60% with the use of RDD compared to FCD, as well as the number of human resources implemented and the useful work area for each process, decreasing by 33.3% and 33.9%, respectively. In terms of product quality, the product obtained with a RDD presents a more efficient rehydration, however, its water retention stability is 1.36 times lower than the product obtained in the FCD.

Acknowledgments
This work was supported by the company Materias Primas de Zacatecas SPR de RL de CV which allowed the use of its equipment, the study and publication of the results of the analysis of both processes carried out within their facilities; and the Consejo Veracruzano de Innovación Científica y Desarrollo Tecnológico which gave us financial support and encouragement of the development of project 151210.

P-102

EVALUATION OF RNA ISOLATION METHODS FROM BIOFILM SAMPLES OF *CAMPYLOBACTER JEJUNI*

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Biofilm formation is thought to play an important role in the survival and persistence of *Campylobacter jejuni* in food production and processing [1]. Molecular mechanisms involved in biofilm formation can be studied using gene expression analysis [2]. Several methods of RNA extraction for planktonic bacteria exists but these methods are not optimal for biofilms because the presence of an extracellular matrix can interfere with extraction [3]. Polysaccharides bind to nucleic acids and co-precipitate with them, affecting the yield and downstream applications [4]. We evaluated four different RNA isolation methods (M1-4) for isolation of total RNA from C. jejuni biofilms. We first evaluated M1, as it has been successfully used for RNA isolation from planktonic cells. M1 consists of using TRIzol. This method yielded low RNA quantity and purity. M2 is a modified version of M1 consisting of TRIzol and mechanical cell disruption using bead beating. Mechanical disruption did not improve the RNA quantity and purity. M3 has been used for RNA isolation from plant tissues and uses a lysis buffer containing β-mercaptoethanol and SDS. The use of M3 did not improve the yield and quality of the isolated RNA. Finally, M4 was tested, which is a modified version of M3 – SDS was replaced with CTAB. Using M4, we successfully isolated pure RNA at high concentration. Our results show that not all RNA isolation methods are suitable for complex samples, such as biofilms. Testing different isolation methods is critical for obtaining RNA in sufficient quantity and quality for RNA-based experiments in order to obtain accurate and biologically significant results.

Acknowledgments
The authors thank the Slovenian Research Agency for funding a PhD grant to Manca Volk (No. 52659) and the research project (No. J4-3088).

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P-103

ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF BY-PRODUCTS FROM BERRY JUICE PRODUCTION

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The transition towards the sustainability of food sector includes, among others, the full exploitation of the raw materials and by-products. The aim of this study was to valorize the by-products from traditional berry juice production (blackberry, cherry, aronia) and rosehip extract that are usually wasted from these industries. All samples were collected from the local producers and shade-dried. The extractions were done in 50% EtOH (50 mg dry sample/250 mL) using the microwave-assisted extraction (600 W, 5 minutes). After the extraction, the EtOH was evaporated and the extracts freeze dried. The extracts were described for chemical profiles and total phenolic content (TPC). Besides, they were analyzed for antioxidant activity (FRAP, DPPH, ORAC) and antimicrobial activity against common foodborne pathogens (*Staphylococcus aureus, Listeria innocua, Escherichia coli, Salmonella* Typhimurium, *Campylobacter jejuni*) and spoilage bacteria (*Shewanella baltica, S. putrefaciens, S. xiamenensis, Pseudomonas fragi*) using minimal inhibitory concentration (MIC), minimal bactericidal concentration (MBC) assays and bacterial growth inhibition kinetics. The dominant phenolic components in the samples were rutin in blackberry by-product extracts, gallic, protocatechuic, chlorogenic acid, and astringnin in aronia extracts, and gallic acid and quercetin in rosehip extracts. The TPC of the by-product extracts ranged from 30.10 to 159.31 mg gallic acid equivalents/g dry extract, being the highest in aronia and blackberry by-product extracts. The highest FRAP results (mM Trolox equivalent) and DPPH (% inhibition) was observed for blackberry by-product extracts and rosehip extracts, while ORAC values were the highest in aronia by-product extracts. The strongest antimicrobial effect was observed for blackberry juice and rosehip by-products against *C. jejuni* (MIC 0.125 and 0.25 mg/mL respectively) and for blackberry juice by-product against *P. fragi* (MIC 0.5 mg/mL). Blackberry extracts were found to be the most effective, especially against spoilage bacteria belonging to the genera *Pseudomonas* and *Shewanella*.

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P-104

USE OF DIGITAL PCR IN DETECTION OF GENETICALLY MODIFIED ORGANISMS

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Real-time quantitative polymerase chain reaction (qPCR) has been used for detection and quantification of genetically modified organisms (GMOs) for more than two decades. Quantification of GMOs with qPCR is based on the use of standard calibration curve prepared from reference materials. Digital PCR (dPCR) enables absolute quantification without the need for a standard curve. In dPCR, reaction mixture is divided into many individual reactions called partitions, which can either contain target sequence or not. Because of this binary nature of PCR reaction in partitions, dPCR it is less sensitive to partial inhibition, which can influence quantification with qPCR. We have transferred two simplex qPCR-validated assays targeting the soybean species-specific gene and GM soybean line Roundup Ready® to dPCR system and also merged them in one duplex dPCR assay to enable more time and cost efficient analysis. The assays were assessed on certified reference materials and complex real-life feed samples [1]. dPCR also enables high multiplexing, where many GM lines are present in a single sample. We have developed 12-plex dPCR assay for the detection and quantification of 11 genetically modified soybean lines [2]. dPCR is very advantageous also in verification of methods enabling more precise characterisation of reference materials, including zygosity, ratio of GM target:reference gene and concentration of PCR target.

Acknowledgments
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P-105

TESTING AND SELECTION OF FEMALE CATTLE ON BETA-CASEIN A2A2 GENOTYPE FOR THE PREPARATION OF FUNCTIONAL DAIRY PRODUCTS OF HIGHER ADDED VALUE

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Allergy to milk protein is the most prevalent food allergy in Europe. Among milk proteins, caseins are the most common, with beta-casein accounting for 45% of all caseins. There are essentially two genetic variants of beta-casein, namely the A1 group (with sub-variants: B, C, F and G) and the A2 group (with sub-variants: A3, H1, H2, I, J, K and L). Beta-casein A2 is an ancient variant that mutated to A1 about 10,000 years ago. Through cattle breeding, the A1 form spread to all European and world breeds. It is now present in almost all breeds except the zebu and other ancient Indian and sub-Saharan breeds. When milk containing the A1 but not the A2 form of beta-casein is digested, a 7-residue peptide called betacasomorphin-7 (BCM-7) is formed. BCM-7 is known to cause allergic reactions in sensitive consumers. The aim of the project was to develop and optimise a reliable and cost-effective genetic test to identify homozygous A2A2 cows. For this purpose, over 400 animals were scanned and their beta-casein genotype determined. In cooperation with local farmers, milk from A2A2 cows was collected separately, processed into A2 dairy products and brought to market. Producers of A2 dairy products could benefit financially from the new products, while sensitive consumers may overcome their allergic reaction to milk consumption.

P-106

LACTOBACILLUS PARAPLANTARUM PARAPROBIOTICS RESULTED FROM THERMAL AND HIGH PRESSURE INACTIVATION: A KINETIC APPROACH

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Paraprobiotics defined as inactivated microbial cells (non-viable) that confer a health benefit to the consumer, hold the ability to regulate the adaptive and innate immune systems, exhibit anti-inflammatory, antiproliferative and antioxidant properties and exert antagonistic effect against pathogens. Paraprobiotics are gaining notoriety for their ability to exert health benefits when administered in certain amount. Among health benefits, prevention of respiratory and infectious diseases, viral infection, colitis and allergies, were recognized by researchers. This study identified the time-temperature and/or high-pressure parameters of *Lactiplantibacillus paraplantarum* MIUG BL 74 (deposited strain in the Collection of Microorganisms with the acronym MIUG, https://www.mirri.org/about/member-countries/) inactivation and described the kinetics models mandatory to adequately determine equivalence criteria for producing paraprobiotics. The thermal inactivation could be described by the Weibull model, with 5.6 $\log_{10}$ reduction after 50 min at 70 °C and 8 $\log_{10}$ reduction after 15 min at 90 °C, while Zt = 28.2 °C. An accelerated inactivation was observed between 400 and 600 MPa with 2.7 and 7.5 inactivation log10, respectively. Further, the targeted bioactive compounds produced by *Lactiplantibacillus paraplantarum* MIUG BL 74 strain inactivation in different conditions (as thermal, high pressure or high pressure– thermal treatments) will be identified, characterized and included in functional food formulae within the Biotics+ project framework (https://www.biotics.ugal.ro/index.php/en/).

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P-107

COMPARATIVE EVALUATION OF *IN VITRO* ANTIOXIDATIVE ACTIVITY OF PRESSURIZED HOT WATER AND METHANOLIC EXTRACTS FROM GHANAIAN FRUITS AND VEGETABLES

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A balanced diet rich in fruits and vegetables and a healthy lifestyle is recommended as the best approach to combat oxidative stress which is the precursor to oxidative damage [1][2]. Although Ghana is rich in agrobiodiversity, the potential of many indigenous fruits and vegetables to combat malnutrition and diet-related non-communicable diseases in the country is still poorly investigated [3]. Studies have shown that these wild edible plants may contain significantly higher bioactive compounds, including antioxidants, than their non-native counterparts [4]. Pressurized hot water extraction (PHWE) has gained steady progress among newly developed extraction technologies to become a popular green method [5]. This study aimed to determine the antioxidative effects of extracts using green (PHWE) and conventional (organic solvent) methods. PHW and methanolic extracts of six wild edible fruits and vegetables of Ghana were obtained from the dried plant material and the antioxidative activity of each extract was evaluated in vitro using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method [6]. PHW extracts showed better (or equal) results than methanol extracts. A comparative evaluation of the results suggests that the PHWE technique could be recommended as a more efficient and ecologically safer option for extracting antioxidants. In addition, our study provides evidence that the fruit parts of *C. albidum* and the mesocarp of *C. subnudum* exhibit significant antioxidant properties.

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P-108

INFLUENCE OF BLACK SOLDIER FLY (*HERMETIA ILLUCENS*) DEFATTED FLOUR AS A PARTIAL SUBSTITUTION OF FEED PROTEIN COMPONENT ON CHICKEN MEAT QUALITY

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In the last decade, the use of insects as a source of energy, food, and feed has brought important benefits to the environment and the world economy. Due to the continuous increase in population in the last few decades, the consumption of food worldwide has increased significantly, especially meat, which is in continuous growth. A need for an additional source of protein for fattening animals from sustainable sources emerged, which includes the farming of insects. Secondly, the increased population causes an increase in the amount of generated waste, which is an additional worrisome issue in the context of environmental preservation and protection. One of the most innovative technologies developed to reduce waste is bioconversion with the help of insects, and those insects could be further used as feed for fattening animals. Such an approach presents a good example of the circular economy. The aim of this study is to determine the optimal and maximal protein replacement rate originating from the defatted black soldier fly flour, which cannot adversely affect the chemical and sensory properties of chicken meat. For the purposes of this research a total of 180 one-day-old chickens Ross 308 were used for fattening. Four dietary treatments were designed: a control diet (C) and three diets (HI1, HI2, and HI3) corresponding to 15 %, 25 %, and 45% *Hermetia illucens* defatted flour inclusion levels, respectively. After slaughtering, chicken breast meat and legs with thighs were used for meat quality evaluations, which included water and ash content, protein, collagen, and fat content, as well as sensory properties testing of raw and cooked chicken meat. The results of the study in all experimental diets showed that quality parameters of chicken meat did not show negative results in relation to chicken meat produced according to the requirements of standard fattening. The best results are observed with the dietary treatment containing 25 % of *Hermetia illucens* defatted flour. Also, the sensory properties of fresh and cooked chicken meat did not show significant differences compared to chicken meat in the control diet.

P-109 NOT PRESENTED

COMPARISON OF DAIRY REPLACEMENT PRODUCTS' SENSORIAL AND TEXTURAL ATTRIBUTES

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Today dairy replacement products have become more and more popular, although their techno-functional and sensorial evaluation is still missing from scientifical literature. In this study the texture of different yogurt and sour cream replacement products (based on egg white, coconut, rice and soya) were compared to evaluate the differences to traditional dairy products. The aim of this research was to set goals for further product development in textural point of view. All together five replacement products and two dairy product's texture was analysed by an Anton Paar MCR 921 rheometer applying PP 50 oscillation system. A sensorial test was carried out involving 10 untrained panellists using a hedonistic scale between 1 and 10. Our results show that the replacement product's textures are significantly different in comparison to yogurt and sour cream products, that findings of the objective measurement were supported by the results of sensorial. tests.

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P-110 NOT PRESENTED

INVESTIGATION OF RHEOLOGICAL PROPERTIES OF RED BERRY FLAVOURED DAIRY DRINK REPLACEMENTS

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Consumption of yogurt replacement products may be a nutritious way for a sufficient pre- and probiotic intake for people leading a dairy-less diet. In this study the rheological properties of red berry flavoured egg white based yogurt replacements were investigated. A central composite design (CCD) was carried out to analyse the effects of fruit (1.9 – 23.1 m/m%) and collagen (0 – 3,.5 m/m%) concentration added on rheological properties. Our results show that the effects of both ingredients have significant effects on rheological properties which has a significant effect on constants of Herschel-Bulkey mode respond surface diagram s as well.

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P-111

EVALUATION OF *CAMPYLOBACTER JEJUNI* AI-2 SIGNALLING MOLECULE IN THE FOOD MODEL WITH QUANTITATIVE AI-2 BIOASSAY

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Campylobacter jejuni contaminates various foods as a biofilm-forming pathogen and causes serious public health problems. *C. jejuni* possesses a luxS gene homolog and actively produces autoinducer-2 (AI-2), a signalling molecule also found in contaminated foods. What remains unknown is the production of AI-2 by *C. jejuni* during growth. Therefore, we aimed to develop a whole-cell biosensor method for the quantification of AI-2 produced by *C. jejuni* in a defined growth medium and in a food model (5% chicken juice). First we selected *Vibrio harveyi* biosensor that successfully detect and quantify AI-2 signalling molecules using different modelling and experimental approach. Among four *V. harveyi* biosensor strains (BB170, MM30, BB152, MM32), the most sensitive *V. harveyi* MM30 was selected for further analysis [1]. To quantify AI-2 in *C. jejuni* spend medium (SM), a quantitative AI-2 bioassay was developed to determine the bioluminescence responses of *V. harveyi* MM30 as a function of AI-2 concentration in SM and in medium with known AI-2 concentration. The Hill modelling equation was adopted to quantify AI-2. **C. jejuni** was grown overnight in the defined medium or in the food model under optimal conditions. The AI-2 concentration produced by *C. jejuni* in the food model was 5-fold higher than in the defined medium [1]. In the future, we can envision the integration of such whole-cell biosensor assay into microfluidic systems, which have great potential for multiplex monitoring of various contaminants. In the case of food, such contaminants could be AI-2 signalling molecules that can indicate microbial food contamination.

Acknowledgments
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P-112

THE EFFECT OF ENVIRONMENTAL CONDITIONS ON THE SURVIVAL OF *CAMPYLOBACTER JEJUNI* IN MULTICULTURE BIOFILMS WITH THE FOOD SPOILAGE *PSEUDOMONAS FRAGI*

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Campylobacter jejuni remains the most common cause of bacterial gastrointestinal infections in humans worldwide, usually caused by the consumption of contaminated food, especially poultry meat. The bacteria usually live in biofilms, which also increase the survivability of *C. jejuni* under unfavourable environmental conditions. In addition, the presence of spoilage bacteria as part of the primary food microbiota contributes to bacterial contamination in the food industry and in food products. The spoilage bacterium *Pseudomonas fragi* is a strong biofilm producer that promotes cooperation with the oxygen-sensitive *C. jejuni* through a synergistic partnership. The aim of this study was to investigate the effects of various environmental conditions, such as temperature, oxygen, and time, as well as the ratio between *C. jejuni* and *P. fragi*, on the survival and growth of *C. jejuni* in multiculture biofilms using culturable techniques and a proteomic approach. The results showed that C. jejuni are not culturable under some aerobic conditions in monoculture biofilms, mainly due to exposure to oxygen. However, they survive in multiculture biofilms where oxygen is presumably consumed by biofilm partners through aerobic respiration. Proteomics confirmed the reduced oxidative stress response of *C. jejuni* and DNA repair mechanisms [1]. The synergistic interaction in the multiculture *P. fragi* - *C. jejuni* biofilm enables the survival of pathogenic bacteria and their potential persistence in food and on food contact surfaces. Therefore, knowledge of the cooperative interactions between pathogens and spoilage bacteria is important and needs to be improved to achieve successful control of this most prevalent foodborne pathogen.

Acknowledgments
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P-113

ANTI-LISTERIAL BIOCONTROL IN READY-TO-EAT EGGPLANT SPREAD

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Consumers demand foods with prolonged shelf life in which synthetic preservatives are replaced by natural ones. Of particular interest is the use of natural compounds from agricultural by-products as valuable sources of bioactives and secondary metabolites of lactic acid bacteria (LAB). Ready-to-eat (RTE) foods, especially of plant origin, are a preferred choice in our diet but prone to spoilage and also to pathogen transmission. In this study, we evaluated the antimicrobial potential of polyphenolic extracts from blackberry and juniper by-products and four LABs and their cell free spent media (CFSM) based on the results of in vitro growth kinetics. The extract mixture, selected LAB and its CFSM were used in RTE eggplant spread, where we determined the anti-listerial potential of: a) the mixture of blackberry leaf and juniper by-product extracts in a 1:1 ratio, b) LAB, c) CFSM, d) the combination of a-b, and e) the combination of a-c. In vitro, the mixture of extracts inhibited the growth of *L. innocua*, which was used as an experimental surrogate of *L. monocytogenes*, at a concentration of 0.5 mg/mL. Among the studied CFSM from four LAB species, *Lactiplantibacillus paraplantarum* showed pronounced anti-listerial activity (MIC = 10 % CFSM in the test solution), which was enhanced by the addition of the extract mixture. This was not shown in RTE eggplant spread where only CFSM showed anti-listerial potential and was not enhanced by addition of extract mixture. The addition of the selected LAB strain showed antimicrobial activity only after 7 days, making its addition useful in foods that could be stored longer. The best anti-listerial activity was observed with CFSM of *L. paraplantarum*, indicating its potential use as a preservative in this type of plant-based RTE food products.

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P-114

CHARACTERIZING THE CONTENTS OF SUGAR AND VOLATILE COMPOUNDS, AND SENSORY PROFILE OF SELECTED BEE PRODUCTS

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Bee products are a well-known remedy against numerous diseases. However, from the consumers' perspective, it is essential to define factors that can affect their sensory acceptance. This investigation aimed to evaluate the sugar composition, volatile organic compounds (VOCs) and sensory profiles of bee bread, pollen, honey and beeswax. Glucose and fructose were the major components in the investigated bee products. The highest content of fructose was determined in bee bread, pollen, and honey, whereas the highest content of glucose was assayed in beeswax. Moreover, the highest total sugar content was determined in honey (54.02 g per 100 g of product), then pollen (25.63 g/ 100 g), bee bread (16.81 g/ 100 g), and the lowest one in beeswax (2.09 g/ 100 g). According to the results of headspace solid-phase microextraction and gas chromatography-mass spectrometry (HS-SPME/GC-MS), 20 of VOCs were identified in beeswax and honey, then 32 in bee bread, and 33 in pollen. Alkanes were found to dominate in beeswax, bee bread, and pollen, while aldehydes and monoterpenes in honey. The major VOCs determined in beeswax were 2,4-dimethyl-heptane, octanal, nonanal, and 4-methyl-octane; in bee bread: decane, 1-tridecane, and furfural; in pollen: 2,4-dimethyl-heptane, 4-methyl-octane, decane, acetic acid, and 5-methyl-decane, in honey: benzaldehyde, furfural, and linalool. The content of sugars, colour, and odour descriptors as honey-like, sweet, and pungent, was positively correlated only for honey. Beeswax was related to a waxy odour, whereas pollen and bee bread correlated with plant-based and acid aromas, respectively. It can be concluded that the VOCs profile as well as sugar content, and furthermore sensory analysis depend on the stage of nectar processing by bees. The sensory profiling, determination of VOCs and sugar contents of the selected bee products allow to broad their usage in designing new functional food.

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AWARENESS OF HEALTH BENEFITS OF FERMENTED FOODS AMONG GENERAL POPULATION IN NE SLOVENIA

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The fermentation process has been used by humans for thousands of years [1]. The International Scientific Association for Probiotics and Prebiotics (ISAPP) developed a definition for fermented foods in order to describe their role in human diet and to clarify the difference between probiotics and fermented foods as follows: “foods made through desired microbial growth and enzymatic conversions of food components” [2]. In the past people were mostly unaware of the beneficial effects of fermented foods on their health but recently due to the proclaimed health benefits, fermented foods are becoming increasingly popular [3]. The aim of our study was to examine the awareness of health benefits of fermented foods among general population in NE Slovenia. The cross-sectional study included 367 individuals. An anonymous questionnaire was designed to assess the participants' awareness of health benefits of fermented foods as well as the consumption. The collected data were statistically processed using IBM SPSS 27.0 (IBM Corp. Armonk, NY). Compared with the youngest participants (<21 years) knowledge about fermentation was better in older individuals ($p<0.001$). More than a half of participants knew the fermentation process is led by lactic acid bacteria and yeasts. Only 24.5% of the participants became acquainted with fermented foods at home and 61.3% of them were aware of health benefits of fermented foods, but mostly regarding it’s beneficial effect on gut health and immune system. As people today live predominantly in urban areas and incline towards westernized foods, younger generations often lack the knowledge of fermentation and nutritional value of fermented foods. Steps should be taken to educate younger generations regarding the health benefits of fermented foods especially taking into account that most of them expressed their interest in learning more about this process.

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CAMPYLOBACTER STRESS RESPONSE AND MECHANISM OF POST-TRANSCRIPTIONAL REGULATION INVOLVED IN ADHESION AND BIOFILM FORMATION ON ABIOTIC & BIOTIC SURFACE

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Biofilm formation contributes to the prevalence of the foodborne pathogen *Campylobacter jejuni* and enables it to resist environmental stress both outside and inside the host. Our goal is to provide basic on cell mechanisms: (i) stress response to oxidative and aerobic stress reactions with mutant rrpB [1], (ii) outer membrane protein with mutant omp50 [2], (iii) putative global post-transcriptional regulator with mutant csrA [3], (iv) quorum sensing with mutant luxS [4]. We tracked cell adhesion/biofilm from 24 to 48 hours of wild-type *C. jejuni* 11168 and knockout mutants on the abiotic surface of polystyrene and the biotic surface of Caco-2 cells. In addition, we investigated the virulence potential based on invasion into Caco-2 cells. We showed reduced adhesion and also biofilm formation of luxS, omp50, and csrA to polystyrene compared to wild-type *C. jejuni* 11168 as determined by CFU counting. The adhesion ability of the luxS, rrpB, csrA, and omp50 mutants was also decreased on Caco-2 cells, with the last two mutants more severely affected. As with adhesion, the invasion ability of *C. jejuni* mutant luxS was also reduced in Caco-2 cells compared with wild-type *C. jejuni* 11168, but interestingly, it was also lower than the invasion ability of *C. jejuni* rrpB. Invasion of the csrA and omp50 mutants was less than 100 cells/mL. Interestingly, the luxS, omp50, csrA genes are important for adhesion and biofilm formation to abiotic and biotic surfaces and host cell invasion. We can reveal the potential target of stress response mechanisms, membranous proteins, post-transcriptional regulators and quorum sensing for innovative control of *Campylobacter* contamination and infection.

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GELATIN/SODIUM CASEINATE EDIBLE FILMS AS A POTENTIAL CARRIERS OF VITAMIN C

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In order to increase sustainability in food industry the use of edible films as packing materials presents an attractive, ecofriendly alternative to the classic films made of synthetic polymers [1]. The use of natural compounds, such as proteins, polysaccharides and lipids, as well as their combinations for the edible films and coating formation is becoming more common. Interactions in biopolymer solutions can be used to modify film properties. As a result of interactions in charged biopolymers solutions phase separation, i.e. coacervation, may occur. Coacarvation phenomenon has an application in various areas, including film formation [2]. In our previous work, interactions in gelatin/NaCAS (sodium caseinate) were investigated in a detail, and results showed the appearance of coacervate at gelatin:NaCAS mass ratio of 2:1 [3]. The aim of the present study was to investigate the possibility of obtaining edible films based gelatin/NaCAS, as a delivery system of vitamin C, for nutritional purposes and antioxidant effect on foods. Films containing vitamin C were prepared by casting method and evaluated for FTIR analysis, SEM analysis, mechanical, optical and barrier properties. Obtained results showed that properties of the films are influenced by presence of vitamin C. Also, the influence of glycerin, as a plasticizer, addition was investigated.

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CHEMICAL PROFILE, ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF GREEN TEA

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The increase in the consumer's concern about food safety and the use of synthetic additives in food processing has been a challenge for food producers. To replace synthetic chemicals without the loss of food safety, natural compounds rich in bioactive phytochemicals have been intensively investigated. The aim of this study was to determine the phenolic profile, antioxidant and antimicrobial properties of green tea extracts (prepared using ultrasound bath; 2 h, 60 °C, plant material:water = 15:100). The total phenolic content (TPC) and antioxidant activity (ferric reducing/antioxidant power FRAP; 2,2-diphenyl-1-picrylhydrazyl radical scavenging ability DPPH) were determined, and antimicrobial activity against common food-borne pathogens, three Gram-positive (*Staphylococcus aureus*, *Enterococcus feacalis*, *Listeria monocytogenes*) and two Gram-negative bacterial strains (*Salmonella enterica*, *Escherichia coli*). The phenolic profile, analyzed by HPLC, showed gallic acid, rutin, and epicatechin as the most abundant compounds in green tea extract. The total phenolic content was determined by the Folin–Ciocalteu method, and antibacterial activity using the minimum inhibitory concentration (MIC) method and the well diffusion method. The results indicate a rich content of total phenols 8919,44 ± 26,79 mg gallic acid equivalent (GAE)/L and high antioxidant activity of 100-fold diluted extracts (FRAP: 88.15 ± 4.54 mM Trolox equivalent; DPPH: 67.29 %). Besides, the extracts showed good antimicrobial activity against all tested bacteria. The lowest MIC values (892 mg GAE/L) were observed against *S. enterica*, *E. coli* and *E. faecalis*, while the largest inhibition zone (>20 mm) was observed against *S. aureus* and *L. monocytogenes*.

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CHEMICAL CHARACTERIZATION, ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF WINEMAKING INDUSTRY BY-PRODUCTS

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The exploitation of bioactive compounds from agri-food by-products has been attracting an increasing interest from different industries within a circular economy context since several of compounds may have health properties or be used as natural colorants or preservatives. So far, several studies have been developed on the characterization of red wine grape pomace and its components (seeds, skins, and stems). However, less attention has been paid to other by-products, such as grape pomace from white wine, the residues after distillation, wine lees, and diatomaceous earth, the latter used in the filtration of wine and corresponding to about 250 tons/year of waste in Portugal. In this work, samples of these by-products were evaluated for their chemical composition by HPLC-DAD-ESI-MS^n and bioactivities (antioxidant activity by TBARS, DPPH, and reducing power assays, and antimicrobial activity against eight bacteria and two fungi). Fifteen non-anthocyanin phenolic compounds were found, including 5 phenolic acids, 4 flavan-3-ols, 2 O-glycosylated flavanols, 3 flavanol aglycones, and one unknown. In the red wine by-products 12 anthocyanins were detected, most being malvidin derivatives. Wine lees and white grape pomace before distillation presented the highest contents of phenolic compounds. All samples showed antibacterial and antifungal activity against most of the tested microorganisms, with red and white grape pomace and diatomaceous earth having the best bacteriostatic activity, while the lees stood out against fungi. All samples showed promising antioxidant capacity, with very good results obtained on TBARS for the white pomace after distillation and diatomaceous earth.
Overall, the results show that besides grape pomace other wine industry by-products are also good sources of bioactive compounds with high potential for exploitation.

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QUALITY CONTROL OF WATER- AND FAT-SOLUBLE VITAMINS IN FORTIFIED DRINKS

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With the recent increase in the availability and consumption of drinks fortified with vitamins (FD), there are also growing quality, efficacy, and safety concerns, originating from their regulatory oversight [1]. FD, marketed in the EU, must comply with national and EU food regulations. The general EU regulatory framework, covered by Regulation No 178/2002, imposes their safety and appropriate labeling, while proof of their quality is not necessary [2]. Thus, we evaluated the content-related quality of water- and fat-soluble vitamins in FD on the Slovenian market. The contents of vitamins C, B1, B2, B3, B5, B6, B7, B9, B12, D, and E, in their most common forms, were determined in 50 commercially available FD (28 waters, 5 juices, 12 energy drinks, and 5 instant drinks) by a published UHPLC-DAD [3] and HPLC-UV method [4]. FD containing vitamins B7, B9, B12, D, and E below their quantitation limits were also analyzed by an LC-MS/MS method. A total of 244 vitamin contents, ranging between 0% and 907% of the labeled content, were determined in the tested FD. 48% of these were outside the acceptable tolerances (65-150% of the labeled content), published by the European Commission [5]. Inappropriate contents were most often determined for vitamins B7, B2, and B12 (in ≈80% of the tested FD) and B9, B1, and E (in 65-70% of FD). Only 4 of the 50 tested FD had proper contents of all labeled vitamins. The determined low content-related quality of the majority of FD on the market highlight the need for their stricter quality control and regulation.

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SALT CONTENT IN SCHOOL LUNCHES IN SLOVENIA

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Slovenia has an organized system of school meals, and schools are obliged to follow the nutritional guidelines [1]. Salt in meals is an important aspect of the guidelines, as it is a risk factor for chronic diseases [2, 3]. As part of a national survey (n = 50 schools), the content of sodium (Na) in school lunches was determined. The sampling was performed in the form of composite (5-day) lunch samples intended for children (10-13 years). The chemical analysis was carried out in an accredited laboratory and included 95 samples (49 in 2020; 46 in 2022). After the acid digestion of the sample under high pressure, an inductively coupled plasma method with a mass selective detector – ICP / MS [4] was used to determine Na. The salt content (NaCl) was determined by a calculation [5]. The median value of NaCl in lunches was 3.57 g / meal (3.67 g / meal in 2020; 3.46 g / meal in 2022). The guidelines state a recommendation of <1.5 g NaCl / lunch, which means that the value has been exceeded by more than twice. Scientific evidence shows a link between excessive salt intake and health, so it would be crucial to provide additional training for employees in school kitchens.

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MODELING THE KINETICS OF HYDRODISTILLATION TECHNIQUE AND CHEMICAL COMPOSITION OF EXTRACTED OILS FROM LAURIS NOBILIS ALBANIA PLANT MATERIALS

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Our work has to do with the modeling kinetics of Clevenger hydro distillation process [1] of essential oils from plant materials. The mathematical model is based on simultaneous washing and diffusion extraction process [2]. By assessing both first-order kinetic model and the model of simultaneous washing and diffusion, the result indicated that the model of simultaneous washing and diffusion describes better the hydro-distillation mechanism of the essential oil extracted [3]. We figured out that optimum conditions such as time, solid to liquid ratio, and the heating power for extracting the highest amount of essential oil was found to be around 2 h and half, with 1:4 (g/ml), and 250 W respectively [4]. The essential oil yield extracted by hydro-distillation Clevenger Lab apparatus was of max 0.5 v/w. By gas chromatography–mass spectroscopy (GC/MS) method we identified 29 main components from about 50 – 60 compounds present in the extracted essential oils. Monoterpenes were found on the lower percent level in the final essential oils samples extracted with 300 W heating power (90.2 – 97.7 %) compared with the monoterpenes (91.1 – 98.8 %) in the extracted oils with 250 W [5].

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PURPLE WHEAT FLOUR USING IN BAKERY PRODUCT

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Nowadays, consumers are paying more and more attention to healthy eating, and unfortunately, insulin resistance and type 2 diabetes are affecting many people. They are paying more attention to the consumption of fiber-rich foods. In my thesis, we developed high-fiber ready-to-bake flour mixture blends using purple wheat flour (white and wholemeal). For fiber fortification, inulin, chia seed flour and psyllium husk flour were used. After determining the main nutritional parameters of the raw materials, 4 series of experiments were carried out to prepare bread rolls and to test the finished products. The correct mixing ratio of the enriching agents were tested, and the final flour mixtures were tested. At the end of our research, three blends (white purple wheat flour + 4% inulin + 2% psyllium husk flour; wholemeal purple wheat flour + white purple wheat flour + 4% inulin + 4% chia seed flour; wholemeal purple wheat flour + 4% inulin + 4% chia seed flour) were developed and their nutritional data, their material norm and a SWOT analysis were performed.

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DETERMINE THE KERNEL HARDNESS OF HUNGARIAN WINTER WHEAT VARIETIES

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Wheat kernel texture differentiates cultivars of hard and soft wheat classes. The kernel hardness is a genetic factor (control by friabilin protein). The friabilin presents in high concentration in soft grain varieties and low concentration in hard grain varieties [1]. Wheat kernel hardness determines quality, flour yield, flour particle-size, water absorption and other quality characteristics of cereals. The aim of our research was to determine the kernel hardness. We used Lloyd 1000 R Testing Machines (deformation modulus, breaking force, breaking work), the Perten Single Kernel Characterization System (SKCS) 4100 device (Hardness Index), Perten 3303 laboratory mill (specific grinding energy demand), and odometer. Registered and widely used Hungarian wheat varieties were applied in the study. It was 23 different winter wheat varieties. As a result, we found correlation among the results. A strong correlation was found between the Harness Index and the deformation modulus (R^2 = 0,813), between the Hardness Index and breaking force (R^2 = 0,882), and also a strong correlation between the Hardness Index and the breaking work (R^2 = 0,881) in the case of samples that have 13 % moisture content in average. A strong correlation was found in the case of samples that have 13.5 % moisture content in average between the Harness Index and the deformation modulus measured (in vertical state) by the compression method (R^2 = 0,804), and a good correlation between the Hardness Index and the breaking force (R^2 = 0,593). A strong correlation was found in the case of samples that had 10.6 % moisture content in average between the Harness Index and the breaking work measured (in the vertical state) by the compression method (R^2 = 0,791), and a good correlation between the Hardness Index and the breaking force (R^2 = 0,690).

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MATHEMATICAL OPTIMIZATION OF THE FOOD SUPPLY CHAIN IN SLOVENIA

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In this paper, a mathematical model for the food supply chain which represents an extension of our previous work is presented [1]. The food supply chain is defined as a Mixed Integer Linear Programming (MILP) model that optimizes the distribution of agricultural land with regard to the type of food/feed produced, the production technologies, the number of animals used for the production of food of animal origin, and the amount of food imported and exported. The model calculates the optimal values of the variables, which are divided into five groups. The first group is the economic value. The environmental variables include greenhouse gas emissions, nitrogen balance, and the amount of mineral fertilizers used. The third group consists of social variables, i.e., the levels of self-sufficiency of individual food items, the amount of kilocalories and macronutrients produced, the amount of food losses and wastes, and the proportion of land used for human food production. The technological variables group includes the hectares used for different types of agricultural production. The fifth group is a multinormalized function that reflects the change in the value of the key variables compared to the current situation. The model evaluated different scenarios for the development of Slovenian agriculture until 2050. The results showed patterns where certain trade-offs need to be found when planning Slovenian agricultural policy in the future. It also examined how the amount of mineral fertilizers used, the proportion of land devoted to organic farming, and the amount of food losses and wastes are compatible with the goals of the European Farm-to-Fork Strategy and the 2030 Agenda for Sustainable Development [1].

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RELATIONSHIP BETWEEN KERNEL HARDNESS OF WHEAT AND KERNEL CONTENT PARAMETERS OF FLOUR MILLED FROM IT

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Kernel hardness controls by friabilin protein and it depends on the relation between protein matrix and starch granules. Friabilin presents in high concentration in soft grain varieties and it is low concentration in hard grain varieties. The high gluten, hard wheat flour generally contains about 12.0-13.0 % crude protein under Mid-European conditions. The relationship between wheat protein content and kernel texture is usually positive and kernel texture influences the power consumption during milling. Hard textured wheat grains require more grinding energy than soft textured grains. The aim of our research was to determine the possible relationship between kernel hardness and various other parameters of the flour (dough visco-elastic characteristics, wet gluten, water absorption, flour recovery, alveograph). We used Perten SKCS 4100 to determine the kernel hardness, while the Perten 3303 mill was used to establish Particle Size Index (PSI). Registered and widely used Hungarian wheat varieties (7 of HRWW and 4 of SRWW) were applied in the study. Twin correlations were used to determine the relationship among the various traits. According to the results, there is a very strong correlation between the milling energy and the kernel hardness (r=0.99). The correlation between hardness index and the examined flour parameters was also significant (r=0.81-0.87). We found strong correlation between the milling energy and water absorption r=0.878 of the flour. The associations found in this study will help to better understanding the wheat grain and flour quality technological aspects.

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TECHNOLOGICAL FEATURES AND BIO-PROTECTIVE TRAITS OF LACTOBACILLACEAE STRAINS OBTAINED FROM MEDITERRANEAN SPONTANEOUSLY FERMENTED SAUSAGES

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The spontaneously fermented sausages in the Mediterranean area can represent an important reservoir of microbial biodiversity to find new strains of industrial interest. The analysis of the microbial communities of different traditional spontaneous fermented meat products highlighted a high variability in the qualitative and quantitative composition of their microbiota, including lactic acid bacteria (LAB) [1]. Lactobacilli isolated from these products had been previously taxonomically identified and characterized for their antibiotic resistance and amino-biogenic potential. Based on their safety profile, some lactobacilli biotypes, mainly belonging to the species *Latilactobacillus sakei*, have been characterized for their bioprotective and technological features. In particular, the strains were studied for their in vitro antimicrobial activity against foodborne pathogens, assessing also the presence of bacteriocin-encoding genes. The best strains were tested for their acidification and growth performances in relation to salt and temperature, applying predictive microbiology models. The estimated parameters of growth kinetics evidenced an extreme variability among the strains, confirming Lat. sakei phenotypic diversity. The metabolic heterogeneity was highlighted also by volatile organic compounds (VOCs) analysis of a meat batter fermented by the selected strains singularly. An accumulation of different VOCs mainly related to the metabolism of pyruvate (diacetyl and acetoin) and the beta-oxidation of fatty acids was assessed, highlighting the presence of secondary metabolic pathways activated when fermentable sugars are depleted. This study leads to find interesting candidates to be proposed as meat autochthonous starters, exploiting the genetic microbial biodiversity of traditional products of Mediterranean area.

Acknowledgments
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MEDITERRANEAN SPONTANEOUSLY FERMENTED SAUSAGES AS A SOURCE OF LACTIC ACID BACTERIA: A FIRST GLANCE TO THE SAFETY FEATURES OF ISOLATED STRAINS

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Production standards innovations in the meat industry require the use of starter cultures to guide the fermentation enhancing product safety. The bioprospecting of new autochthonous strains to be proposed as tailored made starters is a fundamental strategy to valorize both the local microbial biodiversity and the peculiarity of traditional productions. In this study, 15 Mediterranean spontaneously fermented sausages, collected from four different countries and previously characterized [1], have been used as sources of lactic acid bacteria. These Lactobacillaceae were tested for their biodiversity and taxonomically characterized using molecular techniques, highlighting the presence of 151 strains belonging to *Latilactobacillus sakei* (59.6%), *Latilactobacillus curvatus* (about 26.5%) and *Companilactobacillus alimentarius* (13.9%). These strains have been assessed for their antibiotic resistance against six antibiotics. The results showed a geographical distribution of resistant biotypes: the strains from Italian and Slovenian sausages had lower incidence of antibiotic resistance than those from Spanish and Croatian samples. Particularly, 27% of the strains were resistant to Streptomycin, 16% to Tetracycline, 14% to Gentamycin and 10% to Kanamycin, even if a few strains carried at least one of the associated genetic determinant (tetM/tetS/ermB). The strains were tested also for their amino-biogenic potential. No biogenic amine producers were detected among the *L. sakei*, while a high number *L. curvatus* and *C. alimentarius* accumulated these compounds The Mediterranean spontaneously fermented sausages considered were revealed as a rich source of biodiversity, allowing us to isolate new LAB candidates for the detection of their safety and their suitability for their use in traditional fermented meat products.

Acknowledgments
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P-129

BUCKWHEAT HULLS AS A FUNCTIONAL SUPPLEMENT IN BREAD PRODUCTION

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Buckwheat hulls are by-products of the milling industry with a high content of bioactive compounds and dietary fibre. In this study, we investigated the addition of processed buckwheat hulls and buckwheat hull extracts as a functional supplement and the effect on total phenolic content (TPC), antioxidant activity (AA), colour, texture and sensory properties of the prepared breads. A colloid mill was used to process buckwheat hulls into a form suitable for use in bread formulations. Enriched breads were prepared from wheat flour with an addition of 10% buckwheat hulls or a water extract from equivalent content of buckwheat hulls to obtain 2 different enriched breads and a control bread. As expected, the TPC and AA increased proportionally to the buckwheat hull content in the bread formulations. TPC ranged from 420 µg/g DW in the control bread and 500 to 750 µg/g DW in the enriched bread. Measured by DPPH assay, enrichment with buckwheat hulls resulted in a 120% increase in AA compared to the control bread. Sensory evaluation was performed, and all samples of the enriched breads were rated highly preferred in terms of flavour, technological properties and overall acceptability. In addition, the enriched bread samples showed a significant increase in dietary fibre content. Overall, the incorporation of buckwheat hulls is an effective method for improving the nutritional value and technological properties of bread and other products.

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EXPOSURE ASSESSMENT OF ENTEROBACTERIACEAE IN CONFECTIONERY CAKES

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Confectionery cakes are products obtained by mixing, shaping, baking, or other suitable processing procedures of two or more ingredients, giving the characteristic sensory properties of the product. The chemical composition and high content of water make the confectionery cakes suitable for the growth and multiplication of various microorganisms. Contamination can occur at all stages of the production process thus conducting good hygiene practices is necessary to obtain a product safe for consumption. The aim of this two years study was to provide insight into the contamination of confectionery cakes in the Republic of Croatia by microorganisms, either potentially pathogenic or indicators of hygienic production. The results on the number and type of Enterobacteriaceae in samples in 2018. indicated the presence of certain types of bacteria from the family of Enterobacteriaceae, not listed in Regulation 2073/2005. The number of Enterobacteriaceae above 102 CFU/g was detected in 22.5% of creamy, 22.6% of chocolate, and in 34.4% of fruit cakes. Further bacteria determination was done by the MALDI-TOF method. Exposure assessment was performed by a qualitative approach. Medium to high risk of exposure was found for the bacteria *Enterobacter (E.). asburiae* and *Klebsiella (K.). oxytoca* in chocolate cakes, for *E. cloacae*, Serratia (S.) liquefaciens and Buttiauxella (B.) gaviniae in fruit cakes and for *E. kobei, E. cloacae, Pantoea (P.) agglomerans, S. liquefaciens, E. asburiae, K. oxytoca, B. warmboldiae and Ratinella* in creamy cakes. Following the obtained results, it is recommended that in case of an increased number of Enterobacteriaceae, food should be further analyzed for the presence of pathogens, and then its safety should be assessed.

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WHOLE PROTEOMICS ANALYSIS OF A *LISTERIA MONOCYTOGENES* 1/2A STRAIN EXPOSED AT DIFFERENT STRESS CONDITIONS

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Listeria monocytogenes is considered as one of the most severe foodborne agents causing listeriosis outbreaks, a systemic illness due to ingestion of contaminated food. Listeriosis has a fatality rate of 20-30% [1]. The pathogen is widely spread in nature and can survive in hostile environments, such as high salt, low temperature, and low pH. This study aims to investigate the whole proteome of a *L. monocytogenes* 1/2a strain, grown at 4 different combinations of temperature, pH, and sodium chloride (C1 control: 37°C, pH 7.0, NaCl 0.5%; C2: 37°C, pH 5.5, NaCl 7%; C3: 12°C, pH 7, NaCl 0.5%; C4: 12°C, pH 5.5, NaCl 7%). The total cell lysate of each condition was resolved by SDS-PAGE for running immunoblotting and nLC-MS/MS based proteomics analysis. A total of 1 160 proteins were identified against *L. monocytogenes* uniprot database with 2 peptides per protein as minimum. By gene ontology enrichment analysis, it was observed that in response to the high osmolarity and acidic stress, *L. monocytogenes* survived enriching the pathway of the cellular component biogenesis, modulating cell membrane lipid composition and amino acid metabolism, and acting on the amino acid-dependent acid tolerance systems. Furthermore, modulation of lipids biosynthesis was adopted to overcome the issue of low temperature in C3. In response to a combination of stress parameters in C4, *L. monocytogenes* adapted itself regulating the enrichment of the response to environmental stimuli and modulating the abovementioned pathways, as well as DNA repair. Grouping the genes by functional categories, differently by C1, the number of genes involved in the pathogenesis pathway were higher compared with the other conditions. Overall, the data obtained by this study are interesting to better understand *L. monocytogenes* metabolism when exposed at different stress conditions. Further data analyses will be performed by mean of bioinformatic tools (i.e., VirulentPred and Vaxijen) to identify the potential immunogenic proteins involved in the virulence pathways of this microorganism.

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P-132 Canceled

P-133

FIELD-PRINT: CAN WE TASTE THE DIFFERENCE IN STRAWBERRY QUALITY REGARDING THE PRODUCTION TECHNOLOGY?

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The production system, especially fertilisation has an important effect on the taste and overall quality of strawberries. Since the producers aim for higher yield that increases their profitability, they also have to ensure the likability of strawberries providing the consumers reappearance. The main variability regarding the taste is the cultivar and production technology. In present study we aimed to discover how the fertilization affects strawberry quality, since it is well known that producers try to achieve higher yields with sometimes unreasonable fertilization. We established an experiments where we monitored the effect of different doses and forms of nitrogen and calcium chelate. For this research we chose the strawberry cultivar 'Clery' since it has likable taste and is the mostly chosen variety among Slovenian strawberry producers. We monitored the yield and some other important quality parameters (fruit colour and firmness) including nutritional indicators (total soluble solids, sugars, organic acids and volatile compounds). Both nitrogen and calcium fertilisation had altered sugars, organic acids and volatile content in strawberry fruits. Fertilisation with higher doses of nitrogen and calcium increased the content of unpleasant aromas aldehydes hexanal and (E)-2-hexen-1-. The content of fruity esters was uppermost in fruits fertilised with nano-fertiliser Lithovit. Fertilisation with N and Ca decreased the strength of of ketone and terpenoids fruity aroma. Fertilisation, especially with nitrogen, had mostly negative impact on strawberry flavour while nano-fertilization with Lithovit improved strawberry flavour.

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P-134

SODIUM, POTASSIUM, AND IODINE INTAKE DETERMINED FROM 24-HOUR URINARY EXCRETION: RESULTS FROM A PILOT STUDY

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High intake of sodium, together with low intake of potassium, are two of the leading risk factors that contribute to the risk of developing hypertension. Data on sodium (salt) intake in Slovenian population hasn't been updated since 2012 and data on potassium intake has been lacking. Since salt is also a major source of iodine, activities to reduce salt intake have put adequacy of iodine intake under question. The pilot study was conducted between March and April 2022. A total of 500 participants aged between 25 and 64 were invited to join. Data on participant's health, nutrition and socio-demographic characteristics were gathered through a questionnaire and physical measurements. Sodium and potassium intake was calculated from 24-hour urinary sodium and potassium concentrations. Urinary iodine concentration (UIC) was determined by modified spectrophotometric method as described by Oblak et al [1]. The final sample included 120 participants (56 men and 64 women). Mean urinary sodium and potassium excretion was 164,7 mmol/day (95% CI: 149,4-180,1) and 64,2 mmol/day (95% CI: 59,9-68,4), respectively. This translates to estimated intake of 10,1 g salt/day (95% CI: 9,17-11,05) and 3,25 g potassium/day (95% CI: 3,04-3,47). Median UIC was 95,9 mcg/L (IQR=73,0) and median urinary iodine excretion was 188,3 mcg/day (IQR=89,6). The results of this pilot study indicate a need for further actions to lower salt and increase potassium intakes in Slovenian adult population. According to criteria set by WHO, 52,5% of participants had insufficient iodine status.

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P-135

APPLICATION OF ATR-FTIR SPECTROSCOPY FOR THE CHARACTERISATION OF MILK AND MILK-PHENOLICS POWDERS

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The current trend in food innovations is the development of healthier and sustainable food. One of the promising food products can be goat milk protein-based powders due to the nutritional and functional properties of goat's milk. The aim of this study was the ATR-FTIR analysis of spray dried powders of skim raw goat milk (M), thermally treated goat milk (TM), and thermally treated goat milk enriched with different concentrations of grape pomace seed extract (TME1, TME2, and TME3). The whole statistical procedure (pre-processing and PCA) of ATR-FTIR spectra was performed independently in Amide I region (1700-1600 cm^{-1}). For this region, the first two PCA (PC1 and PC2) classifies all samples into two groups, named A group (M and TM) and B group (TME samples). The heat treatment had no influence on the separation of milk samples (M and TM). Hence, the phenolics-protein interactions in TME samples had an influence on the separation and grouping of the samples in this region. Separation of A group from B group were the most contributed by loadings for 1633 cm^{-1}, 1643-1645 cm^{-1} and 1651-1653 cm^{-1}. This can be attributed to changes in the content of intramolecular β-sheet, random coil structure, and α-helix/large loops, induced after the addition of grape seed phenolic extracts in TM. In the amide I region, the separation between TME samples was also observed. Separation of TME1 from TME2 and TME3 were the most contributed by loadings for 1614, 1622 (intermolecular β-sheet), 1625-1629 (intramolecular β-sheet), 1675, 1679-1681 (turns), 1686 (intermolecular β-sheet) and 1692 cm-1 (β-antiparallel structure). This separation indicated the interactions between goat milk proteins and grape seed phenolic compounds. It can be concluded that PCA analysis of amide I ATR-FTIR spectra can be used for the characterization of milk and milk-phenolics powders.

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UPGRADING THE SLOVENIAN NATIONAL OPEN PLATFORM FOR CLINICAL NUTRITION (OPEN) AND NEWLY DEVELOPED MOBILE APP EATVISOR

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In 2010, researchers from the Jozef Stefan Institute (JSI) developed a web-based application Open Platform for Clinical Nutrition (OPEN), which is intended for nutritional experts and Slovenian residents to monitor and analyse dietary intake as well as to plan a healthy diet. The OPEN platform is based on a Slovenian food composition database (FCDB) and supports dietary recommendations for various groups according to the Slovenian guidelines. In addition, the platform allows users to record food diaries, plan menus, design their own recipes, and inform themselves about nutritional values of specific foods, dishes and meals. Within the framework of a project, which is managed by JSI and Biotechnical faculty, and is co-financed by the Ministry of Health, the web-based platform received a much-needed upgrade between the years 2019 and 2022. The composition of foods depends on their geographical origin, therefore each country needs to compile and maintain its own FCDB. As part of the presented project, the entire database of food items analyzed in Slovenia (14,064 data for 443 foods) was reviewed, updated and enriched with the EuroFIR standardised documentation. Moreover, an additional web-based tool was designed and developed as an advanced database management system, which allows experts to connect the Slovenian FCDB with foreign databases, from which they can easily borrow missing data that are structured and classified in different ways. In addition to the updated OPEN platform, a mobile application Eatvisor for Android and iOS users is currently under development. Functions of the mobile app are adapted to the needs of a variety of different user groups such as healthy individuals, patients and experts. As the OPEN platform is based on a high-quality food composition database and evidence-based dietary guidelines, the update is expected to increase its applicability. As part of the project, its evaluation has been carried out in a real environment, in cooperation with different groups of users, and the platform is being adapted accordingly. By obtaining various sources of funding, the platform will be continuously maintained and updated also in the future.

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THE EFFECT OF THE OAT BRAN ADDITION ON CHICKEN MEAT PâTéS

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Constantly increasing consumers awareness towards healthy diet pushes meat processors to design and develop a novel products [1]. Pâté, thermally treated homogenized meat with non-meat ingredients (oils, spices, texturizers), can be relatively easy modified by the use of dietary fiber [2] without detrimental effects on the product sensory properties. Oat brans containing 16-24% dietary fiber (β-glucan, which participates in blood sugar and body weight control, together with cellulose and lignin) characterized by high hydration capacity, can improve juiciness and texture, as well as, content of water-soluble flavor components of the pate [1]. The objective of the study was the effect of powdered oat brans addition on the quality of chicken meat pâté. To verify the hypothesis of the positive effects of oat brans on the chicken pâté quality the physicochemical analyses together with the sensory and texture profiling, were carried out on pâté prepared with 5-12% powdered oat brans. The plant material additions were estimated based on the available data. The application of oat brans to chicken pate resulted in significant reduction of lightness (L) and redness (a). Higher than 8% concentration of oat brans increased hardness, as well as chewiness and gumminess of the product. Oat brans did not change the flavor of chicken pate, but reduce taste and tenderness acceptability. It can be concluded that the addition of oat bran to chicken pâtés increased protein and minerals content with a good sensorial acceptance of the consumers. The bran produces favorable changes in texture, increasing product chewiness, gumminess and hardness. The optimal amount of oat bran addition should not exceed 8% due to the loss of tenderness and the worsening of the flavor.

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(MIS)INFORMATIVE LABELS OF RESVERATROL FOOD SUPPLEMENTS

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Food supplements are sold in dosage forms (e.g. tablets or capsules) and consumed in small amounts with the purpose of supplementing the normal diet with nutrients and other substances with nutritional or physiological properties. Different regulatory requirements (regarding food labelling, health claims, etc.) aim to ensure food safety of the health conscious consumers trying to improve dietary contribution to health with food supplements. Despite that, food supplements are still connected with many practices non-compliant with regulation ranging from mislabeling or differences in declared and actual nutrient content to the use of ingredients harmful to health and even food fraud. In our study the market of food supplements containing resveratrol in Slovenia was examined. A systematic evaluation of labels of 22 food supplement products was performed to check their compliance with EU requirements for food information, nutrition and health claims on food, food supplements and novel foods. The results show that while most labels contained the necessary information, multiple errors were also present. Irregularities ranged from typos and to statements that could result in confusion and misinformation of consumers.

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RESVERATROL FOOD SUPPLEMENTS - DECLARED VS. DETERMINED CONTENTS

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Resveratrol, a stilbene (polyphenol), is produced in different plants as a part of a chemical self-defense against pathogens and stressful conditions. Resveratrol is present in our diet as it can be found in grapes (wine), cranberries, strawberries, mulberries, currants, pistachio, peanuts, etc. Resveratrol's antioxidative, anti-inflammatory, estrogenic, cardioprotective, antitumor and antiviral properties that also contribute to positive effects on health, contributed to increased scientific interest in this compound. The food supplements industry offers a diverse variety of products with resveratrol. These food supplements are promoted for health benefits such as cardiovascular support, cellular anti-aging properties, promoting a healthy response to biological stress etc. An evaluation of declared content of resveratrol in 20 food supplements was carried out using a method based on high-performance thin-layer chromatography (HPTLC) coupled with densitometry. The analyses were performed on HPTLC silica gel plates developed with developing solvent n-hexane–ethyl acetate–formic acid (20:19:1, v/v/v) [1] in a saturated twin through chamber. Development of plates was followed by derivatization with anisaldehyde detection reagent. The results offer an informative overview of compliance of resveratrol contents with declared contents for food supplement products available in the Slovenian market, which is quite concerning from a food safety point of view as 95% of products contained different contents of resveratrol than declared and 25% of products even exceeded the maximum level stated in conditions under which a food supplement with trans-resveratrol may be used (150 mg/day).

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THE EFFECT OF PLANT EXTRACTS AND ESSENTIAL OILS ON THE ADHESION OF *CANDIDA GLABRATA*

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The incidence of fungal infections, particularly those caused by *Candida species* (candidiasis) has increased significantly, causing high levels of morbidity and mortality. This fact is mainly due to the rise in antimicrobial resistance and the limited number of efficient antifungal drugs, which still have many side effects. The use of natural antimicrobial agents has gained much attention to inhibit disease-causing microorganisms. Therefore, the aim of this study was to evaluate the antifungal and antiadhesion potential of fifteen plant extract, essential oils and compounds against *Candida glabrata*. Susceptibility tests indicated that essential oils of *Cinnamomum verum* and *Origanum vulgare* showed the highest inhibitory effect. Antiadhesion ability of the plant extracts and essential oils against *C. glabrata* ZIM 2369 was estimated by the standard crystal violet assay. The results showed that the essential oils of *C. verum*, *O.vulgare*, *Satureja montana* and *Thymus vulgaris* have promising activity against the initial phase of biofilm formation and the preformed 24h biofilm. In contrast, the essential oils of *Salvia officinalis* and *Salvia sclarea* were inactive against *C. glabrata* biofilm. On the other hand, *Sedum roseum* extract showed the strongest antiadhesion effect. As *Candida* biofilms are intrinsically resistant to conventional antifungal agents, alternative therapeutics like plant-based natural products have been evaluated for their antimicrobial and antibiofilm activity. Understanding more about the antimicrobial performance and possible mechanism of the tested plant extracts and essential oils will be helpful for their application against *Candida* spp. in medicine in the future.

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P-141 NOT PRESENTED

THE EFFECT OF ADDING DIFFERENT OILS ON LIQUID EGG PRODUCTS PROPERTIES

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Egg products are widely used and are known for their easy use and long shelf life when compared to regular eggs. In the food industry the most used egg product is pasteurized liquid whole eggs, it's usually used in bakery products, fresh and dried pasta, and ice cream. Around Europe egg products represent almost 20% of total consumption[1]. Adding flavors and fortifying egg products to increase the benefits and customer acceptance is the aim of this study. Olive oil, sunflower oil, palm oil, and coconut oil. All mentioned oils have a great antioxidant activity and phenolic content, olive oil for example is known for its positive effect on inhibiting foodborne pathogens and enhancing cardiovascular health [2] . On the other hand about 90% of fatty acids that are found in sunflower oils are unsaturated oleic and linoleic acids that can decrease plasma lipoproteins and total cholesterol [3]. Palm oil as well is one of the most used oils in food manufacturing and well known for its content of antioxidant compounds [4], meanwhile coconut oil has a unique composition of medium chain fatty acids which influence its nutritional value [5]. 2.5, 5, 7.5% V/V of olive oil, sunflower oil, palm oil, and coconut oil were added to pasteurized liquid whole eggs, pH, colour, viscosity and sensorial evaluation were measured to evaluate the effect.

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P-142 Canceled

P-143

THE RELATIONSHIP BETWEEN THE FATTY ACID COMPOSITION OF HUMAN MILK AND GROWTH AND BODY COMPOSITION OF CHILDREN FROM THE SLOVENIAN COHORT »MY-MILK«

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The aim of this research was to study the fatty acid (FA) composition of human milk (HM) and to assess the relationship between the FA composition of HM and growth and body composition of children from birth to seven years of age. In the study were included 106 mother-child pairs from the Slovenian cohort »My-milk«. The fat content in milk sampled on average on the 30th day of lactation ranged from 1.55% to 6.98%, saturated fat content from 33.17% to 57, 38%, unsaturated from 8.51% to 51.97% and an omega-6/omega-3 ratio (ω-6/ω-3) from 3.01 to 25.44. We found a statistically significant positive association between the content of monounsaturated FA and the length of the child at 3 months ($p = 0.038$) and bone mineral density at 7 years ($p=0.045$), a negative association between the content of ω-6 FA and length at 12 months ($p=0.020$), between the content of total fat in HM and bone mineral density at 3 months ($p=0.030$) and between the ω-6/ω-3 ratio and length at 12 months ($p=0.002$). The ω-6/ω-3 ratio was positively associated with BMI at 7 years of age ($p=0.022$). Arachidonic acid (ARA) stood out among individual FA, as we found the most connections between growth parameters and the share of ARA in HM. The results showed the influence of HM on the growth parameters and body composition of children and are a good starting point for awareness-raising measures on the importance of breastfeeding at the national level.

Acknowledgments
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P-144

TOWARDS ZERO WASTE FOOD PRODUCTION: UTILIZATION OF GRAPE SEEDS

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In recent decades, wine production has been expanding, with emerging wine regions and new small and medium-sized wineries. Winemaking produces large amounts of grape seeds, often discarded as waste, which are rich in oil, dietary fibers, tocopherols, and polyphenols. If used, the seeds are usually utilized as a source of oil, while the cake remaining after oil extraction is the additional waste with limited usage. Thus, we are working to establish the procedures for the complete utilization of grape seeds with zero byproducts. Pinot Noir variety from a small winery, Zmajevac, Serbia, was used. The main benefit of the oil, obtained by cold pressing, is the high content of unsaturated fatty acids, i.e., linoleic (70 %) and oleic acid (19 %), with a total oil content of 15 % and an 11 % yield after cold pressing. To facilitate handling, potential addition to food products, and its protection, grape seed oil was encapsulated into calcium alginate-based gel capsules. Encapsulation techniques, electrostatic extrusion, and atomization were used to produce finely powdered encapsulates with encapsulation efficiencies of close to 90 %. The potential use of these capsules is in the substitution of saturated fats in food products where the capsules, apart from protecting oil, could prevent its leakage from food matrices. The results showed that the oil cake could be a promising source of dietary fibers. It contained up to 38 % of insoluble dietary fibers and around 2 % of soluble ones (w/w). The high content of insoluble dietary fibers is a basis for further modifications to increase the content of soluble fibers and modulate the nutritional properties of the oil cake. Thus, we tested the enzymatic and hydrothermal processes as modification procedures. The results showed that the enzymatic treatment was more promising regarding the control of soluble/insoluble fibers ratio. Also, the enzymatic process should be more cost-effective regarding capacity and energy consumption.

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P-145

VALORIZATION OF SEA BUCKTHORN BERRY (HIPPOPHAE RHAMNOIDES L.) OIL AS A POTENTIAL SOURCE OF LIPOPHILIC BIOACTIVE MOLECULES

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Production of natural compounds from medicinal plants with many biological effects have become very popular due to increasing concern regarding the safety of using synthetic compounds and the impact of COVID-19 on health. Sea buckthorn (Hippophae rhamnoides L.), (SB) is well known as an important source of natural antioxidant and antimicrobial bioactive molecules (BAM). The most recognizable SB product is berry oil (SBO) which contains high amounts of lipophilic BAM such as unsaturated fatty acids, tocopherols, carotenoids and sterols [1] but variations in their composition have been revealed among cultivar and growing conditions [2]. Supercritical CO2 extraction of oil as an advanced method gains increasing popularity due to better extraction efficiency compared to conventional extraction methods. Therefore, the aim of this study was to evaluate fatty acid, sterol and α-tocopherol content, as well as antioxidant capacity (AC) of SBO obtained by supercritical CO2 extraction from SB berries grown in Croatia. Tocopherol content was determined using HPLC/FLD, fatty acid and sterol content using GC-MS and AC using ORAC method, respectively. A total of 16 sterols were determined and the most represented was sitosterol (589.28 mg/100 g of oil). Moreover, high amounts of unsaturated fatty acids, such as omega-7 palmitoleic fatty acid (34.54%) and omega-6 γ-linolenic acid (10.78%) were determined. SBO was characterized with high α-tocopherol content (275.63 mg/100g oil) and high AC (1676.90 μmol TE/100g of oil). Obtained results indicated that SBO is rich source of various lipophilic BAM with high AC which could be used in the production of natural compounds and functional foods as well as food additives.

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PROJECTS


Supporters of CEFood 2022
PETER RASPOR


Supporters of CEFood 2022
The Aim of the Project
to prepare a curated catalogue of sequences of possible new tobamoviruses
=> to be ready in case of future emergence
To elucidate the role of water-linked epidemiology:
stability of emerging tobamoviruses in water
transmission through water
to help future risk assessment studies and management practice strategies
to develop and validate reliable, efficient, fast and easy-to-use diagnostic procedures for monitoring of emergent tobamoviruses in water samples.
PRIMOŽ TREVEN
DANIELA BORDA

PR-1

DISCOVERY AND WATER-LINKED EPIDEMIOLOGY OF EMERGENT TOBAMOVIRUSES INFECTING CROPS

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Diseases caused by emerging viruses have become more important over the last few decades in terms of their incidence and economic impact. Currently, the most economically important emerging virus is tobamovirus tomato brown rugose fruit virus (ToBRFV). Due to their physical and biological properties, tobamoviruses can spread rapidly and have high epidemic potential. A search for yet unknown tobamoviruses in different plant species and in different environmental sample matrices should provide us with valuable information, possibly before the emergence of such species as crop pathogens. This would enable quicker development of tests and it should provide better understanding of the possible points of origin of such viruses. Modern agriculture requires the use of irrigation in plant production and global food security is threatened by the severe shortage of water. Hydroponic systems as they require significantly less water, can contribute to the solution of this global problem, but on the other hand, the use of circulating nutrient solutions holds the potential for rapid and effective spread of water-transmissible plant pathogens increasing the chance of pathogen outbreaks if the system is not managed intensively. It has been shown that waters used for irrigation represent a source of inoculum for some environmentally stable viruses. However, only few studies have been carried out to assess the potential for water-mediated transmission of such viruses. To date, no studies have investigated how long ToBRFV can survive in a water environment, nor the possibility and/or efficiency of its transmission to plants through irrigation water. This knowledge is essential for future epidemiology and risk assessment studies. The outcomes of this project will expand the current knowledge on plant viruses, their epidemiology and the burden they pose for important field crops, such as tomato, pepper, cucurbits, and others and thus contribute to sustainable food production.

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PR-2

NEMDETECT: EARLY DETECTION OF QUARANTINE NEMATODES IN POTATOES USING REMOTE SENSING

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Among plant-parasitic nematodes, root-knot nematodes (RKN; *Meloidogyne* spp.) and potato cyst nematodes (PCN; *Globodera* spp.) have the greatest negative impact on agriculture worldwide. Their recurring and in recent years more frequent outbreaks in Europe are cause for concern. Infestation foci can become full-field infestations if unmanaged and can result in significant yield loss. Early detection of infections, i.e. prior to development of visible symptoms, is therefore crucial, at both plant and seed material levels. Current methods to detect infestations in the field are adequate soil sampling, followed by nematological analysis in the lab, and visual examination of tubers or plant roots for symptoms (pimples, root knots, cysts). While these approaches produce accurate results, they are labour intensive and time consuming, and therefore impractical on a larger scale. Remote sensing methods can provide objective, accurate, and cost-efficient alternatives. In this project we developed remote sensing methods for the detection of four nematode species (*Meloidogyne chitwoodi*, *M. fallax*, *Globodera rostochiensis* and *G. pallida*) in potatoes. Experiments were conducted at four spatial levels: tubers, pot, and field, in Slovenia, Belgium, and England. Hyperspectral and multispectral sensors, mounted on ground, unmanned aerial vehicles, and ultralight airplanes were used for data acquisition. Results indicate that accurate detection of infections prior to development of visible symptoms is feasible. Moreover, latent infections in tubers can also be accurately detected. Implementation of remote sensing methods and precision agriculture in plant protection schemes at a national level would allow for more effective management, and has the potential for a significant beneficial impact on yields and reduced use of pesticides.

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PR-3

EU PROJECT EIT FOOD, AS A TOOL TO EQUIP ENTREPRENEURS AND PROFESSIONALS WITH THE SKILLS NEEDED TO TRANSFORM THE LOCAL AND GLOBAL FOOD SYSTEM

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The European Institute of Innovation and Technology (EIT) is a research and development vehicle of the European Union, that enhances Europe's ability to innovate by nurturing entrepreneurial talent and supporting new ideas. The EIT brings together the knowledge triangle of business, education, and research to create cross-border partnerships – Knowledge and Innovation Communities (KICs). EIT Food accelerates innovation to build a future-fit food system that produces healthy and sustainable food for all. Supported by the EU, the project started in 2017, EIT invests in projects, organizations, and individuals that share goals for a healthy and sustainable food system. EIT unlocks innovation potential in businesses and academia and creates and scales agri-food startups to bring new technologies and products to the market. EIT Food's mission is to equip entrepreneurs and professionals with the skills needed to transform the food system and educate and inspire the next generation. Moreover, KIC wants to build an inclusive and innovative community where the consumer is actively involved. From the beginning Polish partners which contributed to the EIT are, the Institute of Animal Reproduction and Food Research of the Polish Academy of Science, the University of Warsaw, and companies: Maspex Wadowice Group. At the Institute in 2017-2022 over 50 projects were carried out under the EIT Food logo. They covered different areas like Education, Innovation, and Public Engagement. One of the projects in which the Institute is involved concerns the optimized processes in the baking industry with computer models to minimize food waste, energy consumption, and CO_2 emission (PrO4Bake), realized in the IAR&FR PAS in Olsztyn from 2020. The complex approach will foster the digital transition of the bakery sector in Europe and forward the sustainable production of food. The adoption of digital tools in food processing by bakeries can be significantly enhanced by on-site training and assistance that contribute to overcoming the resistance against change to digital solutions.

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PR-4

SHORT FOOD SUPPLY CHAINS: HOW THE RESULTS OF SMARTCHAIN PROJECT CAN HELP?

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SMARTCHAIN Project was launched in September 2018 and lasted until the end of August 2021 aiming to support the shift toward collaborative short food supply chains (SFSCs) in Europe. The Project involved 43 partners from 11 EU countries and analyzed 18 case studies of different SFSCs in terms of technological, regulatory, social, economic, and environmental factors searching for the key parameters that influence the success of SFSCs. The Project also explored regulatory obstacles to the development of SFSCs [1] and bottlenecks that hamper the development of SFSCs [2]. Based on the obtained data, the Project identified five exploitation models and proposed business recommendations as well as innovative and practical solutions to improve the innovation and business performance of SFSCs. The Project also proposed tools for assessment of the level of social innovativeness of SFSCs allowing them to improve it. Set of recommendations on how to increase the purchase of SFSCs products, on how to improve the sustainability of SFSCs' environmental and socio-economic sustainability were developed. For the easier share of knowledge and innovative practical solutions with SFSCs, the SMARTCHAIN Innovation Platform was developed. On this platform, it can be found information about 9 innovation and collaboration hubs, innovation inventory and initiative inventory, SFSCs-related publications, SFSCs-related weblinks, training materials, and gain model. Besides the web page, the Short Food Chain EU Community on the LinkedIn platform was created. At the moment, the Community counting more than 500 members and constantly growing. Members of the Community frequently share information about events, publications, practical tips, and new ideas related to SFSCs.

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PR-5

ENTRECOMPFOOD PROJECT - APPLYING ENTRECOMP TO ATTRACT YOUNG PEOPLE TO THE 1ST EUROPEAN MANUFACTURING SECTOR: THE AGRI-FOOD INDUSTRY

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The European agri-food industry is not attracting enough young people to the sector, notably due to unappealing salaries, lack of notoriety of companies and establishment of sites in rural areas. Thus, tensions affect businesses generating a gap between education and the world of work which needs to be overcome. The main objective of the EntreCompFood project is to build sound European Collaborative Communities of practice (CoCos) and related learning activities to stimulate innovation and entrepreneurship towards students and young entrepreneurs (main targets of the project) firstly in this sector. Six partners from three EU countries compose the consortium and the project will last 36 months. Three CoCos will be created, consolidated and expanded all over Europe to support the development of entrepreneurial skills with key identified stakeholders. Events will be organised to enhance dialogue at EU, national, and local levels among the CoCos. Thanks to those exchanges, a strategic vision for future developments will be built to allow an appropriate usage of the frame for the sector. The main learning outcomes based on EntreComp will be new curricula covering 6 preidentified EntreComp skills (Creativity, Vision, Ethical and sustainable thinking, Motivation and perseverance, Mobilising resources, Working with others, Learning through experience), extracurricular activities (creation of a special EntreCompFood prize rewarding the best adaptation of the EntreComp by young people), assessment for career guidance and usage of the Moodle e-learning platform to give access to the created learning content. Those new learning opportunities will be tested and assessed towards targets: more than 130 students, young entrepreneurs, teachers/trainers and 100 European organisations (notably public authorities) are expected to benefit from this project. Dedicated communication and dissemination activities will be carried out to promote the approach and main results of the project at local, national and EU levels.

PR-6

BIO-PROTECTIVE CULTURES AND BIOACTIVE EXTRACTS FOR THE IMPROVEMENT OF THE SHELF-LIFE OF PERISHABLE FOODS (BIOPROMEDFOOD)

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Global projections show that food demand will increase by 35% by 2030. In this perspective, waste reduction in production systems and supply chains through a valorization of food by-products and/or prolonging of food shelf life and enhancement of food safety can become a global strategy to guarantee the environmental sustainability of agro-food systems. The development of sustainable approaches to assure safety quality and shelf life of fresh products are crucial aspects of pursuing production efficiency ensuring high food levels and diet habits. BioProMedFood aims to enhance the safety and quality of Mediterranean (Med) perishable foods through the exploitation of two innovative and sustainable approaches, evaluated individually and in synergy: the use of compounds with antioxidant and antimicrobial potential and the application of bio-protective or functional microbial cultures. The first approach involves the extraction, purification, and use of bioactive compounds from low-cost sources, characterized by a great biodiversity potential such as olive, wine, and berries by-products or wild-grown brown seaweeds, using green technologies. These extracts are combined both with consolidated strategies (MAP) and active food packaging. The second approach is aimed to valorize the biodiversity and genetic bacterial heritage represented by traditional meat products of the Med area, isolating and selecting autochthonous bio-protective Lactic Acid Bacteria (LAB) strains. These are studied to reduce microbiological risks and extend the shelf life of six Med foods (fresh or fermented pork sausages and fish products, aubergine, and RTE fruit). These microbial resources are tested in fresh food as bio-protective cultures or traditional fermented meat products as starters. The application of new LAB cultures and natural bioactive compounds will provide new biotechnological tools to meet consumer demand for safe minimally processed products, reducing small-scale traditional production safety concerns and valorizing sustainable sources and by-products.

PR-7

LAKTIKA, FRACTIONATION AND PROCESSING OF WHEY PROTEINS FOR THE FORMATION OF NEW FUNCTIONAL FOODS AND FOOD SUPPLEMENTS

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The recently completed project LAKTIKA, Fractionation and processing of whey proteins and exploitation of the residue for the formation of new functional foods and food supplements, funded in the frame of the Operational Program for the Implementation of the European Cohesion Policy in the period 2014-2020, Promoting the implementation of Research and Development projects (TRL 3-6) (Ministry of Education, Science and Sport, Republic of Slovenia), was carried out in cooperation of Arhel with Biotechnical faculty (UL), Faculty of Pharmacy (UL) and Faculty of Chemistry and Chemical Engineering (University of Maribor). The main objective of the project was to better exploit the potential of whey, a by-product of the food industry. Activities included fractionation of whey proteins (i), microencapsulation of lactoferrin (ii), enzymatic hydrolysis of lactoferrin (iii), production of probiotics and metabolites in whey residues with reduced protein content (iv), and separation of residual whey components (v). Innovative technological processes for separation of whey proteins were developed, focusing on lactoferrin. Several possibilities for reuse of whey in high value-added products were demonstrated. For example, whey has been successfully used to produce probiotic biomass, metabolites such as nisin, vitamin B12, or kefir grains. A pharmaceutical formulation with enteric-coated pellets containing lactoferrin has been developed. Separation of IgG and lactoperoxidase by cation chromatography using monolythe columns was first optimised on laboratory and later on pilot scale, while α-lactalbumin was isolated from the remaining fraction by selective precipitation. The use of the protein-rich fractions as food or feed supplements, as well as the production of the starter for organic waste treatment, were also tested. Whey fractions were successfully incorporated into cosmetic products. Finally, cascade approaches of the whey treatment were proposed in order to obtain high added value products and to approach as much as possible the goal of zero waste. The results obtained form the basis for further development of new functional foods and dietary supplements based on whey.

PR-8

PERSONALIZED NUTRITION FOR HEALTHY LIVING: THE PROTEIN PROJECT AND APPLICATION.

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Proper nutrition is essential for maintaining good health and the prevention or treatment of noncommunicable diseases, such as cardiovascular disease and diabetes. However, achieving and sustaining a healthy lifestyle is challenging,

especially within an increasingly obesogenic environment, where energy dense, nutrient poor foods are common and opportunities for physical activity (PA) reduced. Personalised nutrition aims to provide dietary advice tailored to the individual based on their characteristics, including their physiological or genetic profile, as well as individual likes and dislikes. Whilst personalised approaches are expected to increase adherence, nudging users towards healthier choices and therefore optimising outcomes, research is heterogenous and equivocal. New advances in ICT technologies and, especially, in wearable sensors, big data analysis and artificial intelligence techniques, as well as direct-to consumer genetic testing, blood and gut microbiome analysis, open new opportunities for researchers to monitor and collect information related to dietary behaviours to feed into personalisation systems. The PROTEIN project aims to develop an end-to-end ecosystem that will engage people with a healthy and pleasurable diet and PA programs adapted to users' needs and driven by their personal preferences, physiological characteristics, and health status. The main objective of PROTEIN is to create an ICT-based system for providing personalized nutrition based on the collection and analysis of large volumes of data related to users' dietary behavioural patterns (food choices, energy, macro/ micronutrient intake), physical activity (motion, exercise) and individual parameters (anthropometric measurements, blood glucose, genetic information, blood parameters, gut microbiome and exhaled breath analysis). The PROTEIN app is currently being tested in real users across a variety of population sub-groups and this presentation will summarise the extensive development work underpinning the current version of the app, its features and initial feedback from users.

Acknowledgement
Co-funded by Horizon 2020 Framework Programme of the European Union (No 817732).

PR-9

SMART OVEN

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Quality food preparation in the age of digitization and connected devices is becoming increasingly important for everyone. The development of household appliances dictates the use of more smart sensors, innovative algorithms and intuitive functions, which enable the user to easily achieve high-quality results. Gorenje is in the final stage of development of a pyrolytic oven with grill technology, including smart functions and the Connect Life mobile application. The new oven platform is intended for the Chinese market and includes the three innovative options. The first is Easy to use where the oven offers innovative grill food preparation technology that, thanks to advanced algorithms and a shaped grill plate, enables the preparation of grilled steaks on one side and pizza on the other. Measuring the temperature of the grill plate is made possible by a temperature sensor, which can be used to precisely control the process of grilling steaks and baking pizzas. Because juices and fats are released during food preparation, the oven includes a pyrolytic function, which allows for easy cleaning due to the elevated temperature (460 °C). The second innovative option is smart features where the oven supports the Connect Life mobile application with the following smart functions. i.) Shopping for ingredients through the Connect Life app, ii.) EAN code scanning – with the EAN code, the user transfers the settings for temperature curves, time and other parameters to the oven. iii.) Voice instructions: The user receives voice instructions on using the oven via the mobile application. iv.) Recipe sharing: Users can share recipes with other users and build a community. The third important option is New dimensions in food preparation where the new smart oven platform introduces two important benefits for the end user: a) Using the smart oven gives quality results without any cooking knowledge. With the EAN code, the user transfers the parameters to the oven. Thanks to automatic programs and smart algorithms, the result is of high quality and repeatable and b) The possibility of discovering new dimensions of food preparation and flavors thanks innovative algorithms.

PR-10

ISO-FOOD: PERSPECTIVES, CHALLENGES AND SUSTAINABILITY

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In 2014 the Department of Environmental Sciences at the Jožef Stefan Institute (JSI) established the ISO-FOOD ERA Chair for isotope techniques in food quality, safety and traceability. ISO-FOOD focuses on three thematic pillars: food authenticity, including developing and applying analytical and statistical tools to verify the geographical, production (organic or conventional), and species origin; translating isotopic and chemical signatures as fingerprints of local food products and the development of food quality and safety tools as the third pillar for detecting and identifying potentially hazardous chemical substances intentionally or unintentionally introduced during food processing. This third pillar includes organic substances derived from agricultural produce, food additives and packaging, non-essential and toxic elements including their speciation, nanoparticles, and natural and human-made radionuclides. It also includes the study of essential elements, bioactive compounds, and alternative and novel foods. A key strategy was to develop simultaneously two horizontal themes underpinning these three pillars: metrological support and the management of food compositional data. ISO-FOOD also focuses on knowledge transfer through organizing educational and training events aimed at national and international partners from academia, industry, NGOs and government agencies. The education of PhD students is achieved through a new food curriculum at the Jožef Stefan International Postgraduate School established in collaboration with the Biotechnical Faculty, University of Ljubljana.
Although official funding for the Chair is over, ISO-FOOD continues to unlock the department's potential through national and international projects. In this presentation, I will explore the motivation for hosting an ERA Chair as part of an overall strategy to build on the JSI's existing capacities and detail our vision of establishing the IJS as a leading multidisciplinary, international centre for isotopic and chemical techniques relating to food safety, quality and authenticity, building human capital, and transforming the JSI into a destination of choice for young researchers.

PR-11

UNDERSTANDING AND EXPLOITING THE IMPACTS OF LOW pH ON MICRO-ORGANISMS: A COST ACTION

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Understanding the impact of low pH on bacteria and yeasts is clearly of critical importance for a range of pure and applied microbiology disciplines, including clinical/veterinary, industrial/environmental, and food/drink microbiology. Research

in this area has made great progress in recent years, with much improved understanding of the molecular events which enable micro-organisms to sense and respond to low pH, and synergies between fundamental and applied research in the disciplines above have begun to develop. Despite this, there is considerable unrealised potential for people working in these different disciplines to interact more fully, and to share concepts, methods, and data. With this in mind, we established a COST Action (CA18113) entitled “EuroMicropH: Understanding and exploiting the impacts of low pH on micro-organisms”, which was launched in Spring 2019 and will run until 2023. We have used this Action to develop databases of relevant literature and of Action participants and their diverse expertise. In addition, we have specific working groups looking at applications in all the above fields, working to develop more and better links between fundamental and applied research. Role of Funding is available from the Action to enable lab exchanges and conference visits for people working in this area. Details of the work of the Action to date, and of the available funding opportunities that we can offer, will be presented.

Acknowledgments
The work performed by all authors was done within the framework of EuroMicropH-COST Action CA18113.

PR-12

FNS CLOUD PROJECT: APPROACHES OF BRANDED FOOD LABELLING AND COMPOSITION DATA COLLECTION FOR USE IN RESEARCH, SERVICES AND POLICY MAKING

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Existing food, nutrition and security resources (data, knowledge and tools) for health and agri-food sciences are fragmented and lack critical mass and access by user communities is often 'unevenly' distributed. This means data are not readily found, accessible, interoperable, or reusable. European HORIZON2020 research project 'Food Nutrition Security Cloud' [1] aims to develop solutions to this problem and will launch a first-generation 'food cloud', federating existing and emerging datasets with new services to support re-use by researchers. An important part of the project is focused on food composition and labelling data, which can either originate directly from food manufacturers, or are collected from regulated sources (i.e. labels). Food labelling exists to protect and support consumers' informed food choices, but also provide useful data for user communities, including policy makers, food businesses and researchers. In recent years, the food industry has come under increasing pressure to reformulate foods and improve their nutritional composition, but in most countries this is done on a voluntarily basis. A variety of data collection approaches [2] include conduction of cross-sectional monitoring studies of food stores, web scrapping and crowd-sourcing – which have become particularly interesting with the growing use of smart phones and associated infrastructure. A Slovenian case study will be presented, focused into beverages, yoghurts and breakfast cereals, showing how a combination of data collection approaches can be used together for assessments of nutritional composition of products in the food supply and use of specific ingredients (i.e. food additives). We will also demonstrate the importance of branded food composition data for businesses and service providers, on example of smart phone application.

Acknowledgments
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PR-13

MICROBIAL INTERACTIONS AS A BASIS OF *CAMPYLOBACTER JEJUNI* BIO-CONTROL

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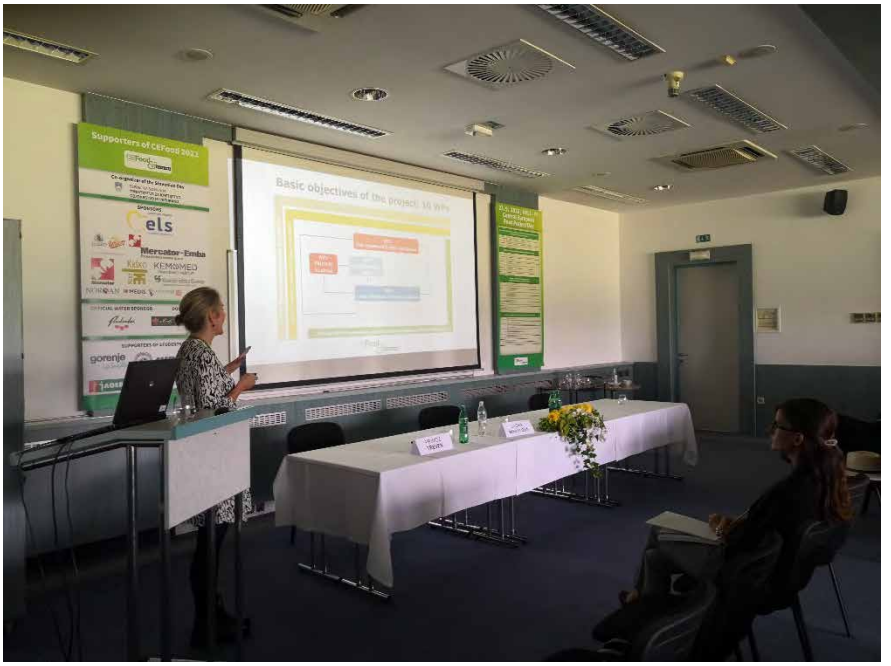
Campylobacter jejuni is the most frequent and increasingly resistant foodborne bacterial intestinal human pathogen, with high costs for public health and the economy. New methods and strategies for control of *C. jejuni* are needed, without inducing new resistance mechanisms. Biological control with specific phytochemicals, live bacteria and their metabolites are the options, however, interactions of *C. jejuni* are not well understood yet. The currently running project is tackling the gap in the fundamental knowledge of *C. jejuni* interactions on the (i) cell-to-cell, (ii) inter-strain and (iii) inter-species (*C. jejuni-B. subtilis*) level. We aim to understand quorum sensing (QS) mechanisms and quantify inhibition of QS, adhesion and biofilms on contact surfaces, and virulence reduction on model cell lines. Concerning inter-strain interactions of *C. jejuni*, this is the first project studying the impact of phylogenetic relatedness of *C. jejuni* strains on their interactions in co-culture, during biofilm formation and during spread of antibiotic resistance determinants. We target also *C. jejuni-B. subtilis* interactions to gain new knowledge of molecular mechanisms behind *B. subtilis* antagonistic interaction reducing *C. jejuni* survival, growth, and biofilm formation. Novel knowledge gained enables new understanding of *B. subtilis* as a probiotic antagonist of *C. jejuni*. With specified project aims we are contributing new knowledge to the fundamental and applied science of bacterial interactions – essential for the development of new strategies that will improve bio-based control of the important food-borne and increasingly resistant bacterial pathogen - *C. jejuni*.

Acknowledgments
This work was supported by Slovenian Research Agency (ARRS, J4-2542).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Slovenian day« The Event of Food, Culture and Socializing

(September 28,2022):
Ministry of Agriculture, Forestry and Food,
Republic of Slovenia

The welcome words by the President of the Scientific and Organizing Committee of the CEFood 2022 Congress, dr. Peter Raspor, Professor Emeritus.

Opening address: Minister of Agriculture, Forestry and Food, Ms. Irena Šinko.

A musical performance, the Brežice music school (traditional Slovenian music).

A lecture entitled ‘Around Slovenia with a Spoon and a Glass' by the Director of The Posavje Museum Brežice, Ms Alenka Černelič-Krošelj.
A musical performance, the Brežice music school (traditional Slovenian music).
Invitation to visit the stands and taste Slovenian foods and beverages, by the 'Princess of Slovenian wine Cviček'.

Conducted by dr. Bety Breznik, Member of the Scientific and Organizing Committee of the CEFood 2022 Congress.

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Peter Raspor, Slovenia

International Scientific Committee

The Program and Organizing committee and Advisory committee constitute International Scientific Committee of CEFood 2022 and are entitled for activities as specified in committee's tasks.

Program and Organizing Committee

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The Program and Organizing committee (POC) is composed of individuals and legal entities who understand and practice their responsibility for constituting program the organization and conducting the congress as follows:

Each member of the POC participate voluntarily and to the best of its' own ability to achieve good team spirit and organize high-quality event.

Each member of the POC will opening her/his unique capabilities for common mission adding to the mission comparable effort with all members of the team.

Each member of the POC is responsible for the representation and promotion of the congress mission in its' own professional environment.

The POC is responsible for all organizing aspects of the CEFood2022, such as: financial management, logistics, scientific program, abstract management, sponsorship and exhibitor management, communications, marketing and onsite management at the conference;

The POC is responsible for developing a well-balanced, high-quality scientific program together with Advisory Committee to be presented at the

conference. The conference is a unique opportunity for the members of the POC to showcase their institution's expertise and the developments in food science and technology in their region.

Each member of the POC participate take care about planning and realizing task in concordance with the team at regular meetings, If this will not be possible then she/he will inform POC in advance on common platform for communication

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The Advisory Committee is composed of the representatives of 17 CEI countries as follows: Albania, Austria, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Hungary, Italy, Moldova, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovakia, Slovenia and Ukraine.

Members of the Advisory Committee understand and practice their responsibility for the organization and conducting the congress along the following lines by:

1. Representing the CEFood 2022 mission within their countries in the field of food science, technology and nutrition, at all relevant organizations and other activities to enhance congress' visibility and attractiveness among food and nutrition professionals within all their relevant circles.
2. Suggesting / selecting prominent speakers and distinguished researchers from the food domain from their countries to the Scientific and Organizing Committee at the very early stage of CEFood 2022 preparation.
3. Promoting the congress mission at an early stage by encouraging professionals from the food domain to bring their work to the attention of the Scientific and Organizing Committee by sending abstracts from which presentations will be selected.
4. Spreading information about the CEFood 2022 in their respective countries to all relevant institutions, groups and companies to join the CEFood 2022 at different levels of program preparation and realization.
5. Building the spirit of importance of food for humankind with high respect for ethical and moral norms within the food supply chain, but also in research, development and education networks.

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Members of the Honorary Committee understand and practice their responsibility along the following lines by:

- Promoting the CEFood 2022 in their countries at all relevant scientific and professional levels and circles;
- Spreading information about CEFood 2022 in the CEI countries and also to the European scientific, research, development and educational space covering food in broadest view;
- Suggesting potential speakers to the Scientific and Organizing Committee in the early stage of the CEFood 2022 program design;
- Building the spirit of importance of food for humankind with high respect of ethical and moral norms within the food supply chain, but also in research, development and education networks.
- The Honorary Committee is composed from the principal organizers of all CEFood congresses.

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CEFOOD 2022 CONGRESS PROGRAM

Legend:
KL: Keynote lecture
OP: Oral presentation
FP: Flash presentations - young researchers
PR: Oral presentation of a project
R: Oral presentation at a Roundtable
W: Oral presentation at Workshops and World Café
P: Poster presentation

PRECONGRESS MEETING	
Monday, September 26, 2022	
HALL - CE	**Chairs: Fatih Özogul & Sonja Smole Možina**
17:00-20:00	4th GA Meeting of BioProMedFood / Bio-protective cultures and bioactive extracts as sustainable combined strategies to improve the shelf-life of perishable Mediterranean food **(Note: Restricted for project partners)**

Tuesday, September 27, 2022 - Central European Food Project Day			
HALL - P / Introduction to event		**Chairs: Ana Le Marechal-Kolar, Mitja Lainščak, Primož Treven, Peter Raspor**	
08:35-08:45	-	Mitja Lainščak	Reaserch activities in Slovenia: past present and future in agri-food cluster
08:50-09:00	-	Ana Le Marechal Kolar	Food R&D needed more than ever
HALL - P / Session 1		**Chairs: Daniela Borda & Primož Treven**	
09:15-09:30	PR-1	Ana Vučurović	Discovery and water-linked epidemiology of emergent tobamoviruses infecting crops
09:35-09:50	PR-2	Uroš Žibrat	NemDetect: Early detection of quarantine nematodes in potatoes using remote sensing
09:55-10:05	PR-3	Małgorzata Wronkowska	EU project EIT FOOD, as a tool to equip entrepreneurs and professionals with the skills needed to transform the local and global food system
10:10-10:25	PR-4	Mirjana B. Pešić	Short food supply chains: how the results of smartchain project can help?
10:30-11:00	Coffe break & Exhibition		
HALL - P / Session 2		**Chairs: Dasha Mihaylova & Primož Treven**	
11:00-11:15	PR-5	Urška Pivk Kupirovič	Entrecompfood project - applying entrecomp to attract young people to the 1st European manufacturing sector: the agri-food industry
11:20-11:35	PR-6	Fatih Özogul	Bio-protective cultures and bioactive extracts for the improvement of the shelf-life of perishable foods (BIOPROMEDFOOD
11:40-11:55	PR-7	Diana Paveljšek	Laktika, fractionation and processing of whey proteins for the formation of new functional foods and food supplements
12:00-12:15	PR-8	Kathryn Hart	Personalized nutrition for healthy living: the protein project and application
12:20-12:35	PR-9	Simon Brezovnik	Smart Oven
12:40-13:15	Lunch break & Exhibition		

Tuesday, September 27, 2022 - Central European Food Project Day			
HALL - P / Session 3		**Chairs: Mirjana Pešić & Primož Treven**	
13:15-13:30	PR-10	Nives Ogrinc	Iso-food: perspectives, challenges and sustainability
13:35-13:50	PR-11	Aleksandra Djukić-Vuković	Understanding and exploiting the impacts of low pH on micro-organisms: a cost action
13:55-14:10	PR-12	Anita Kušar	Fns cloud project: approaches of branded food labelling and composition data collection for use in research, services and policy making
14:15-14:30	PR-13	Sonja Smole Možina	Microbial interactions as a basis of *Campylobacter jejuni* bio-control
14:30-14:45	Kemomed d.o.o., commercial presentation		
HALL - P / Wrapping up session		**Chairs: Primož Treven & Peter Raspor**	
14:45-15:15	Final discussion		
15:45-16:45	Poster mounting at the Poster Square		
GRAND HALL		**OPENING SESSION** **Chairs: Peter Raspor, Irena Vovk & Andrej Ovca**	
17:00-17:30	**OPENING CEREMONY** Slovenian national anthem to recognise honorary patronage of the President of the Republic of Slovenia Borut Pahor Welcome to 11th Central European Food Congress by Peter Raspor, CEFood 2022 congress president. Welcome words by Professsor Viktor Nedović, acting moderator of CEFood in the name of EFFoST Tha artistic contribution: Zdravko Perger, baritono and Stefan Pajanović, Piano.		
	OPENING LECTURES		
17:30-18:00	PL-1	Lučka Kajfež Bogataj	From environment to food (and back): what has to be done in the next decade
18:00-18:30	PL-2	Karl-Heinz Wagner	Dietary challenges related to demographic shift in aging population
18:30-19:00	PL-3	Hugo de Vries	The future partnership sustainable food systems (SFS); consequences for food science and technology (FST) and vice versa
19:00-22:00	WELCOME PARTY with Slovenian regional gastronomy Ensemble Doctor & Doctor		

Wednesday, September 28, 2022 - From technology to food			
07:00-	Registration		
07:30-08:30	Poster session with morning coffee		
GRAND HALL		**Chairs: Elena Velickova & Vlado Mrša**	
08:30-08.55	PL-4	Atanas Pavlov	Plant in vitro technology for foods and food additives: current status, speculations and future prospects
09:00-09:15	Break & Exhibition		
HALL - A / Session 1		**Before and after the harvest (Dedicated to France Adamič) Chairs: Michael Murkovic & Bety Breznik**	
09:15-09:35	KN-1	Yaroslav Blume	Underutilized and forgotten crops: future for smart food
09:40-09:55	OP-1	Polona Kogovšek	Molecular techniques for detection and identification of plant pathogenic and food spoilage fungi
10:00-10:15	OP-2	Sandra Bulut	Antifungal activity of essential oils and β-cyclodextrin/essential oil microparticles against toxigenic Aspergillus spp.
10:20-10:35	OP-3	Chiara Rossi	Application of a starch-based aerogel loaded with hexanal to control postharvest decay of sweet cherries
HALL - B / Session 2		**Plants - a staple food or an alternative? (Dedicated to Fran Jesenko) Chairs: Zuzana Ciesarová & Bojan Butinar**	
09:15-09:35	KN-2	Katarzyna Małgorzata Majewska	Wheat on the censored – whether we really should eliminate wheat products from our diet?
09:40-09:55	OP-4	Johana Rondevaldová	Underutilized fruits and vegetables with future potential for food and nutrition security: a case study of south east asia
10:00-10:15	OP-5	Mirjana B. Pešić	The application of polyacrylamide gel electrophoresis for plant-based food authentication and functional food quality evaluation
10:20-10:35	OP-6	Erika Dobroslavić	Antioxidant stability of medicinal plants' hydrosols during storage
HALL – C / Session 3		**Potentials and limitations of bioactive compounds (Dedicated to Anton Janša) Chairs: Jaroslav Havlik & Primož Treven**	
09:15-09:35	KN-3	Stela Jokić	Insights in advanced extraction techniques used for bioactive compounds isolation
09:40-09:55	OP-7	Ajda Kunčič	Antimicrobial activity of Slovenian honeys in relation to the content of phenolic compounds and antioxidative activity
10:00-10:15	OP-8	Giulia Tabanelli	Effects of *Rubus fruticosus* and *Juniperus oxycedrus* derivatives on the culturability and viability of *Listeria monocytogenes*
10:20-10:35	OP-9	Ena Cegledi	The influence of extraction and enviromental parameteres on the isolation of bioactive compounds from nettle (*Urtica dioica* L.)
10:40-10:50	Final session discussion		
10:40-11:05	Break & Exhibition		

Wednesday, September 28, 2022 - From technology to food			
HALL – A Roundtable		**Edible insects - food of the future? Dedicated to Franc Bučar Sponsored by: Chemass d.o.o. Chairs: Diána Bánáti & Andrej Ovca**	
11:10-13:00	RT-1	Diána Bánáti	Edible insects for human consumption: a trend or a fad?
		Panel members: Atanas Pavlov, Anca Ioana Nicolau, Domagoj Gabrić, Michael Murkovic, Andrea Gross – Bošković	
HALL – B World cafe		**World cafe on Food Supplements Dedicated to: Boris Kuhar Sponsored by: Norsan & Medis Chairs: Slađana Šobajić & Evgen Benedik**	
11:10-13:00	W-1	Irena Vovk	Analyses of food supplements – challenges and benefits
	W-2	Tena Niseteo	Implications and challenges of food supplementation in children
	W-3	Slađana Šobajić	Legislative on food supplements in EU - What we have and what is missing
HALL – C Workshop		**Challenges for beer and wine in today's food world Dedicated to Matija Vertovec and Ferdo Fišer Sponsored by: Pivovarna Laško Union & Agricultural Institute of Slovenia Chairs: Viktor Nedović & Franci Čuš**	
11:10-13:00	W-4	Iztok Jože Košir	Determination of the geographical origin of hops and terroir influence on the quality
	W-5	Franc Čuš	Wine quality: yield, yeast or terroir?
	W-6	Viktor Nedović	The impact of new technologies on beer quality and sustainability
	W-8	Boris Gadzov	Linking beer flavour fingerprints with consumer preferences in different beer styles and trends on the market
13:00-14:05	Lunch & Exhibition		
HALL - A / Session 4		**New food products, technologies and techniques (Dedicated to Franc Bitenc) Chairs: Gerhard Schleining & Evgen Benedik**	
14:10-14:30	KN-4	Slavica Grujić	Development of sweet bakery products with controlled nutritive quality, according to the recommendations for a healthy nutrition
14:35-14:50	OP-10	Tersia Needham	From veld-to-fork: post-mortem ageing techniques to improve the eating quality of common eland (Taurotragus oryx) meat
14:55-15:10	OP-11	Çağım Akbulut Çakır	The effect of irradiation on some microbiological and chemical properties of reduced fat white cheese from raw milk
15:15-15:30	OP-12	Lidija Fras Zemljič	Chitosan formulations enriched with incapsulated phyto/phycochemicals as active coating for polylactic packaging foil
15:35-15:50	Final session discussion		

Wednesday, September 28, 2022 - From technology to food			
HALL - B / Session 5		**Can we improve food properties and prevent food fraud at the same time? (Dedicated to Marta Blinc) Chairs: Yaroslav Blume & Mojca Jevšnik**	
14:10-14:30	KN-5	Jaroslav Havlík	Nuclear magnetic resonance spectroscopy: a versatile and robust tool for food fraud detection
14:35-14:50	OP-13	Andreja Ramšak	Using omics approaches in seafood traceability: a case study from Slovenia
14:55-15:10	OP-14	Tomislav Mikuš	Influence of the addition of white button mushroom supplement in the diet on the sensory and technological properties of lamb meat
15:15-15:30	OP-15	Sandra Balbino	Optimization of almond based dairy-free milk alternative formulation fortified with myrtle, laurel, and fennel extracts
15:35-15:50	Final session discussion		
15:50-16:45	Poster session with afternoon tea & Exhibition		
GRAND HALL		**Chairs: Anca Nicolau & Andrej Ovca**	
16:45-17:10	PL-5	Livia Simon Sarkadi	Importance of amino acids and biogenic amines in food quality and nutrition
GRAND HALL		**Chair: Bety Breznik**	
17:15-21:00	Slovenian day / The Event of Food, Culture and Socializing The opening words by the President of the Scientific and Organizing Committee of the CEFood 2022 Congress, Peter Raspor Opening address: Ms. Irena Šinko, Minister of Agriculture, Forestry and Food, Vida Čadonič – Špelič, president of the Committee for Agriculture, Forestry and Food and member of the National Assembly. A musical performance, the Brežice music school (traditional Slovenian music). A lecture entitled 'Around Slovenia with a Spoon and a Glass' by the Director of The Posavje Museum Brežice, Alenka Černelič-Krošelj. An invitation to visit the stands and taste Slovenian foods and beverages will follow by an address by the 'Princess of Slovenian wine Cviček'.		

Thursday, September 29, 2022 - From food to nutrition			
07:00-	Registration		
07:30-08:30	Poster session with morning coffee		
GRAND HALL		**Chairs: Viktor Nedović & Nataša Poklar Urlih**	
08:30-08:55	PL-6	Blaženka Kos	Next-generation probiotics and prebiotics – an efficient strategy for balancing the human microbiota
09:00-09:15	Break & Exhibition		
HALL - A / Session 6		**Food related health hazards and risks (Dedicated to Ivo Pirc) Chairs: Gabriella Kiskó & Primož Treven**	
09:15-09:35	KN-6	Zuzana Ciesarová	Acrylamide-free foods: a challenge and experience
09:40-09:55	OP-16	Petra Mohar Lorbeg	Resistomes of probiotic and starter cultures as potential risk factors for the spread of antibiotic resistance
10:00-10:15	OP-17	Krisztina Takács	Traceability and prediction of allergenic risk of alternative protein sources
10:20-10:35	OP-18	Levent Şen	Physical, chemical and sensory characterization of calcium fortified plant-based milks prepared in different formulations
10:40-10:55	OP-19	Nada Smigic	Older consumer food safety perception of ready-to-eat foods
11:00-11:10	Final session discussion		
HALL - B / Session 7		**Nutrition: is the point in the food or in the gut? (Dedicated to Dražigost Pokorn) Chairs: Ladislav Kokoska & Mojca Jevšnik**	
09:15-09:35	KN-7	Nataša Poklar Ulrih	Novel approaches in enhancing bioavailability of bioactive substances
09:40-09:55	OP-20	Maja Berlic	The contribution of kindergarten meals to the daily nutrition: a randomized controlled evaluation
10:00-10:15	OP-21	Snežana Barjaktarović-Labović	Iodine status of breastfeeding mothers in Montenegro
HALL - B / FLASH		**Dedicated to Marjan Simčič Chairs: Loredana Dumitrascu & Irena Vovk**	
10:15-11:00	FP-1	Lukáš Huml	How to detect contamination by anabolic-androgenic steroids? Focus on tailor-made multidisciplinary approaches
	FP-2	Kim Bratkič	Exploring the use of salt tolerant plants as sources of sustainable food additives: functionalization of yogurts with Carpobrotus edulis fruit extract
	FP-3	Meta Sterniša	*Pseudomonas* spp. – is it really just spoilage?
	FP-4	Martina Čagalj	The effect of microwave- and ultrasound-assisted extractions on the antioxidant potential of selected seaweeds from the Adriatic

Thursday, September 29, 2022 - From food to nutrition			
HALL - B / FLASH		**Dedicated to Marjan Simčič** **Chairs: Loredana Dumitrascu & Irena Vovk**	
10:15-11:00	FP-5	Anja Bolha	Relationship between salt consumption, measured by 24-hour urine collection, and salt-related knowledge and behaviour in young adults
11:00-11:10	Final session discussion		
HALL – C / Session 8		**Biotechnology: evolution or revolution?** **(Dedicated to Friderik Gerl)** **Chairs: Aleksandra Djukić- Vuković & Andrej Ovca**	
09:15-09:35	KN-8	Steva Lević	Analytical methods for encapsulation
09:40-09:55	OP-22	Neža Čadež	Evolutionary engineering of autochthonous yeasts for novel beer-like fermented beverage
10:00-10:15	OP-23	Allan Olspert	Valorization of food by-products by using solid state fermenations
10:20-10:35	OP-24	Ilija Gasan Osojnik Črnivec	Opportunities for ethanol production by encapsulated yeasts in favourable and unfavourable growth environtmets
10:40-10:55	OP-25	Tomasz Sawicki	Inhibitory potential of betalains-rich products against digestive enzymes and formation of advanced glycation end-products linked to type 2 diabetes
11:00-11:10	Final session discussion		
11:15-11:30	Break & Exhibition		

Thursday, September 29, 2022 - From food to nutrition			
HALL - B Workshop		**Food and its safety in a fast changing world Dedicated to Marko Gerbec Sponsored by: ICFMH – International Committee on Food Microbiology and Hygiene Chairs: Andreja Rajkovic & Peter Raspor**	
11:30-13:15	W-9	Andreja Rajković	Microplastics in food safety: From toxicity to shuttle effect?
	W-10	Antonello Paparella	Plant essential oils for food safety: From research to practice
	W-11	Gabriella Kiskó	Antibiotic resistance: Still Food safety concern?
	W-12	Peter Šimko	How efficient is Elimination of aflatoxin treat from milk?
	W-13	George Nychas	Data Science; can it be at the Food Safety service
	W-14	Peter Raspor	Food Microbiology/food safety education and training obstacles in virtual world?
HALL – C Workshop		**Modern food: local vs. global, traditional vs. innovative in the "healthy" perspective Dedicated to Aleksandra Kronhauzer Frazer Sponsored by: Mercator-Emba Chairs: Nadiya Boyko & Bojan Butinar**	
11:30-13:15	W-15	Daniela Borda	EU consumer profiling: local and global food safety practices
	W-16	Adrienn Hegyi	Modern Healthy food: Local vs. Global, who is the winner? Internet vs. to eat on-site?
	W-17	Nadiya Boyko	Healthy food – how to measure? to detect? to prove?
13:00-14:05	Lunch & Exhibition		
HALL - A / Session 9		**Food microbes: friends or foes? (Dedicated to France Megušar & Jelisava Adamič) Chairs: Antonello Paparella & Sonja Smole Možina**	
14:10-14:30	KN-9	Raffaella Di Cagno	Metabolic and functional paths of microorganisms in fruit and vegetables based foods
14:35-14:50	OP-26	Katarina Šimunović	Bacterial interactions of a potential probiotic strain Bacillus subtilis PS-216 lead to foodborne pathogen control in biofilms and in poultry
14:55-15:10	OP-27	Evelyne Selberherr	Advances in microbiome research to understand microbial dynamics across the food chain and during ripening
15:15-15:30	OP-28	Conrado Carrascosa Iruzubieta	Evaluation of efficacy of essensial oil against Pseudomonas spp from artesanal cheeses
15:35-15:50	Final session discussion		

Thursday, September 29, 2022 - From food to nutrition			
HALL - B / Session 10		**Consumer's food choices and risk managment (Dedicated to Magdalena Knafelj Pleiweis & Rajko Ložar) Chairs: Daniela Borda & Andrej Ovca**	
14:10-14:30	KN-10	Anca Ioana Nicolau	New challenges and opportunities for industry to support consumers in managing food safety risk
14:35-14:50	OP-29	Saša Kenig	Health promoting effects of Helichrysum italicum and H. arenarium Infusions
14:55-15:10	OP-30	Mojca Korošec	Comparison of three sensory discrimination tests for a routine work with a 12-member panel in food industry
15:15-15:30	OP-31	Petra Chaloupková	Impact of the COVID-19 pandemic on nutrition and lifestyle behaviour of european consumers
15:35-15:50	Final session discussion		
HALL - C / Session 11		**Food analytics (Dedicated to Maks Samec) Chairs: Livia Simon Sarkadi & Irena Vovk**	
14:10-14:30	KN-11	Michael Murkovic	Contaminants originating from heat processing of foods
14:35-14:50	OP-32	Vasilij Valenčič	Changes in sensory characteristics, volatile compounds, and biophenols in olive oils due to the olive fruit fly bactrocera oleae (gmelin) infestation
14:55-15:10	OP-33	Toomas Paalme	Relative refractive index values of sugars, organic acids, alcohols, and those application in quantitative chromatographic analysis using RDI detector
15:15-15:30	OP-34	Katja Babič	Can we verify the origin of Slovenian pork meat on the market?
15:35-15:50	Final session discussion		
15:50-16:25	Poster session & Exhibition		
GRAND HALL		**Chairs: Eva Glencser & Bojan Butinar**	
16:30-16:55	PL-7	Andrej Ovca	Systematic analysis of formal education and training in the field of food safety with combined research approach
19:00-22:00	**Gala dinner** Gastronomic experiance by Chefs Jožef Oseli, Branko Podmenik, Cvetka Granc and Aleksander Bohinc and staff from hotel Terme Tha artistic contribution Katarina Perger, soprano and Tadej Horvat, piano, Bojan Sotošek, guitar		

Friday, September 30, 2022 **CE-I-FooDay (Central European Inspiration Food day)**			
GRAND HALL		**Introduction**	
08:30-08:40		Opening by Peter Raspor, Organižer of event Message from Franc Bogovič, Member of European parlament (SLS/EPP) Message from HATZ repersenative, Vlado Mrša	
GRAND HALL		**Chairs / promotors: Ilirjana Boci, Gerhard Schleining, Verica Dragović Uzelac, Kokoška Ladislav, Éva Gelencsér Antonello Paparella, Małgorzata Wronkowska, Daniela Borda, Mirjana Pešić, Nadiya Boyko, Peter Raspor**	
08:40-08:55	OP-35	Fatjon Hoxha	Tackling honey adulteration patterns in current food systems
09:00-09:15	OP-36	Victoria Krauter	Food packaging: Food quality, safety and sustainability
09:20-09:35	OP-37	Andrea Gross-Bošković	The current challenges for salt in technology and human nutrition
09:40-09:55	Break & Exhibition		
10:00-10:15	OP-38	Marketa Houdkova	Antimicrobial potential of plant volatile agents for food shelf life extension
10:20-10:35	OP-39	Zsuzsanna Bugyi	Challenges and future prospects of gluten analysis in food
10:40-10:55	OP-40	Sergio Ghidini	From target to untargeted chemistry to improve food safety and authenticity
11:00-11:15	OP-41	Małgorzata Korzeniowska	Poultry meat production and processing – beyond the challenges
11:15-11:25	Break & Exhibition		
11:30-11:45	OP-42	Loredana Dumitrascu	Non-animal protein sources and resources- new strategies of valorization into value-added ingredients
11:50-12:05	OP-43	Ana Salević	The advantages and disadvantages of active, biodegradable materials for food packaging
12:10-12:25	OP-44	Viktoriia Kiptenko	Traditional [Ukrainian] food - the challenges for the sustainable nutrition and pathway to success
12:30-12:45	OP-45	Jelka Šuštar-Vozlič	The use of plant genetic resources for healthy food and environment
12:50-13:00	Break & Exhibition		
GRAND HALL		**Chairs: Peter Raspor, Irena Vovk & Andrej Ovca** **Closing session**	
13:00-13:25	PL-8	Daniela Borda	Food technology and nutrition in a scoop – ice cream
13:30-14:30	Closing ceremony with best flash presentation awards, best poster presentation awards and invitation to the next meeting		

POST CONGRESS MEETING	
Friday, September 30, 2022	
HALL - CE	**Chairs: Joana Amaral & Irena Vovk**
15:00-18:00	Meeting of Food Chemistry Divison (Restricted for members) / European Chemical Society **(Note: Restricted for members)**


The main wine sponsor
at the gala dinner
is Wine cellar Krško
and director and oenologist
Jure Grubar
KRŠKO
KLET
Guest chefs:
Jožef Oseli,
Branko Podmenik
(Borbona catering)
Wine pairing selected by the
3rd level sommelier
Aleksander Bohinc
SOMMELIER
MASTER
terme čatež
3
BORBONA
creative & vegan
catering
SLOVENIAN
GALA DINNER
CEFood & Congress
Terme Čatež
29th September 2022

TURN Premium white sparkling wine,
traditional method,
Dolenjska wine region,
extra brut, 2019, 0,75L,
Wine cellar Krško

A signature dish of
chef **Cvetka Gramc** (Terme Čatež)

TURN Premium white pinot,
Bizeljsko - Sremič wine region,
dry, 2018, 0,75L,
Wine cellar Krško

Marinated trout tartar,
buckwheat crunch,
horse radish and young cheese cream,
marinated shallot,
fresh herbs,
trout caviar.

A signature dish of
chef **Branko Podmenik** (Borbona catering)

TURN Premium Blaufränkisch,
Bizeljsko - Sremič wine region,
dry, 2017, 0,75L,
Wine cellar Krško

Aged beef,
pumpkin puree,
cottage cheese dumplings,
glazed autumn vegetables,
meat sauce and Blaufränkisch reduction,
mustard seeds.

A signature dish of
chef **Jožef Oseli** (Borbona catering)

Sauvignon selection,
Bizeljsko - Sremič wine region,
sweet, 2010, 0,50L,
Wine cellar Krško

Grape cake,
jurka grape jelly,
caramelized pear,
chestnut foam.

Not the flour makes the bread, but the hand.

(Kruha ne naredi moka ampak roka)
(Slovenian Proverb)

20 years back:

Nature gives us food for survival and pleasure.

Narava nam daje hrano za preživetje in užitek.

(September 2002)

Today:

Let our Food be our thought,
our health and our respect for Mother Earth.

Naj bo naša hrana naša misel,
naše zdravje in naše spoštovanje materi Zemlji.

In 20 years:

I dream of food provided by Nature.

Sanjam o hrani, ki jo daje Narava.

(P. Raspor, September 2022)