

Congresso Internacional
International Congress

S4agro23

Book of Abstracts

March 2-3, 2023

Cine-Teatro Avenida

Castelo Branco, Portugal



Cofinanciado por



UNIÃO EUROPEIA
Fundo Europeu
de Desenvolvimento Regional

Pedro Dinis Gaspar

University of Beira Interior, Portugal

(Editor)

Date

March 2023

Cofinanciado por:



UNIÃO EUROPEIA
Fundo Europeu
de Desenvolvimento Regional

Title:

Book of Abstracts - International Congress S4Agro

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Acknowledgments:

The editorial board thanks the “Programa Operacional Fatores de Competitividade” - COMPETE for funding the S4Agro project.

The partners of the S4Agro Project thank all public and private institutions, entities, and agencies that have contributed to the project objectives.

ISBN:

978-989-654-931-2

DOI:

10.25768/654-932-9

Graphical project and design:

Catarina Laginha

Note:

This book includes the Abstracts of the papers presented at the S4agro International Congress 2023 – Congresso Internacional S4Agro 2023 . *Soluções Sustentáveis para o Setor Agroindustrial (Sistema de Apoio a Ações Coletivas - SIAC: 02/SIAC/2019, Ref.: 46425)*

The book is available for download at https://s4agro.pt/congresso/book_of_abstracts_s4agro2023/.

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Framework

The Project S4AGRO: Sustainable Solutions for the Agroindustrial Sector (*Soluções Sustentáveis para o Setor Agroindustrial* - Sistema de Apoio a Ações Coletivas - SIAC: 02/SIAC/2019, Ref.: 46425) aims to qualify SMEs in the agro-industrial sector, namely in the meat products, horticultural products, dairy products and bakery products, to adopt innovative and sustainable solutions to increase their productivity, effectiveness and efficiency in terms of Industry 4.0 and circular economy..

The main objective is to identify and disseminate among SMEs in the agro-industrial sector, good practices in the use of sustainable primary (ecological) and secondary (recyclable and/or reusable) packaging and the critical factors to their application and the most effective logistics practices. Innovative technologies and best practices in the use of intelligent and/or active packaging are also addressed in this context. It also addresses cybersecurity, aiming to identify critical factors for the security of computer systems and qualification for the application of good practices. It is also aimed at identifying and characterizing waste-generating points and defining innovative solutions for their use in order to improve production efficiency and reduce environmental impacts. It also aims to enable, disseminate and facilitate access to training processes for the introduction of scientific and technological-based innovation in order to enable SMEs to accelerate the adoption of Industry 4.0.

Congress S4AGRO

S4Agro International Congress 23 is a technical and scientific international event devoted to food science and technology. It brings together researchers, scientists, policy makers, professionals and students from multidisciplinary food-related fields to share the latest advances in the current scientific knowledge, with industrial relevance and new developments in food science and emerging technologies, devoted to help the sustainability of the agrofood sector.

It aims to discuss innovations, technologies and engineering methods and procedures in packaging, food loss and waste, circular economy, sustainability, and cybersecurity applied to the agro-food industry. Communications addressing novel combination of more than one technology are welcome, as well as studies dealing with innovation and advances in all branches of the Congress topics.

See all details at <https://s4agro.pt/congresso/en/>

Topics

- Sustainability
- Novel and emerging technologies
- Packaging
- Logistics
- Food loss and waste reduction and valorization
- Circular Economy
- Cybersecurity
- Energy Efficiency
- Information and Communication Technologies
- Food safety
- Food security
- Entrepreneurship
- Knowledge transfer, Skills and Qualifications

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Program

March 2

09h30 Opening Ceremony

Auditorium

Mayor of Castelo Branco - **Leopoldo Rodrigues**

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President IIA of Instituto Politécnico de Coimbra - **Marta Henriques**

11h00 Presentation of the Project +AGRO

Auditorium

Global coordinator of +AGRO - **Pedro Dinis Gaspar**

11h30 Food Lounge

Tasting of InovCluster's delicacies and Networking

11h40 Strategies to Prevent Food Waste in Agroindustries

Main Auditorium

Elias, Miguel – University of Évora

11h40 Monitorização em tempo real da temperatura e humidade

Auditorium 2

do ar na curta distribuição de produtos hortofrutícolas: O caso de

estudo PrunusPOS

Gaspar, Pedro Dinis – University of Beira Interior

11h50 Embalagem de elevado desempenho para frutos Auditorium 2

perecíveis: A abordagem Pack2Life

Gaspar, Pedro Dinis – University of Beira Interior

12h00 Primary Packaging – Sustainable solutions for Food Main Auditorium

Pereira, Carlos Dias – Instituto Politécnico de Coimbra

12h00 Uma abordagem integrada à cultura de plantas silvestre e ao turismo em regiões de montanha por via de um sistema previsional inteligente de suporte à decisão em sustentabilidade: Montanha Viva Auditorium 2

Gaspar, Pedro Dinis – University of Beira Interior

12h10 Secondary Packaging Sustainable for Food Main Auditorium

Pinheiro, Rita – Instituto Politécnico de Viana do Castelo

12h10 (Re)inovação de tecnologias para irrigação e abastecimento de água a pequenos agricultores: A abordagem MED-WET Auditorium 2

Gaspar, Pedro Dinis – University of Beira Interior

12h20 Sistemas de monitorização e de apoio à decisão em agrobiodiversidade aplicado à viticultura: Resultados de campo do sistema BioD'Agro Auditorium 2

Gaspar, Pedro Dinis – University of Beira Interior

12h30 Active and Intelligent Packaging Main Auditorium

Gaspar, Pedro Dinis – University of Beira Interior

12h30 *Aplicação da tecnologia disruptiva blockchain nas cadeias agroalimentares visando o desenvolvimento sustentável, uma revisão sistemática*

Auditorium 2

Galvez, Luighi Digenaro Cruz

12h45 Food Loungue

14h00 Good Practices for a Greener and Digital Agroindustry **Main Auditorium**

Luzio, António - Green Flavours

14h00 *Workshop: Secondary Packaging – Standards that generate innovation*

Campos, Alexandre – Competinov

Auditorium 2

14h20 *Workshop:Active Packaging*

Auditorium 2

Lima, Tânia

14h30 *Workshop: Intelligent Packaging*

Auditorium 2

Gaspar, Pedro Dinis – University of Beira Interior

14h50 *By4Dev – Create professionals for the valorization of agroindustry waste*

Dominguez, Carlos Cabo Dominguez – Fundecyt

Main Auditorium

15h00 *Round Table: Sustainability and Reduction of Food Waste in Agroindustry*

Main Auditorium

Velho, Manuela Vaz – Director of CISAS Instituto Politécnico de Viana do Castelo

16h15 Food Lounge

Tasting of InovCluster and Networking products

16h30 Sustainable Packaging

Main Auditorium

Gândara, João - Instituto Politécnico de Coimbra

16h30 Intelligent and Active Packaging

Auditorium 2

Gaspar, Pedro Dinis – University of Beira Interior

16h40 Aromatic and Medicinal Plants – Based Tourism Sector: success cases and best practices

Main Auditorium

Do Paço, Arminda – University of Beira Interior

16h40 A sustainable, nutritious, and innovative fish sausage with seaweed

Fernandes, Wilson D.

Auditorium 2

16h50 Aromatic and Medicinal Herbs – Biodiversity, Quality and Sustainable Use: A Systematic Review.

Main Auditorium

Hamdane, Samia

16h50 Effects of decoction treatment on bioactivities of seaweed

Auditorium 2

Caetano, Miguel

17h00 Microbiological safety of fresh beef sausage

Main Auditorium

Ricardo-Rodrigues, Sara

17h00 Cheese microbiota under the microscope: technological

Auditorium 2

and pathogenic potential

Serrano, Susana

**17h10 Gestão Sustentável de Resíduos na Produção de
Plantas Aromáticas e Medicinais**

Main Auditorium

Marcelino, Sara

**17h10 Seaweeds-based edible coatings for extending the shelf
life of seafood.**

Auditorium 2

Miranda, Andreia

**17h20 Bibliometric analysis about agriculture, stochastic
analysis frontier (sfa), and data envelopment analysis (DEA)**

Main Auditorium

Oliveira, Henrique de

**17h20 Selection of sustainable and nutritionally balanced
plant-based flours to fortify gluten-free products**

Auditorium 2

Sousa, Ana Patricia

**17h30 Análise de eficiência eco energética de climatização
de cogumelos com proposta de equipamento específico, com fim de
reduzir consumo de energia e emissões de CO².**

Main Auditorium

Santos, Alexandre F.

**17h30 The effect of glazing on the physicochemical and
microbiological properties of Alentejano x Duroc pork meat**

Auditorium 2

Rouxinol, Maria Inês

17h40 Closing of the 1st day of the Congress

Main Auditorium

Christelle Domingos - InovCluster

20h30 Dinner

March 3

09:00 Participants Check.in

Main Entrance

09:00 Soluções Tecnológicas Inovadoras para a

Main Auditorium

Agroindústria mais Verde e mais Digital

Rodrigues, Ivanoel – Hortee

09:30 The effect of biodegradable film packages on texture and
color properties of Alentejano x Duroc pork meat

Auditorium 2

Galveias, Ana

09:40 Fast wild fermentation as a tool for valorization of olive
pomace paste by-product

Auditorium 2

Palmeira, Josman Dantas

09:50 Análise bibliométrica: Um estudo aplicado à rotulagem
ecológica nos produtos alimentares.

Auditorium 2

Borges, Eduardo

10:00 Fortification/enrichment of Sarrajão (Sarda sarda) fillets
with hydrocolloid and vegetable and animal protein coatings

Auditorium 2

Solinho, Joana

- 10:10** Quality of fresh sausages made from cachena meat – texture and sensory analysis
Ricardo-Rodrigues, Sara
Auditorium 2
- 10:20** Circular Bioeconomy in the wine sector: applications and challenges for the exploitation of biochar produced from vine pruning
Ferraz, Ana Isabel
Auditorium 2
- 10:30** Cibersegurança nas Empresas Agroindustriais – A contribuição do projeto S4agro
Antunes, Mário - Instituto Politécnico de Leiria
Main Auditorium
- 10:50** Food Lounge
Degustação de produtos InovCluster e Networking
- 11:20** Mesa Redonda
A importância da Cibersegurança para as empresas
Antunes, Mário - Instituto Politécnico de Leiria
Main Auditorium
- 11:20** Workshop
Embalagens Primárias Sustentáveis
Gândara, João - Instituto Politécnico de Coimbra
Auditorium 2
- 11:40** Workshop
Práticas para redução do desperdício alimentar
Elias, Miguel – University of Évora
Auditorium 2
- 12:00** Use of edible coatings for storage of ‘crimson’ seedless
Auditorium 2

table grapes

Ricardo-Rodrigues, Sara

**12:10 Behaviour of prickly pear stored in cold conditions in
different packaging materials**

Auditorium 2

Trindade, Sofia

12:30 Food Lounge

Lunch

**14:00 Concurso S4agro – Desafios e Soluções inovadoras
no Agroalimentar / Entrega de Prémios**

Main Auditorium

Teixeira, André – Soresa

14:00 Workshop

Auditorium 2

Cibersegurança

Antunes, Mário - Instituto Politécnico de Leiria

14:20 Spatial modelling and agro-industrial organic waste

Auditorium 2

**recovery in circular (bio)economy processes and smart regional
development**

Alonso, Joaquim Mamede

14:30 European citizens' self-responsibility in climate change

Auditorium 2

Impediment

Mata, Fernando

14:40 Do Portuguese traditional cheeses harbor potentially

Auditorium 2

or spoilage bacteria?

Zueva, Maria

14:50 Sustainable dietary choices: the contribution of the **Auditorium 2**
ALTERNATIVA project as a tool for selecting alternative proteins

Assunção, Ricardo

15:00 Sustainability indicators in agricultural organizations: **Auditorium 2**
An systematic review of literature

Ferreira, Sandra

15:00 Scientific Presentation – POSTERS **Auditorium 2**

- Assessment of the potential of green phenolic extracts of a chestnut by-product to be used as a natural preservative – Veríssimo, Lavínia
- Antioxidant potential of ultrasound-assisted extracts rich in phenolic compounds obtained from a chestnut biowaste - Veríssimo, Lavínia
- Study of texture and the phenolic composition of grapes cv. tempranillo under different irrigation treatments - *Agulheiro-Santos, Ana Cristina*
- Food waste assessment in the fresh sector of a large-scale food retail store – Gomes, Mariana
- Food waste assessment in a hospital catering services – Araújo, Alberta
- Innovative technologies, parameters and good practices in sustainable secondary packaging of agri-food products – Pinheiro, Rita
- Dissemination of Enterococcus spp. on various foods and food-related settings – Santana, *Andressa Rodrigues*

15:30 Round Table

Cooperation towards Innovation – What Opportunities?

Paiva, Teresa - Instituto Politécnico da Guarda

17:00 Main Auditorium

Cerimónia de Encerramento

17:30 Food Lounge

Juniper of honor and Tasting of InovCluster products

Book of Abstracts

QUALITY OF FRESH SAUSAGES MADE FROM CACHENA MEAT - TEXTURE AND SENSORY ANALYSIS

S. Ricardo-Rodrigues¹, A. C. Agulheiro-Santos^{1,2}, M. Laranjo¹, M. E. Potes^{1,3}, M. Elias^{1,2*}

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Abstract

Cachena is a cattle breed part of the Portuguese genetic heritage. Animals are small and the meat is known by its excellent organoleptic characteristics. However, there is a need to valorize the meat coming from less noble cuts with lower commercial value. This will allow the producer to add value to his product and prevent the sale of meat for fresh consumption that is tough and fibrous, leading to the reduction of food waste along the food chain. The fresh sausages are a new product developed with Cachena meat. The aim of this work is to evaluate the quality (texture and sensory characteristics) of fresh beef sausage over 14 days of storage. Three independent batches were prepared, and analyses were performed at 0, 5, 10 and 14 days of storage. Samples were stored under vacuum at $2 \pm 2^\circ\text{C}$. Instrumental texture (Texture Profile Analysis-TPA) and sensory analysis by a trained sensory panel were performed. Data were statistically analyzed using ANOVA and Tukey's HSD test ($P < 0.05$). There is a significant increase in hardness ($6.5\text{N} \pm 1.4$ to $10.7\text{N} \pm 2.1$) and gumminess ($4.7\text{N} \pm 1.1$ to $7.4\text{N} \pm 1.6$) over the storage period. Regarding the sensory evaluation, the panel of tasters identifies significant differences along the storage period for the parameters taste intensity (around 73.6 to 62.7) and global appreciation (around 72.5 to 60.6). On day 14, negative tastes and smells are identified. According to the results obtained, fresh sausages can be consumed within a maximum storage period of 5 days. After the 10th day of storage, there is a significant increase in hardness, as well as a decrease in the quality evaluation of the product by the sensory panel.

Keywords: Fresh sausage; food quality; Texture profile analysis; sensory evaluation.

Acknowledgements: This work was supported by project PDR2020-1.0.1-FEADER-030803, funded by national funds through Fundação para a Ciência e a Tecnologia (FCT)/MCTES and co-funded through the European Regional Development Fund (ERDF), and by project UIDB/05183/2020 (MED) financed by national funds through FCT. Sara Ricardo-Rodrigues acknowledges a PhD grant from FCT (2021.07663.BD).

Theme: Food loss and waste reduction and recovery

Presentation: Oral

Aromatic and Medicinal Plants - Based Tourism Sector: success cases and best practices

**Arminda do Paço^{1,2}, João Capucho^{1,2}, Vítor Moutinho^{1,2}, Henrique de
Oliveira^{1,2}**

**¹ Management and Economics Department, University of Beira Interior,
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This paper aims to identify the most successful cases and best practices of tourism based on aromatic and medicinal plants (AMPs). Through a literature review and analysis of existing case studies, we evaluate the impact and initiatives that the AMPs industry has on the tourism sector worldwide. Due to their distinct characteristics and benefits, AMPs have the potential to be a valuable tourism product. It can either be used for aromatherapy, traditional medicine, and as ingredients in cosmetics and food products, among others. For instance, tourists can visit herb gardens, and learn about the harvesting, drying, and processing of these plants, as well as participate in the process. Tourists can also learn about the uses and benefits of the plants used by traditional medicine practitioners. We also examine the potential for these initiatives to contribute to conservation efforts and local community development, since some regions have developed AMPs-based tourism to promote local culture and tradition while also benefiting rural communities economically. Overall, the use of AMPs as a tourism product has the potential to be a profitable and long-lasting industry. Lastly, we draw some recommendations for policymakers and practitioners looking to replicate or expand upon the identified best practices in the field of AMPs-based tourism.

Keywords: Aromatic and Medicinal Plants (AMPs); Tourism Product; Best Practices

European citizens' self-responsibility in climate change impediment.

F. Mata¹ *

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Abstract: *The impacts of climate change in food production systems may be very disruptive, and, therefore, sensibilization of individuals is paramount for the establishing of principles aiming to minimize anthropological impacts. The aim of the present study is to research the European citizen's stance in self-responsibility to tackle this issue. Data used were collected from the European Social Survey. The following questions were used: 1 – “How worried are you about climate change? And question 2 – “To what extent do you feel a personal responsibility to try to reduce climate change?” that were contrasted with the individual perceptions of the society and its policies. The following were used as independent variables. Socio-economic: age, gender, and years in education; Attitudinal statement and perception Individual perception about the society and its policies: trust in the legal system, trust in scientists, satisfaction with the state of the economy, satisfaction with the government, satisfaction with the democratic system, satisfaction with the state of the health services, and satisfaction with the state of the education services. Ordinal regressions with a cumulative logit link were successfully fit to data. Model 1: People satisfied with the national government are more worried; Women more worried than men; Older people more worried; More educated more worried. Model 2: Women feel more self-responsible than men; Older people more self-responsible; People that trust in scientists feel more responsibility when satisfied with the economy and the health system of the country; Older people that trust in scientists also have more responsibility.*

Keywords: climate change; self-responsibility; European citizens; Food production

Theme: Sustainability

Presentation: Poster

Food waste assessment in the fresh sector of a large-scale food retail store

Mariana Gomes¹, Carla Barbosa^{1,2,3} and Alberta Araújo^{1,2,4,*}

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Abstract:

Nowadays, around 14% of the food produced in the world is wasted before achieving the commercialization platforms, while 17% of the food available to consumers on the market, is also wasted. Reducing and preventing this food waste is critical as it has an adverse impact on the society. Mitigating waste is also in line with the goals of the 2030, where objective 12.3 aims at reducing 50% of the food loss and waste along supply chains until 2030 (UN General Assembly, 2015). Due to the complex nature of food supplychain this is a major challenge for all its players, who deal with retail stakeholders.

This study was carried out in a large-scale food retail store, where methodologies to reduce food waste have been applied and monitored. The objective of this study was to optimize the procedures already adopted and quantify the waste not discarded in 2022 (11 months) in the fresh sector, based on the adoption of different tools to mitigate food waste and breaks.

Over the year of 2021, this food store already implemented measures to combat food waste avoiding financial losses of more than 37 million euros, which 20.1 million euros were due to the marketing actions such as distinguishing products with a pink label, alerting customers to the end of validity of some products. In 2021, approximately 21 million euros in food surpluses were donated to 1448 institutions. Donations increased by 39.1% overcoming 370 more institutions than in 2020. Analysing data from 2022 it was observed that the Bakery sector has the highest amount of waste reaching 5,186 wasted units of products, being traditional bread the main wasted product. Of the almost 223 bakery products commercialized for customers, 154 had losses of around 10 units during the 11 months of this study and 43 had losses of only 1 unit. In the fruit section, breaks represent a greater economy loss due to its commercial value when compared to pastry products. In the fresh fruits and vegetables section, carrots were the product with the highest breakages volume, with a total of 90 packs in the 11 months under analysis, mainly due to its more perishability.

Concerning solutions for improving the mitigation of food waste, this study revealed that training in good practices handling fresh products; optimization of expiry dates labeling, adjusting the mentions, “consume until” and “consume preferably before”, according to the accurate products shelf life. In Europe, expiration dates account for around 10% of the 8 million tonnes of food

wasted along the value chain, which corresponds to €3 to €6 billion per year. In order to mitigate the high waste generated in the Bakery and Take Away sections, it is recommended to reduce the price close to store closing time, to improve product selling and reduce the amount of discarded food. Reuse of fruits/vegetables to prepare meals in the catering section, as well as in dehydration, allowing the extension of products shelf life.

Keywords: food waste; food supplychain; discarded food; food loss

Theme: select among topics

Presentation: Oral/Poster (select one)

Cheese microbiota under the microscope: technological and pathogenic potential

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Abstract: Portuguese traditional products with Protected Designation of Origin -PDO- reflect the richness of the geographical area and cultural knowledge, passed on from generation to generation, resulting in value added products, worth consuming and studying. PDO cheeses are extremely rich from the nutritional scope and present a variety of microorganisms, mainly lactic acid bacteria (LAB), with putative technological applications and/or potential underlying pathogenicity.

The regions of Nisa and Azeitão produce PDO cheeses using ewes' raw milk and *Cynara cardunculus* as coagulation agent. The autochthonous cheese microbiota is mainly composed by LAB, including genus such as *Lactococcus*, *Lactobacillus* and *Enterococcus*, which may act as starter/non-starter LAB for the cheesemaking industry, or be used as probiotics. However, these *in house* microbes may also possess hazardous features, like hemolytic ability or resistance to antibiotics. Thus, the scope of the present study was to evaluate PDO-cheese autochthonous microbiota, regarding the technological and pathogenic potential.

After microbial isolation, and selection of representative LAB using RAPD-PCR, a series of assays were performed: hemolytic, lipolytic, proteolytic and gelatinolytic ability, and evaluation of the antimicrobial properties against the foodborne pathogen *Listeria monocytogenes*. All isolates found to be beta-hemolytic (around 2%) were eliminated from further testing, whereas the remaining were selected considering their antimicrobial and proteolytic/lipolytic activities; resulting in a pool of 79 *Lactococcus*, 88 *Enterococcus* and 92 other LAB. Those isolates are now being tested for probiotic properties and resistance to antibiotics.

Overall, the present research highlights the versatility of PDO-cheese autochthonous microbiota, a microbial richness worth investigating.

Keywords: PDO cheeses, autochthonous microbiota, lactic acid bacteria, technological potential, pathogenic potential.

Monitorização em tempo real da temperatura e humidade do ar na curta distribuição de produtos hortofrutícolas: O caso de estudo PrunusPOS

Real-time monitorization of air temperature and humidity in the short distribution of horticultural products: The PrunusPOS case study

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Abstract: *A cadeia de abastecimento deve manter condições ideais de conservação na contribuir para a manutenção da qualidade dos produtos hortofrutícolas e para a redução do desperdício alimentar. A temperatura e a humidade relativa do ar são dois parâmetros essenciais para este objetivo. A sua monitorização pode apoiar a tomada de decisão na logística e gestão de rotas, bem como no diagnóstico e prevenção atempada de desperdícios alimentares. No presente estudo, dispositivos de rastreabilidade com sensores de temperatura e humidade relativa do ar com comunicação sem fios monitorizam embalagens com produtos hortofrutícolas ao longo de uma rota de curta distribuição com cinco paragens (4h30m). Os dados dos sensores e uma etiqueta de localização são enviados via GSM para monitorização em tempo real. Os resultados indicam variações na temperatura e humidade relativa do ar que atingem cerca 7,5°C e 35%, respectivamente. Estas variações devem-se fundamentalmente à frequente abertura de portas, procedimentos operacionais, e condições irregulares de refrigeração. Os resultados alertam para procedimentos que geram variações desnecessárias de temperatura e perdas de energia. Este estudo destaca a importância da monitorização individual dos produtos para o controlo da qualidade e redução do desperdício ao longo da cadeia de abastecimento.*

Keywords: intelligent packaging; temperature; humidity; supply chain; food waste; food quality; food preservation; transportation.

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

Food waste assessment in a hospital catering services

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Abstract: Waste reduction in healthcare generally focuses on care activities and general financial management strategies, however food waste may be of a major concern (Saber, 2022). This food loss is produced every day by patients, healthcare workers, and visitors. Waste prevention is a priority in Europe because large amounts of food are being wasted with hospitals at the top when compared to other foodservice sectors (Dias-Ferreira, 2015).

This study was conducted in a catering unit in a general hospital context aiming at monitoring its waste and classify according to the type of served meals, namely breakfast, lunch, snack, dinner and supper. Meals are distributed to users admitted to the hospital unit, as well as to the cafeteria (external customers). To help this monitorization, a digital platform was developed to support recording and subsequent evaluation of the waste in the different types of meals. Daily records were carried out over a week per meal type, by weighing the quantities of produced food, as follows: before preparation, which includes fruit and vegetable (including peels, trimmings...); final product (after preparation, including leftovers), distribution and consumption. Weight of food served to patients and that returned after the meal allowed to estimate the plate waste for the average meal, as well as for individual meal items. To obtain the percentage of waste, it was necessary to calculate the differences in quantity in each of the stages of the production cycle: quantity produced, quantity actually used for the distribution of each food and quantity rejected and not used after cooking. Waste is recorded directly on the platform. Final results express the average of 5 days monitoring, corresponding to a week of production.

Results revealed that breakfast represents a high amount of waste, around 39%, largely associated with the type of product, barley with water, wasted right after cooking (35 kg/day) also the meal with highest production rate (187 kg/day). Special attention was paid to the purees or thickened liquids diets that represents a final waste of more than 50%. With regard to tea (drink) waste is around 30%, mainly wasted before distribution due large production. The mixture milk and barley is 20% wasted by patients and clients, being the product with lower impact in this waste balance though it is produced in large quantities (44.67 kg). These results can help to point out some preliminar measures for food waste combat, such as to produce barley and tea in more accurate quantities having in mind that it is necessary to estimate an adequate daily production. Regarding the consumption of liquid and puree diets, a more personalized follow-up is suggested, where it is possible to estimate the amounts consumed and prescribed for certain specific groups.

Dias-Ferreira, C., Santos, T., & Oliveira, V. (2015). Hospital food waste and environmental and

economic indicators—A Portuguese case study. Waste management, 46, 146-154.

FAO - Food and Agriculture Organization of the United Nations (2021). Technical platform on the measurement of food loss and food waste. Home. Retrieved from: <http://www.fao.org/food-loss-and-food-waste/en/>

Saber, D.A., Azizi, R., Dreyer, S., Sanford, D., Nadeau, H. (2022). Hospital Food Waste: Reducing Waste and Cost to our Health Care System and Environment. OJIN: The Online Journal of Issues in Nursing Vol. 27, No. 2.

Keywords: Waste reduction, Hospital, Meal delivery, Food loss

Theme: select among topics

Presentation: Oral/Poster (select one)

Selection of sustainable and nutritionally balanced plant-based flours to fortify gluten-free products

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Abstract:

Celiac disease is an autoimmune disorder caused by intolerance to gluten, which is found in wheat and similar proteins in barley, rye and oats. This disorder is characterized by the inability to digest a protein fraction, classified as gluten. A person with this syndrome, which appears usually in early age, cannot consume a number of cereal products, particularly pasta and bread derivatives, and the acceptable treatment is a strict adherence to a 100% gluten-free diet for life. There are growing concerns over the nutritional adequacy of gluten-free dietary pattern because it is often characterized by an excessive consumption of energy and a reduced intake of fibre, minerals and complex carbohydrates. Nutritionists recommend pulses crops (grain legumes or plant-based) such as chickpeas, lentils, lupins and beans, in the diet as they have many nutritional benefits. Most gluten-free products (especially bread), which are typically produced from gluten-free flours, have poor sensory, textural and nutritional properties. Bread is one of the cereal products that is composed mainly of wheat flour. However, wheat is a main cause of several food allergic reactions. The rapid increase in gluten-related diseases has led to a growing demand for gluten-free products in the market.

The aim of this study was the selection of sustainable and nutritionally balanced plant-based flours to fortify gluten-free products, specially bread. As a result, new nutritionally richer and healthier formulations are expected, through fortification with nutritionally rich raw materials (such as plant-based flours), without the addition of synthetic additives and lactose, and with high organoleptic and sensory quality.

The following plant-based raw materials were selected: lentils (*Lens culinaris*), lupins (*Lupinus albus*), white beans (*Phaseolus vulgaris*), chickpeas (*Cicer arietinum*), carob and carob germ (*Ceratonia siliqua*) and pseudocereals, namely quinoa (*Chenopodium quinoa*) and buckwheat (*Fagopyrum esculentum*). Since an approach to more economical sources was also intended, and these flours have a high market price, for lentil, white bean and chickpea flours, the market options sold in grain were also studied, and a then grinding into flour. The work focused on nutritional (fibre, protein, lipid, mineral, carbohydrate content) and moisture content characterization of plant-based raw materials selected.

Results showed that the highest protein value was obtained from carob germ flour (50.87%±0.08%), followed by lupine flour (31.49%±0.06%) and lentil flour (23.85%±0.08%). According to Regulation (EU) 1924/2006, concerning nutritional and health claims made on foods, it can be stated that all flours studied are “rich in fiber”, as they contain at least 6g of fiber/100g, with the exception of buckwheat flour, which can be considered a “source of fiber”, as it contains at least 3g of fiber/100g. Lupine, lentil and carob germ flours scored the highest fiber contents, 20.88%±0.04%, 11.50%±0.39% and 11.38%±0.54 %, respectively. In the case of ash content, it was found that carob and lupine germ flours (6.89%±0.06% and 4.29%±0.05%) had the highest ash values, which may be indicative of higher content of minerals. It should be noted that, for all the analyzes carried out, significant differences were found between the results for the different flours studied ($p < 0.05$).

From this work it was concluded that lentil, lupine, chickpea and carob germ flours were selected to fortify gluten-free products considering their fibre, ash and protein content. Plant-based flours can be a sustainable and balanced raw-material added to gluten-free bread with positive impact on its nutritional properties and nutritional claims.

Keywords: Gluten-free, plant-based, flours, nutritional, fortify

APLICAÇÃO DA TECNOLOGIA DISRUPTIVA BLOCKCHAIN NAS CADEIAS AGROALIMENTARES VISANDO O DESENVOLVIMENTO SUSTENTÁVEL, UMA REVISÃO SISTEMÁTICA.

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Resumo: *A importância da aplicação das tecnologias disruptivas nas cadeias agroalimentares é inegável. Por isso, a presente revisão sistemática baseada no Modelo PRISMA, identificou 65 artigos com o intuito de analisar os eixos temáticos da aplicação de Blockchain nas cadeias agroalimentares visando o desenvolvimento sustentável. Os resultados apontam, que o Blockchain e o Desenvolvimento Sustentável passaram de uma ligação empírica para uma teórica e experimental que garante o atendimento dos Objetivos de Desenvolvimento Sustentável.*

Keywords: Tecnologias Disruptivas; Blockchain; Desenvolvimento Sustentável; Gestão da Cadeia Agroalimentar.

1. INTRODUÇÃO

É indubitável que a agricultura e as cadeias agroalimentares evidenciam mudanças promovidas pela aplicação das tecnologias; e o uso de dados e informações são cruciais para a melhoria da produtividade e da sustentabilidade (Vangala et al., 2021). Em virtude disso, entende-se que os níveis de produção atual possuem melhor performance em relação às produções de outros tempos.

Por outro lado, alguns autores comentam as possíveis crises alimentares fortalecidas por escassez hídrica, energética e climática ou por fatores relacionados, como os altos índices de crescimento demográfico, as mudanças climáticas e o avanço social que não se alimenta de forma sustentável. O supradito cenário é nomeado “*Perfet storm*” por Beddington (Benyam et al., 2021; Davies & Garrett, 2018).

Do outro lado, foram realizadas diferentes iniciativas ao redor do mundo objetivando atingir os Objetivos de Desenvolvimento Sustentável. A sustentabilidade proposta no ano 1987, na Assembleia Geral das Nações Unidas, permite satisfazer as necessidades presentes, ou que estão por vir, sem comprometer a capacidade das gerações futuras para suprir ou atender as suas

próprias necessidades (Brundtland & ONU 1987).

As tecnologias disruptivas começam ter maior protagonismo, um exemplo disso é o Blockchain e a relevância dele não só no mercado financeiro, mas também em sua aplicabilidade dentro dos processos da cadeia agroalimentar em dimensões ambientais, sociais e econômicas. Desse modo, grandes avanços e melhoras significativas estão acontecendo nas cadeias agroalimentares, as principais vantagens incluem maior transparência, rastreabilidade, autenticidade, confiança, descentralização e segurança (Erol et al., 2022; Köhler & Pizzol, 2020; Mercuri et al., 2021). Com isso, faz-se a seguinte questão de pesquisa: Quais são os eixos temáticos que emergem da literatura de aplicação do Blockchain nas Cadeias Agroalimentares visando o Desenvolvimento Sustentável?

Dessa maneira, resultados pós-aplicação garantem que a tecnologia Blockchain é sustentável ou contribui à sustentabilidade da cadeia (Friedman & Ormiston, 2022; Kamble et al., 2020; Mao et al., 2018; Rashid et al., 2022). Contrariamente, aproveitando a corrente sustentável, existe o termo apresentado na pesquisa do Lyon et al., o “Green Washing” ou lavagem verde, que basicamente é ato de ludibriar os clientes ao formar crenças excessivamente positivas resultantes das práticas ou produtos aparentemente sustentáveis de uma organização (Dos Santos et al., 2021), de modo que o Blockchain e os benefícios pós-aplicação poderiam ser tomados para reforçar ideias de práticas excessivamente ambientais.

Considerando todo o apresentado, o objetivo geral deste artigo é analisar os eixos temáticos de aplicação do Blockchain nas Cadeias Agroalimentares visando o Desenvolvimento Sustentável. Os objetivos específicos são 3: identificar as redes de co-ocorrência e os clusters que emergem da literatura estudada, mapear os tópicos temáticos de maior a menor relevância e evidenciar as ODS vinculadas às pesquisas identificadas.

Em resumo, os parágrafos estão organizados da seguinte forma: a seção 2 apresenta-se a fundamentação teórica, a seção 3 apresenta a metodologia da pesquisa, a seção 4 evidencia os resultados e, finalmente, a seção 5 encerra a pesquisas com as discussões e conclusões.

2. FUNDAMENTAÇÃO TEORICA

A tecnologia Disruptiva Blockchain é um livro de distribuição de dados descentralizado que pode ser público, privado ou misturado (público-privado) permitindo a adição de informação em forma de blocos; essa informação, uma vez validada, é enviada à rede e não pode ser modificada (Bai et al., 2022; Raboaca et al., 2020; Zhang et al., 2022). Deve-se entender como tecnologia disruptiva aquela que permite mudar toda forma convencional de produção, ou seja, oferece uma mudança profunda nos processos tradicionais. Vale ressaltar que, alguns autores apresentam o Blockchain como uma tecnologia relativamente nova apresentada ao mundo por Satoshi Nakamoto no ano 2008 (Khan et al., 2020). No entanto, o Blockchain teve precedentes, considerando esforços pela descentralização e imutabilidade dos dados que, ao redor dos anos 1990, emergiu com a proposta de novo esquema de desconcentração e encadeamento de blocos (Hwang, 1990). Seguidamente, foi proposto outro modelo com assinaturas digitais para cada dado

garantindo a imutabilidade e descentralização (Haber & Scott Stornetta, 1991). A literatura manifesta que aplicação do Blockchain também propõe os contratos inteligentes, alguns autores assumem que os contratos inteligentes foram criados a partir do Blockchain, mas a proposta da virtualização e automatização dos contratos foi apresentada no ano 1996 como o acordo de vontades funcionais e digitalizadas (Szabo, 1996).

Com o avanço da literatura, as diferentes aplicações de Blockchain na cadeia agroalimentar por diferentes autores permitem obter uma visão abrangente. Logo, uma primeira reflexão sobre o Blockchain é que não deveria ser considerado como uma panaceia, e sim como catalizador de melhoras ainda não exploradas (Klerkx & Rose, 2020). Outrossim, o Blockchain foi identificado como parte das 12 tecnologias que contribuem ao desenvolvimento sustentável e a economia digital inclusiva (Davies & Garrett, 2018; Mercuri et al., 2021).

Por outro lado, a sustentabilidade e as suas dimensões sociais, ambientais e econômicas são avaliadas dentro das novas propostas de Blockchain e Cadeia Agroalimentar. Ainda, a ligação entre Blockchain e sustentabilidade é empírica e poderia permitir criar novos modelos de negócios sustentáveis (Mercuri et al., 2021).

3. MÉTODO

O método está baseado no modelo *Systematic Reviews and Meta-Analyses* (PRISMA), o qual garante a replicabilidade e transparência (Morelli & Ignacio, 2021; Munir et al., 2022). Observar a Figura 1.

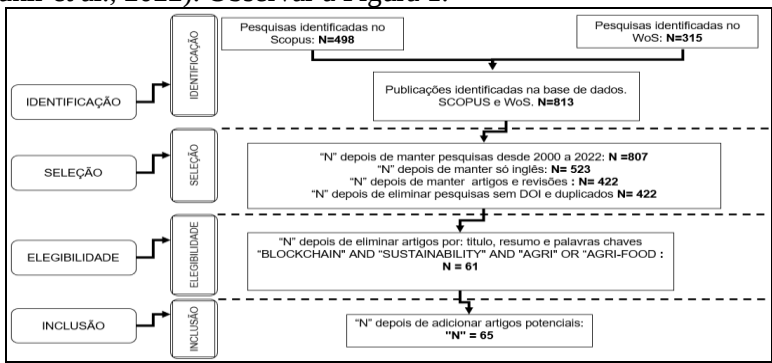


Figura 1. Diagrama PRISMA

4. DESENVOLVIMENTO E RESULTADOS.

Para o presente ponto, apresentam-se os resultados da revisão sistemática baseados nos dados identificados e processados em Rstudio e VOSviewer. E, desde já, evidencia-se um crescimento dentro da literatura acadêmica sobre o tópico estudado.

Assim, a rede de co-ocorrência foi trabalhada com o Thesaurus para melhorar a clarificação dos clusters, evidencia-se que os tópicos das pesquisas estão atrelados à gestão da cadeia de suprimentos, rastreabilidade, e-agriculture, desenvolvimento sustentável e seguridade alimentar. Em seguida, os clusters definidos nas redes de

co-ocorrência podem ser analisados na Tabela 3, a qual mostra a descrição dos Clusters.

Cluster	Title	Keywords	links	Total link strenght	ocorrence
Cluster Vermelho	Blockchain e Desenvolvimento sustentável	blockchain	16	159	50
		decision making	12	38	8
		enviromental technology	10	36	8
		supply chain	16	136	34
		sustainable development	15	105	36
		traceability	14	34	7
		transparency	10	32	7
Cluster Verde	E-agriculture e Performance	agriculture	14	69	15
		digital storage	10	23	4
		e-agriculture	14	62	13
		IoT	15	74	18
		network architecture	10	19	3
		performance	6	9	3
Cluster Azul	Food Supply Chain e Safety	Food safety	11	16	3
		Food security	10	17	3
		Food Supply Chain	14	57	11
		Review	7	14	3

Tabela 3. Clusters identificados.

De acordo com a Figura 4, observe-se que Blockchain, Cadeia Sustentável e Inteligência Artificial no quadrante III, são tópicos que continuam sendo estudados agora e também serão no futuro próximo, isso inclui as dimensões e ODS da Sustentabilidade.

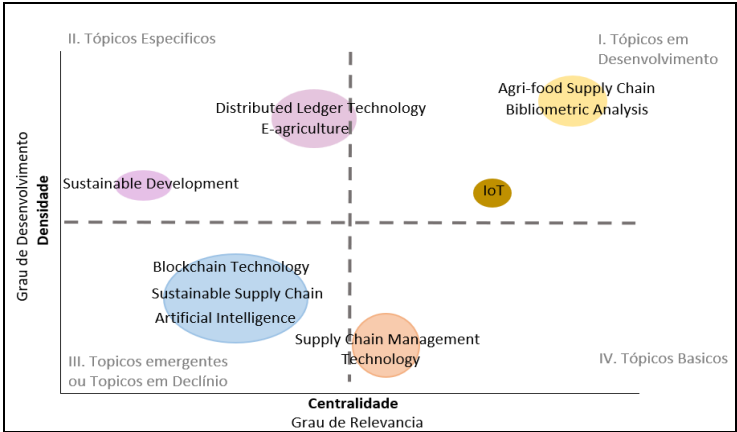


Figura 4. Eixos temáticos da literatura.

Nesse sentido, foram identificados os **Objetivos do Desenvolvimento Sustentável** (OD's) dentro da literatura. Por conseguinte, a Figura 5 apresenta as diferentes OD's atreladas com as dimensões da Sustentabilidade.

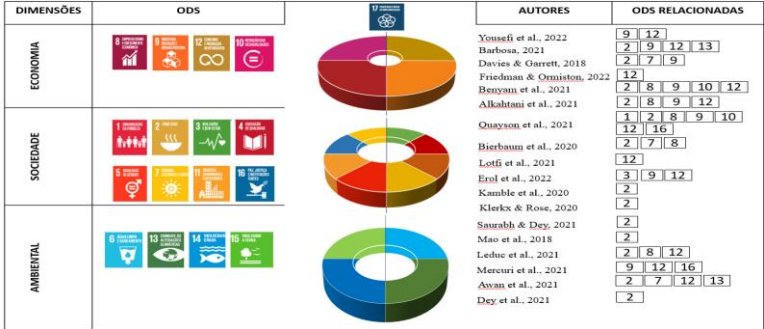


Figure 5. Objetivos de Desenvolvimento Sustentável atreladas à literatura.

Adaptado de Azote Images for Stockholm Resilience Centre.

Finalmente, os resultados foram apresentados e organizados, objetivando atingir os objetivos específicos apresentados na introdução desta pesquisa. Como foi detalhado, os resultados estão baseados inteiramente na literatura identificada consultada no último semestre do 2022.

5. DISCUSSÕES E CONCLUSÕES

Em relação às discussões, um primeiro apontamento está relacionado com a produção científica e o nível de desenvolvimento da literatura estudada; apesar da pandemia COVID-19, a literatura teve um crescimento em relação às pesquisas publicadas. Assim, o incremento dos artigos publicados permitiu evidenciar a relevância do conteúdo dentro da literatura científica, desse modo foram mapeadas pesquisas com diferentes níveis de contribuições. Também, evidencia-se que foi necessário incluir os precedentes da tecnologia Blockchain contrariando à percepção de que o Blockchain foi “criado” por Satoshi Nakamoto.

Destaca-se que o vínculo de Blockchain nas Cadeias Agroalimentares e o Desenvolvimento Sustentável era empírico; mas, depois das análises dos últimos 20 anos, observou-se que existem relações de produto de mercado, experimentais e teóricas com os diferentes ODS, tal e como foi apresentado na Figura 5. Contrariamente, os ODS vinculados às pesquisas foram obtidas da base de dados Scopus e algumas delas não apresentaram essas vinculações, por isso foram excluídas dessa análise particular. Além disso, a Figura 5 evidencia que existe uma maior concentração de relação das pesquisas com os ODS-2, ODS-12 e ODS-9 sendo repartidas entre as dimensões econômicas e sociais, destacando que os ODS da dimensão ambiental são pouco relacionados dentro do escopo do presente estudo, isso oferece uma oportunidade de discussão e abordagens futuros.

Uma primeira conclusão, evidenciou os autores com pesquisas centrais, alguns deles possuem colaborações ou desenvolvem trabalhos complementários com o fim de acrescentar a literatura de Blockchain na cadeia de suprimentos, o autor Kamble e Klerkx apresentam trabalhos sólidos sobre o tópico estudado, alguns outros autores com índices maiores não foram incluídos na revisão devido aos critérios de elegibilidade da presente pesquisa.

Sobre a segunda conclusão, pode-se afirmar que graças às redes de co-ocorrência, existem autores que garantem que a aplicação do Blockchain reafirma a sustentabilidade. Em contraste, existe um nível baixo de estudos aprofundados sobre a sustentabilidade de aplicação de Blockchain na cadeia agroalimentar, isso quer dizer que não foi mensurado em lapsos de tempo os ganhos da aplicação da tecnologia Blockchain, nem o consumo de energia que é gerada por causa dessa. Assim, até agora, só foram apresentadas as vantagens e benefícios que são geradas no curto prazo e, em alguns casos só foram mencionados os desafios que o Blockchain apresenta no curto prazo e com uma operatividade não massiva.

A terceira e última conclusão, permite sinalar que o mapeamento dos tópicos emergentes garante a pertinência do tópico estudado. Também, pode-se afirmar que existe relação entre as pesquisas identificadas e os ODS; nesse sentido, as pesquisas podem visar atingir os diferentes ODS das três dimensões da

sustentabilidade já que, como foi observado, existe um caráter transversal por parte das pesquisas permitindo conhecer as oportunidades de pesquisa ou investigação. Por tanto, uma delas é aprofundar na sustentabilidade de aplicação do Blockchain na cadeia agroalimentar ao longo prazo, garantindo que não existam efeitos colaterais. Outro apontamento deveria ser focado na mensuração direta ou indireta da aplicação de Blockchain nas três dimensões da sustentabilidade (ambiental, econômica e social), asseverando o uso massivo dessa nova ferramenta. Finalmente, evidenciou-se a relevância do tópico estudado para as cadeias agroalimentares e a comunidade científica em geral. Também, foi respondida a questão de pesquisa, e os objetivos foram atingidos neste último capítulo.

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Do Portuguese traditional cheeses harbor potentially pathogenic or spoilage bacteria?

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Abstract: Cheese is a highly appreciated food product all over the world. However, there is a low number of studies on the characterization of the autochthonous microbiota of Portuguese traditional cheeses with Protected Designation of Origin (PDO). Hence, the present research focused on the analysis of PDO-cheeses produced at Azeitão and Nisa. Although the autochthonous microbiota is mostly constituted by Lactic Acid Bacteria (LAB), potentially pathogenic bacteria, such as *Listeria monocytogenes*, *Staphylococcus aureus* and *Escherichia coli*, or spoilage microorganisms, like *Pseudomonas* spp., may also be present. LAB are known to contribute, in a determinant way, to the maturation of the final product and development of specific organoleptic features. Typically, pathogenic and spoilage microorganisms are present in reduced numbers, which may be associated with the fact that LAB possess antimicrobial capacity, due to the production of bacteriocins or other compounds hence, contributing to prevent or inhibit the development of undesirable microorganisms.

In the present study, technological, potentially pathogenic and spoilage microorganisms present in Azeitão and Nisa PDO cheeses were isolated using selective media and further analyzed using conventional microbiology. Subsequently, RAPD-PCR genetic profiles of the isolates (n=120) were compared using the Bionumerics software, and genetically distinct bacteria were selected for the evaluation of hemolytic activity, antibiotic resistance and biofilm formation. Results obtained so far confirmed low microbial counts of pathogenic and spoilage microbes on the PDO-cheeses under analysis, whereas LAB are present in high numbers. To finalize, cheese-LAB will be evaluated regarding the anti-biofilm activity against the putative pathogens and spoilage microorganisms.

Keywords: Traditional cheese, autochthonous microbiota, technological, pathogenic, spoilage.

Theme: Food safety

Presentation: Poster

The effect of glazing on the physicochemical and microbiological properties of Alentejano x Duroc pork meat

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The oxidation of fats, the so-called rancidity, limits the shelf life of frozen foods. The glazing process is usually used in fish preservation. It reduces the occurrence of rancidity by oxidation, due to the weak solubility of oxygen in ice (Zoldos *et al.*, 2011). The aim of this study was to assess the effect of glazing meat from the “Alentejano” pig (a Portuguese pig breed) in the physicochemical properties (texture, colour, pH and a_w) and in the microbiological quality. The studied meat samples (slices with approx. 150g) are from a commercial cut named “secreto”, obtained from the *latissimus dorsi* muscle. In the glazing process, the meat is previously submitted to cryogenic freezing. Afterwards, a protective layer of ice is formed on the surface of meat following its immersion in water. The meat was maintained at -21 °C with a relative humidity (RH) of 100 % until sample collection. Two conditions were compared: glazed meat and control (meat subjected to cryogenic freezing), at two different storage times: 0 and 6 months. Microbiological counts of mesophilic and psychrotrophic microorganisms, enterobacteria and moulds and yeasts were performed. Colorimetric measurements were done using a Konica Minolta colorimeter (CR 400). Shear force was obtained using a Stable Micro System TA-Hdi texturometer. pH and a_w measurements were also determined. A one-way analysis of variance (ANOVA) was performed for the factor glazing.

Significant differences were observed between glazed and control meat for mesophilic ($p<0.001$) and psychrotrophic microorganisms ($p<0.05$) and yeasts ($p<0.05$). The opposite was observed for moulds ($p>0.05$) and enterobacteria ($p>0.05$). Regarding colorimetric measurements, no significant differences were observed between control and glazed meat ($p>0.05$). Concerning pH and a_w , no significant differences were detected between control and glazed meat ($p>0.05$). No statistically significant differences were found between the two treatments regarding shear force ($p>0.05$).

The obtained results showed no advantages of glazing against cryogenic freezing up to 6 months of storage. However, further studies are needed to understand if this technique might be advantageous for longer storage periods.

This work was supported by ICAPP - Research in Alentejo Black Pork Meat, reference POCI-01-0247-FEDER-072109, co-financed by the European Regional Development Fund (FEDER) through Compete 2020 – Competitiveness and Internationalization Operational Program (POCI).

ASSESSMENT OF THE POTENTIAL OF GREEN PHENOLIC EXTRACTS OF A CHESTNUT BY-PRODUCT TO BE USED AS A NATURAL PRESERVATIVE

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Abstract: *Recently, the agricultural residues of the chestnut chain production have attracted attention as sources of compounds that can be used as alternative natural additives in several industries. Previous studies have associated the presence of phenolic compounds with beneficial bioactivities exhibited by some chestnut by-products, such as flowers and shells. From a sustainable and economic point of view, the valorization of chestnut bur, a poorly exploited by-product, as a source of bioactive molecules with promising applications as a natural ingredient could be interesting, given its availability and low cost, besides meeting the demand for clean label formulations, especially in the food and beverage industries. This work aimed to evaluate the phenolic composition of green extracts of C. sativa burs and their antimicrobial activities as the first step to establish their potential to be used as preservatives. Burs from trees cultivated in the Trás-os-Montes region were milled and subjected to ultrasound-assisted extraction (UAE) and microwave-assisted extraction (MAE) with ultrapure water. The phenolic compounds of the obtained extracts were analyzed by HPLC-DAD-(ESI)-MS, and the antimicrobial activity was assessed against different bacteria and fungi of food relevance. The extract obtained by MAE presented the highest concentration of phenolic compounds (3.359 ± 0.003 mg/g extract), being quercetin-3-O-rutinoside the major compound found (0.3872 ± 0.0004 mg/g extract). Among the tested bacteria, the MAE bur extract was particularly effective against S. aureus ($0.3/5$ mg/mL) and showed higher antimicrobial activity against both Gram-negative and Gram-positive bacteria when compared to the UAE one. The antifungal activity against A. brasiliensis and A. fumigatus was similar for both samples tested. The results point out the chestnut burs as an interesting source of phenolic compounds with good antimicrobial activity, having potential to be explored as a preservative solution for the beverage industry, avoiding the use of artificial compounds with associated harmful effects.*

Keywords: C. sativa bur; Waste reuse; Polyphenols; LC-MS; natural preservatives; Green extraction methods.

Acknowledgements: FCT, Portugal for financial support through national funds FCT/MCTES to CIMO (UIDB/00690/2020); national funding by FCT, P.I., through the institutional scientific employment program-contract for L. Barros, and through the individual program contracts of S.A. Heleno. European Regional Development Fund (ERDF) through the research and technological development incentive system (SI I&DT) notice 13/si/2020 corporate R&D projects in co-promotion for inland territories, within the scope of Project Bio4Drinks (NORTE-01-0247-FEDER-113508), and for the research contracts of D.B. Rodrigues, T. Finimundy and J. Gonçalves.

CYBERSECURITY IN AGRIFOOD INDUSTRY

A self-assessment application for SME

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Abstract: *Small and medium-sized enterprises (SMEs) in the agrifood industry face unique challenges when it comes to cybersecurity. Due to the nature of their business, these companies handle sensitive information, may suffer data breaches, and are vulnerable to cyberattacks on their just-in-time inventory management systems and other technology to manage their supply chains.*

Many SMEs in the agrifood sector may not have the resources to invest in robust cybersecurity measures, leaving them vulnerable to cyberattacks. Though implementing security measures can be costly and time-consuming, the potential risks of not doing so can be even greater. SMEs in the agrifood industry should therefore consider cybersecurity to be a critical aspect of their business and invest the necessary resources to protect against cyber threats.

Cybersecurity self-assessment applications can be a useful tool for SMEs in the agrifood industry to measure their risks and help companies to identify vulnerabilities in their systems and processes, and to prioritize areas for security improvement.

In the project S4AGRO (<https://s4agro.pt/atividades/#atividade-4>) it was developed a cybersecurity self-assessment application, to reveal the level of commitment of the companies to the best practices disseminated by the Portuguese Cybersecurity Center (<https://www.cncc.gov.pt/>). These guidelines are grounded in ISO-27001 standard and can help companies identify gaps in their compliance with the framework and develop action plans to address them. Despite self-assessment applications do not replace external testing and auditing, these tools give SMEs in the agrifood industry a better understanding of their cybersecurity posture and risks and take steps to mitigate them.

Keywords: Cybersecurity; Information Security; Governance; Self-assessment; SME

Theme: cybersecurity

Presentation: Oral

Dissemination of *Enterococcus* spp. on various foods and food-related settings

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Abstract: *Enterococcus* spp. are ubiquitous bacteria that inhabit the normal intestinal microbiota of humans and animals and colonize a wide range of niches, including fresh and fermented foods. In recent years, enterococci have emerged as opportunistic pathogens, due to the propensity to acquire antibiotic resistance, last resort antibiotic vancomycin being the major concern.

The goal of the present work was to isolate and assess the genetic diversity of enterococci recovered from 21 foods and 24 food-related surfaces. Sampling occurred at two canteens, seven Portuguese cheesemaking factories and several locations regularly surveyed by a food safety private company. Each sample was spread-plated in enterococci selective media (with/without vancomycin), around 20% of the characteristic colonies were selected for genus confirmation, DNA extraction and RAPD-PCR with primers OPC15 and GTG, in independent reactions. Amplification patterns' analysis and dendrogram construction was performed using the BioNumerics software.

Overall, no clustering by type of sample (food or surface) or sample source was observed among the isolates, suggesting the wide dissemination of distinct enterococci across settings. Nevertheless, isolates from food-related surfaces clustered with high-level similarity values (> 95%), whereas some of the presumptive vancomycin-resistant enterococci (VRE) clustered by sample-type.

In conclusion, results obtained confirmed the presence of enterococci on distinct foods and food-related settings, including presumptive VRE, pointing towards a need for regular biosurveillance.

Keywords: *Enterococcus*; food; food-related settings; microbial diversity, biosurveillance.

Theme: Food Safety

Presentation: Poster

Fast wild fermentation as a tool for valorization of olive pomace paste by-product

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Abstract: Olive oil is an important Mediterranean-food which consumption is increasing worldwide. Along with its production, several by-products are generated, including olive-pomace (OP). OP is a by-product with high-levels of polyphenols with recognized antioxidant-activity. Remotion of OP stone-pieces originates olive-pomace paste (OPP). Our study evaluated the potential of the fast wild-fermentation (WF) of OPP as a process of valorisation of OPP as a new food-ingredient.

WF was promoted at three different temperatures (4°C/RT–Room temperature/37°C), 3 bottles for each temperature, during 2 days(d). The total microorganism count (TMC) was evaluated, through surface spread of OPP and dilutions in PCA. The TMC was done in triplicate and incubated at 37°C/48h.

The results show that the fast WF of OPP promotes the growth of natural-microbiota. The time evaluated shows that 2d are enough to observe a change in the natural-flora, with highlight to RT with TMC growing from 9.2×10^4 to 1.35×10^7 , followed by 37°C with 9.2×10^4 to 4.9×10^6 . For 4°C, as expectable, the growing was slow with small change of total population. The fermented-OPP shows a functional-food potential. An exploratory approach of the organoleptic features was done showing that fermentation improves the aroma/taste of OPP.

The results of fast WF of OPP show that this by-product has the potential to be transformed into a new food-ingredient, with short fermentation time, depending on temperature conditions. This represents a new approach of Mediterranean-agroindustry for by-product valorisation, relevant in terms of food-security and environmental-sustainability.

Keywords: Olive pomace paste, Fermentation, Waste valorization, Sustainability, Food security

Theme: Perda alimentar e redução e valorização de resíduos

Presentation: Oral

This work was funded by FERMOPSY-(EXPL/SAU-NUT/0370/2021) from FCT/MCTES and AgriFood XXI I&D&I (NORTE-01-0145-FEDER-000041, PORNorte 2014/2020). We thanks FCT/MCTES to support LAVQ (UIDB/50006/2020), UCIBIO (UIDP/04378/2020+UIDB/04378/2020), i4HB (LA/P/0140/2020) and CESAM (UIDP/50017/2020+UIDB/50017/2020+LA/P/0094/2020).

Embalagem de elevado desempenho para frutos perecíveis: Resultados da solução Pack2Life

High performance packaging for perishable fruits: The results of the Pack2Life solution

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Abstract: Após a colheita, os frutos estão sujeitos a processos de respiração, transpiração e formação do etileno, que individual ou cumulativamente proporcionam amadurecimento rápido, diminuição das propriedades organoléticas e redução da qualidade, com principal destaque para as características nutricionais e diminuição do tempo de comercialização. Adicionalmente, sendo a cereja e o pêsego frutas de estação (primavera-verão), muito sensíveis e perecíveis, o seu tempo de comercialização é bastante curto sob pena de deterioração acentuada. A extensão da vida útil dos frutos na pós-colheita é conseguida em grande parte pela utilização de refrigeração e pela adequada acomodação na embalagem. Neste estudo apresenta-se uma nova embalagem reutilizável, Pack2Life, com um sistema de monitorização contínua integrado, que se adapta a diferentes condições de utilização (armazenamento e transporte), e que potencia o comércio sustentável de frutos no seu expoente máximo de qualidade. Esta embalagem secundária do tipo “vaivém” (sistema pooling), pode ser utilizada para transporte e comercialização da fruta em alvéolos (ex.: pêsego) ou para acomodar embalagens primárias (ex.: cusetes de cereja). A análise técnico-funcional realizada a modelos de embalagem existentes e a recursos de carácter inovador passíveis de serem integrados num novo conceito, permitiu dirigir paralelamente a investigação da conceção da embalagem em quatro vertentes distintas, mas complementares, (1) conceção da embalagem com geometria otimizada, robustez mecânica e composta por materiais amigos do ambiente; (2) otimização do escoamento do ar e da transferência de calor no interior da embalagem; (3) consideração de um alvéolo composto por materiais de mudança de fase; (4) inclusão de um sistema de rastreabilidade em tempo real. Foram requeridas análises numéricas e experimentais para o design e teste do protótipo. A nova embalagem proposta incorpora vários conceitos com diferentes sistemas de ventilação e mecanismos para a otimização da circulação do ar, através de diferentes configurações geométricas, procurando equilibrar a resistência estrutural da embalagem com uma refrigeração mais eficaz. Incorpora também alvéolos com inclusão de materiais de mudança de fase para otimizar os processos de arrefecimento e de aquecimento, e

permite o seu rastreamento através de um dispositivo de monitorização de fácil acoplamento.

Keywords: Embalagem, packaging, design estrutural, desempenho térmico, escoamento, análise computacional, CFD, testes experimentais, PCM, rastreabilidade.

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

Uma abordagem integrada à cultura de plantas silvestre e ao turismo em regiões de montanha por via de um sistema previsional inteligente de suporte à decisão em sustentabilidade: Montanha Viva

Montanha Viva – An intelligent prediction system for decision support in sustainability: An integrated approach in mountain regions to wild plants culture and tourism

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Abstract: *Com vista a estimular, de forma integrada, o aproveitamento económico da cultura de plantas silvestres de regiões de montanha e o potencial turismo sustentável de montanha que lhe possa estar inerente, é desenvolvido um sistema inteligente de apoio à decisão em tempo real, especialmente projetado para a operação em localizações inóspitas e remotas (sem ligação à internet). Este Sistema de apoio à decisão visa contribuir para a redução de consumo de recursos naturais, promoção da biodiversidade e a preservação da sustentabilidade ambiental. Para tal, é realizada a identificação e caracterização de plantas de montanha com características potenciadoras de mitigação natural de pragas e doenças em culturas agrícolas e com propriedades de aplicação em saúde e bem-estar. É desenvolvido um sistema de sensorização local e remota por visão computacional. A análise do vigor das plantas recorre a algoritmos de inteligência artificial, que irá suportar a decisão na realização de atividades culturais em plantas existentes ou em novas explorações agroflorestais. Paralelamente, a análise do vigor das plantas ao longo do ano possibilita a adequação dinâmica de trajetos pedonais disponíveis na aplicação de turismo sustentável, no sentido de fomentar ou restringir a passagem em pontos específicos do trajeto*

dependendo do estado de crescimento da flora e da fauna.

Keywords: Intelligent and real-time decision support system, Mountain plants, Remote locations, Biodiversity, Environmental sustainability, Pests and diseases, Agricultural crops, Health and welfare, Artificial intelligence, Sustainable tourism.

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

Spatial modelling and agro-industrial organic waste recovery in circular (bio)economy processes and smart regional development

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Abstract:

The globalisation and climate change challenges, population growth, food security and energy assurance, and the development of techno-scientific digital knowledge and governance systems may prove to be critical in shaping smart societies and communities. The implementation and maturity of ecotechnologies and innovative biological treatment and valorisation processes at laboratory or pilot scale should evolve towards optimising local and regional operational circular systems.

In the context of the IPVC TECH - ENVIROTECH project, spatial data were collected, and geocoding exercises were developed on agro-industrial, food and forestry units/activities of Viana do Castelo region (NW Portugal) to support spatial models for location and dimensioning of treatment and valorisation units for organic by-products and/or waste.

The exploratory results indicate the diversity of typologies, high quantities and strong dispersion of organic by-products and/or waste generated by agro-industrial units or regional agro-forestry areas. The analysis of quantity, density, exploitability and transport costs associated with the technical data of recovery processes performance allow exploring alternative scenarios to locate and allocate organic by-products and/or waste to valorisation/treatment units.

The resulting advances highlight the interest in concentrating different organic by-products and/or waste types in new operators or existing infrastructures with operating and waste management licenses. Environmental management and social responsibility have to converge effectively to economic growth and transition to a circular, green, innovative and efficient (bio)economy, and, to that regard, critical spatial knowledge and digital decision-action support systems are required.

Keywords: organic waste recovery; waste management; spatial location-allocation; decision model; value-add bioproducts; circular (bio)economy.

Acknowledgments: Project TECH – Technology, Environment, Creativity and Health (financiado pelo Sistema de Apoio à Investigação Científica e Tecnológica – NORTE-01-0145-FEDER-000043).

Theme: Circular Economy

Circular Bioeconomy in the wine sector: applications and challenges for the exploitation of biochar produced from vine pruning

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Abstract:

Overcoming global challenges such as climate change, natural resources scarcity and food, water and energy supply needs, requires processes advances and systems optimisation along the production and consumption chains supported by technological innovations and spatial decision models to locate and dimensioning valorisation units fostering circular economy and sustainable development. This study aims to define valorisation strategies for Alto Minho vineyards by-products focusing in the assessment of vine pruning biochar produced by slow pyrolysis as fertiliser and low-cost adsorbent; and develop a spatial decision model to support its exploitability.

Experimental essays showed: i) Biochar production yield varying from 37.0% (300°C) to 28.3% (600°C); ii) no phytotoxicity to *Lepidium sativum* using biochar extracts prepared with 5-20% (v/v); and iii) a maximum capacity for copper uptake of 29.4 mg·g⁻¹ biochar (300°C), confirming biochar potential as an added value product.

From spatial data concerning the location and age of Alto Minho vineyards, a multicriteria model was developed using an analytical hierarchy process enabling the assessment of biochar production and the optimization of pyrolysis units location and sizing considering environmental, economic and social parameters. Vineyards are mainly located in medium/upper Minho and Lima rivers valleys, organised in parcels with the capacity to produce a maximum of 0.5 t·ha⁻¹·year⁻¹ of biochar pointing out the need to set up collective pyrolysis units. Considering soils suitability to biochar application, an insufficient availability of vine pruning was identified, suggesting the collection of additional sources of waste biomass to produce the biochar needed to fulfil the soil amendment necessities.

Keywords: Agro-industrial by-products; low-cost adsorbent; pyrolysis; spatial decision model; sustainability

Acknowledgments: Project TECH – Technology, Environment, Creativity and Health (financiado pelo Sistema de Apoio à Investigação Científica e Tecnológica – NORTE-01-0145-FEDER-000043).

Aromatic and Medicinal Herbs - Biodiversity, Quality and Sustainable Use: A Systematic Review.

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Abstract: *herbs are important for the psychological and physical connection with nature as well as for tourism. in this systematic review, we have highlighted several points on this subject. The biodiversity of aromatic and medicinal herbs is considerable in Asian and European regions. The production quality of products is higher in these climates. Their recognition depends on herbal books or new methods based on developed databases that allow identifying the plant from a photo. It is important to find sustainable uses for this product to ensure its existence. Energy recovery in the preparation of the products through energy systems after storage and packaging is mentioned in the current work. The use of this product is generally recommended due to its natural properties and shelf life.*

Keywords: Aromatic and Medicinal Herbs; Sustainability; Biodiversity; Energy; Storage and Packaging.

Theme: Sustainability; Packaging; Energy Efficiency; Food safety.

Presentation: Oral

ANTIOXIDANT POTENTIAL OF ULTRASOUND-ASSISTED EXTRACTS RICH IN PHENOLIC COMPOUNDS OBTAINED FROM A CHESTNUT BIOWASTE

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Abstract: Antioxidants are considered compounds that inhibit or control the oxidation of food and beverage's components, preventing deterioration and prolonging their useful life. The most used antioxidants in these sectors are synthetic; however, there is a growing concern about their potential negative effects on health. Consumer preference has shifted towards ingredients derived from natural sources that can replace synthetic ones. Recent studies indicate that *Castanea sativa* is a source of phenolic compounds that can be used as effective antioxidants. Chestnut is a traditional food consumed throughout Europe in fresh and processed ways, and its shells constitute an underexploited biowaste. The objective of this work was to determine the phenolic composition and antioxidant activity of extracts of *C. sativa* shells harvested in the region of Bragança in Portugal. The extracts were prepared using a green extraction process (ultrasound-assisted extraction, UAE) with food-grade solvents (ethanol:ultrapure water 80:20 (v:v), and ultrapure water (100%)). The antioxidant properties were evaluated through the inhibition of lipid peroxidation in porcine brain tissue through the formation of thiobarbituric acid-reactive substances (TBARS), whereas the polyphenols were analyzed by HPLC-DAD-(ESI-)MS. The EC₅₀ (concentrations able to exert 50% of antioxidant activity) values were calculated to evaluate the antioxidant efficiency of each extract. The extract prepared using ultrapure water as solvent presented the highest concentration of phenolic compounds (8.1±0.2 mg/g extract), with ellagic acid being the major compound found (1.27 mg/g freeze-dried extract) and revealed the best antioxidant properties, presenting lower EC₅₀ values (0.018±0.0005 mg/mL) than the hydroethanolic extract. In summary, chestnut shells have phenolic molecules that may be associated with their antioxidant activities, both depending on the solvent used, highlighting that the greenest solvent, water, provided the strongest results.

Keywords: *C. sativa* shell; waste reuse; TBARS; LC-DAD-MS; natural preservatives; innovative extraction methods; green solvents.

Acknowledgements: FCT, Portugal for financial support through national funds FCT/MCTES to CIMO (UIDB/00690/2020); national funding by FCT, P.I., through the institutional scientific employment program-contract for L. Barros, and through the individual program contracts of S.A. Heleno. European Regional Development Fund (ERDF), through the research and technological development incentive system (SI I&DT) notice 13/si/2020 corporate R&D projects in co-promotion for inland territories, within the scope of Project Bio4Drinks (NORTE-01-0247-FEDER-113508), and for the research contracts of D.B. Rodrigues, T. Finimundy and D. da Costa.

Theme: Food loss and waste reduction and recovery

Presentation: Poster

Effects of decoction treatment on bioactivities of seaweed

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Abstract: Nowadays, seaweeds arouse great interest in the scientific community because they contain numerous and relevant compounds, with potential biological activity. In overall, the seaweeds are a food source very rich in vitamins, fibers, minerals, and proteins. These characteristics make seaweed's use in food very appealing, and help to promote food products with added qualities, of natural origin, for the functioning of the human organism and helping to improve human health.

The main goal of this present study was to evaluate the impact of decoction process on one brown seaweed, *Fucus vesiculosus*, tested three ratio of solid:liquid (m:v) 1:16; 1:50 and 1:100, respectively. The effect of treatment time at 15 and 30 min was analysed by determination of total phenolic content (TPC) and antioxidant capacity expressed by scavenging antioxidant capacity of DPPH. The pH value, solids soluble content (SSC), and color (CIELab) of the extracts, were also evaluated.

Compared the three ratio of solid-liquid applied in seaweed subjected to decoction, an increase of in all was observed compared to control samples that was not subjected to heat treatment, being the highest at 1:50 (m:v). Regarding the results obtained after the decoction the most promising was the decoction after 30 minutes. Another interesting result was observed in SSC being the ratio of 1:16 that contributes to the highest extraction of solids soluble compounds.

Overall, the results obtained showed a very promising value regarding the decoction process, from a natural source, the seaweed *Fucus vesiculosus*, allowing the application of an effective and promising extraction methodology to be applied in the formulation of new food products.

Keywords: Decoction; Brown macroalgae; Antioxidants; Food Industry; Bioactive.

Sustainable dietary choices: the contribution of the ALTERNATIVA project as a tool for selecting alternative proteins

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Abstract: *The impact exerted by the food systems in terms of climate change and global warming, exploitation of natural resources and loss of biodiversity, is mainly associated with the growth of the human population. Among the major contributors to this impact, the production of proteins of animal origin, such as red meat and dairy, represents a particular concern. Therefore, the need to transform food systems is urgent and should be supported by decisions settled in assessing and integrating simultaneously the overall health and sustainability impacts.*

“ALTERNATIVA | Alternative protein sources in the European diets – integrating health risk-benefit and sustainability”, a European project funded by the European Food Safety Authority (EFSA), aims to establish a harmonized and holistic methodology, bringing together and combining knowledge in health risk-benefit assessment of foods and sustainability assessment, considering in addition to health, other aspects as the environmental, social and economic impact of the consumption of certain foods. This approach is expressively useful for the agro-industrial sector. It will facilitate the decision process regarding health and sustainability, e.g. identifying the best alternatives to produce foods, including those of animal origin and their alternatives, guaranteeing the sustainability and health aspects of these decisions.

Under this communication, the approach developed under ALTERNATIVA will be presented, as a contribution to minimizing the effects of the current pressures exerted by the food systems, trying to provide safe, economically fair, affordable, nutritionally adequate and healthy diets having lower impacts on the sustainability of food systems.

This work was supported by the “ALTERNATIVA | Alternative protein sources in the European diets – integrating health risk-benefit and sustainability” funded by EFSA Partnering Grants (GP/EFSA/ENCO/2020/03 Partnering grants – GA 2). The authors declare that this work reflects only the authors’ view and EFSA is not responsible for any use that may be made of the information it contains.

Keywords:

Food systems

Health

Sustainability

Alternative protein sources

One Health

Theme: Sustainability**Presentation:** Oral

ANÁLISE DE EFICIÊNCIA ECO ENERGÉTICA DE CLIMATIZAÇÃO DE COGUMELOS COM PROPOSTA DE EQUIPAMENTO ESPECÍFICO PARA ESTE FIM COM FIM DE REDUZIR CONSUMO DE ENERGIA E EMISSÕES DE CO₂

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Resumo: *O mercado de cogumelos tem crescimento acelerado no mundo atual, apesar de avanços na tecnologia a colheita é um procedimento mais artesanal, a China é o maior produtor mundial, países como Portugal e Brasil não são autossuficientes em produção de cogumelos, entre as dificuldades na produção de cogumelos está a questão da climatização com controle de temperatura e umidade relativa [1], num desses produtores foi colocado analisadores de energia no sistema de iluminação, climatização e bombeamento de água, para uma produção de 2200 kg de cogumelo num galpão climatizado de 100 m², foi constatado um consumo de 48 kWh de iluminação, 1.575 kWh na climatização e 9 kWh no bombeamento de água, com isso o índice foi de 0,7515 kWh/kg de cogumelo tipo champignon-de-paris (*Agáricus bisporus*), com equipamento sugerido usando R-454-B como fluido refrigerante o resultado estimado usando o modelo proposta de equipamento de climatização foi de 0,537 kWh/kg.*

Palavras-chaves: TEWI; Emissões direta e indireta; Fluido refrigerante, climatização cogumelos, sustentabilidade na agricultura.

Theme: select among topics

Presentation: Oral.

The effect of biodegradable film packages on texture and color properties of Alentejano x Duroc pork meat

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The use of packaging is beneficial for food preservation, reducing the influence of external factors, such as physical, chemical and even microbiological factors that are responsible for food quality, safety, and hygiene (Daniloski *et al.*, 2019). In recent years, the use of biodegradable films and packages have been investigated due to their non-toxic, biodegradable and environmentally friendly properties. They offer a viable solution for the reduction of conventional plastics from sources, such as oil (Fernando *et al.*, 2015; Leceta *et al.*, 2013). All the factors described above combined with the need to extend shelf life and protect foods from external factors, has led to an increase in the use of these films (Abdollahi *et al.*, 2012). The aim of this study was to assess the effect of biodegradable film compared with the commonly used package in three batches of meat (*latissimus dorsi* muscle, a commercial cut named “secreto”) from “Alentejano x Duroc pig cross breed”. Colour and texture were studied in two different storage times: 0 and 6 months. Colour was evaluated using the chromatic coordinate system $L^* a^* b^*$, measured with a Konica Minolta colorimeter and texture evaluation was done measuring the Warner-Bratzler (WB) shear force. Following an analysis of variance, at a significant level of 0.05, no significant differences in shear force were found between 0 and 6 months of storage ($p>0.05$). Considering the analysis of the colour results, no significant differences were found between 0 and 6 months, between different batches. Because no significant differences were found in the meat texture and colour between the two storage times, it is possible to conclude that the use of these biodegradable film packages could contribute to maintain meat quality.

This work was supported by ICAPP - Research in Alentejo Black Pork Meat, reference POCI-01-0247-FEDER-072109, co-financed by the European Regional Development Fund (FEDER) through Compete 2020 – Competitiveness and Internationalization Operational Program (POCI).

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ANÁLISE BIBLIOMÉTRICA: UM ESTUDO APLICADO À ROTULAGEM ECOLÓGICA NOS PRODUTOS ALIMENTARES

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Abstract: *Os rótulos ecológicos podem representar uma ferramenta para promover e apoiar produtos mais sustentáveis, na medida em que fornecem informação que permitem aos consumidores selecionar os produtos com melhor desempenho ambiental. Os rótulos ecológicos podem ajudar a criar uma consciência ecológica em torno do consumo sustentável, e a promover atitudes de respeito pelo meio ambiente, contribuindo para a criação de hábitos de consumo responsáveis por parte dos consumidores. Os rótulos ecológicos assumem-se como uma ferramenta privilegiada de comunicação com o consumidor e, por isso, ganham especial destaque na investigação em duas vertentes complementares: i) o papel que desempenham na decisão do consumidor e quais os atributos que estes mais valorizam; e ii) na quantificação do prémio que os consumidores estão dispostos a pagar por produtos alimentares com rótulo ecológico. O objetivo deste trabalho de investigação é realizar a análise e caracterização das publicações científicas dos últimos 10 anos, indexadas à SCOPUS e Web of Science. Pretende-se efetuar um mapeamento das publicações científicas caracterizadas pelo número de publicações por ano, as principais fontes, os autores mais relevantes, as áreas geográficas onde mais se publica, os documentos mais citados, as palavras chave mais utilizadas, uma análise de cluster, e a análise das tendências de investigação atuais. Estes resultados dão um contributo para o avanço da literatura científica e para a definição e implementação de políticas públicas mais eficazes e efetivas, facilitadoras da comunicação entre produtores e consumidores.*

Keywords: willingness to pay; eco-label; food product; sustainable attributes; determinants of consumption.

Theme: select among topics

Presentation: Oral

USE OF EDIBLE COATINGS FOR STORAGE OF 'CRIMSON' SEEDLESS TABLE GRAPES

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Abstract

Seedless table grape is a commodity with high commercial value. Due to its high perishability it is essential to look for new methods of preservation that increase its period and useful life. Edible coatings, using natural biomaterials such as chitosan and *Aloe vera*, are being explored as a safer and friendly alternative to extend the shelf life of seedless table grapes. This study aims to evaluate the effect of edible coating of chitosan and *Aloe vera* in the post-harvest behavior of 'Crimson' seedless table grapes during a period of 35 days. Fruits were stored in cold conditions at 1 °C and RH 95%. The treatments were: ¹)control, ²)0.125% *Aloe vera* gel ³)0.25% *Aloe vera* gel, ⁴)0.8% chitosan, ⁵)0.8% chitosan + 0.125% *Aloe vera* gel, ⁶)0.8% chitosan + 0.25% *Aloe vera* gel. Analysis were performed at 0, 7, 14, 21, 28 and 35 days of storage, and the following parameters were evaluated: weight loss, color, texture, soluble solids content (SSC), titratable acidity (TA), phenolics compounds and antioxidant content. The use of chitosan coatings improved the preservation of grapes, in respect of texture and antioxidant capacity. The formulations exclusively with *Aloe vera* did not perform the intended coating function due to their physical characteristics. However, these *Aloe vera* solutions showed to be of extreme interest because they were very effective inhibiting the proliferation of fungus. The chitosan treatment has proved to be successful in storing the grapes for a period of 14 days with good characteristics of quality. Nevertheless for longer periods of storage it is advisable to use treatment modalities composed of chitosan and *Aloe vera*, enhancing their complementary effects.

Keywords: Seedless table grapes; postharvest; quality; chitosan; *Aloe vera*

Acknowledgements: This work was supported by project UIDB/05183/2020 (MED) financed by national funds through FCT. Sara Ricardo-Rodrigues acknowledges a PhD grant from FCT (2021.07663.BD).

Theme: New and Emerging Technologies

Presentation: Poster

A SUSTAINABLE, NUTRITIOUS, AND INNOVATIVE FISH SAUSAGE WITH SEAWEED

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Abstract:

*The choices that consumers make when purchasing and consuming food items are of great importance to impel a more sustainable food production/capture. So, the consumption of more sustainable foods should be stimulated by the usage of more sustainable ingredients, locally sourced and seasonal, and by consumer education, for example. With this in mind, an innovative and highly nutritious fish sausage with seaweed was developed, using sustainable ingredients, such as the low-value blue jack mackerel (*Trachurus picturatus* (Bowdich, 1825)) and the seaweed Dulse (*Palmaria palmata* L.) from aquaculture. The purchase of the other ingredients also followed the same sustainability criteria. The developed product was analyzed for its physico-chemical, and nutritional characteristics, including antioxidant activity (DPPH, TPC) and fatty acid and mineral element profiles. Shelf-life and consumer acceptability was also determined. The fish sausage with seaweed showed to be source of protein (10.06 ± 0.54 % fresh weight), fiber (2.71 % fresh weight) and mineral elements such as K, P, Cu and Fe, and rich in unsaturated fatty acids (10.9 ± 0.1 % fresh weight). No antioxidant activity was detected by the methods used. The pasteurized and vacuum-packed product had a shelf-life of 45 days, and the consumer acceptance study showed an 83% purchase intention. So, the developed fish sausage with seaweed proved to be highly nutritious and well accepted by the consumers, while using sustainable ingredients, showing a potential to be produced and commercialized.*

Keywords: Sustainability; Innovation; *Palmaria palmata*; *Trachurus picturatus*; Macroalgae.

Theme: Sustainability

Presentation: Oral

STUDY OF TEXTURE AND THE PHENOLIC COMPOSITION OF GRAPES CV. TEMPRANILLO UNDER DIFFERENT IRRIGATION TREATMENTS

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Abstract:

Irrigation management is a tool fundamental in order to improve the grape quality in semi-arid regions, as Extremadura (SW of Spain). Regulated deficit irrigation (RDI), consist of applying water in quantities smaller than 100% ETc during certain periods of the growth cycle in vines, are used to improve berry and wine quality. In this trial a rainfed, a full irrigation and two RDI strategies, late and early deficit irrigation were applied in a experimental vineyard cv. Tempranillo sited in Badajoz (Extremadura, Spain). Thus, four different classes of irrigation vines treatments and their corresponding wines were studied. The final goals of this work were: i) to better understand berry texture using penetration test and find if it can be used as a tool to evaluate other grape quality parameters; ii) to evaluate the effects of different irrigation treatments on grape and wine quality parameters and phenolic composition of skins in Tempranillo grapes grown in SW of Spain. The deformation values obtained trough penetration test on entire berry discriminated some grapes from the diferent RDI treatments and it was significantly correlated with most of the quality parameters of interest in wine grapes. Total Soluble solids (TSS), was significantly correlated with the ratio between firmness of skin and deformation. Thus, the methodologies proposed could allow wine producers to make rapid decisions and may, therefore, be of use in wine production areas.

Acknowledgements: Sara Ricardo-Rodrigues acknowledges a PhD grant from FCT (2021.07663.BD).

Keywords: Texture; Irrigation; Wine grapes; Phenolic composition.

Theme: sustainability

Presentation: Poster

BEHAVIOUR OF PRICKLY PEAR STORED IN COLD CONDITIONS IN DIFFERENT PACKAGING MATERIALS

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Abstract:

The world population will exceed 9.7 billion by the year 2050 (UN, 2021). The demand for nutritious food will be a huge challenge. Considering the water scarcity and the climate changes, the culture of the *Opuntia ficus-indica* (L.) Mill, , has gained relevance as an effective food production opportunity, especially in the Mediterranean peninsula where climate change is predicted to have a higher impact. Deemed by FAO a "super crop", the prickly pear cactus is a high perishable non-climateric fruit. The objective of this study was to evaluate the storage behavior of the prickly pears, under different modified atmosphere conditions. These fruits, a regional variety referred as "orange", were produced in Alentejo by PepeAromas company, and stored at 2 °C and 90 % RH using three different packaging materials, a cardboard box commercially used by the enterprise, a rigid PET box (Polyethylene Terephthalate) and a biodegradable plastic flexible bag (SILVEX®). Every ten days, fruits were evaluated (weight loss, SST, color L*a*b*, texture, pH, Titratable acidity, phenolic content, and Antioxidant activity). An ANOVA was performed (p<0.05) considering the factors storage time, package modality. It was concluded in a global approach that these "orange" fruits can be stored at 2° C, 90 % R.H for the maximum period of thirty days and that the biodegradable plastic bag is the best maintaining the quality of the fruit during this period. The fruits stored in the cardboard box exhibited the worst behavior, showing high weight loss, and more cases of contamination by fungi.

Keywords: Prickly pear; Cold storage; Shelf life; Packaging material

Theme: sustainability

Presentation: Poster

International Congress on Sustainable Solutions for the Agrifood Industry

Sustainability indicators in agricultural organizations: A literature systematic review

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Abstract:

The competitive context of agricultural organizations is being influenced by the paradigm of sustainable development, being necessary to consider the requirements of sustainability in their activity. Agricultural organizations, namely associations and cooperatives, can facilitate the interaction between farmers and, hence favour the production and marketing of their agricultural products in a sustainable way, as well as the access to services that promote the adoption of sustainable practices. These organizations inform their associates, enabling the technological development, and are also key players in increasing productivity and environmental issues. However, few empirical studies in the literature was addressed to assess the sustainable performance of agricultural organizations. Thus, this article aims to identify and define indicators for evaluating the sustainability of agricultural organizations. A systematic analysis of the literature is developed focused on scientific articles from the bibliographic bases of the Web of Science and Scopus. Sustainability indicators are enable to support predictive models for assessing sustainability, and the literature highlights their contribution to improving the management of agricultural organizations, allowing the visualization of strengths and opportunities to face weaknesses and threats. Mapping documents allowed identifying economic, environmental and social indicators, which are a starting point for a research agenda focused on the role of agricultural organizations on the sustainability of the agricultural sector.

Keywords: Agricultural associations; sustainability assessment; sustainability indicators; Triple bottom line.

AGRADECIMENTOS: Este trabalho é financiado por fundos nacionais através da FCT – Fundação para a Ciência e a Tecnologia, I.P., no âmbito dos projetos UIDB/04011/2020 e UIDB/04007/2020.

Theme: Sustainability

Presentation: Oral

(Re)inovação de tecnologias para irrigação e abastecimento de água a pequenos agricultores: A abordagem MED-WET

(Re)innovation of technologies for smallholder irrigation and water supply: The MED-WET approach

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Abstract: *O crescimento populacional, a mudança no comportamento do consumidor e as alterações climáticas impactam na disponibilidade de água doce. Grande parte da água destinada à irrigação convencional infiltra-se ou evapora, perdendo parte do seu potencial para benefício das culturas. Considerando que as regiões mediterrânicas enfrentam já graves carências de água, todas as tecnologias, métodos, técnicas e procedimentos relacionados com uma irrigação controlada e deficitária assumem uma grande relevância. Neste estudo apresentam-se sistemas de irrigação inovadores, que proporcionam a exploração de recursos hídricos não convencionais, em grande parte não utilizados. São utilizadas para este fim soluções de baixo custo, com materiais naturais e disponíveis a nível regional (Baixa Tecnologia, Baixa Energia, Baixo Orçamento, Fácil de Usar). Estes sistemas de irrigação agrícola inovadores e eficientes, destinam-se fundamentalmente a pequenos agricultores da região mediterrânica, já que os escassos recursos hídricos devem ser utilizados de uma forma eficiente e ambientalmente correta. Pretende-se deste modo contribuir para a resiliência do abastecimento de água e alimentos a longo prazo, sustentabilidade do setor agrícola e promoção da segurança alimentar, apesar dos impactes negativos decorrentes das alterações climáticas na agricultura.*

Keywords: Innovative irrigation systems, Smallholder farmers, Mediterranean region, Efficiency, Environmental protection, Agrifood, SLECI technology, Solar desalination system, Wetlands.

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

SEAWEEDS-BASED EDIBLE COATINGS FOR EXTENDING THE SHELF LIFE OF SEAFOOD

International Congress on Sustainable Solutions for the Agrifood Industry

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Abstract:

*Fresh fish is a highly perishable product due to the chemical composition and the high microbial load on surface, demanding appropriate processing to guarantee their quality and safety during the entire storage. Edible coatings containing natural compounds present an interesting approach to preserve these products, while keeping the product 'natural', although with a higher shelf-life. Seaweeds are described as sources of antioxidant and antimicrobial compounds capable of minimizing major food damage and pathogenic microorganisms [2]. This work aims at studying the antimicrobial and antioxidant potential of *Fucus spiralis* and *Bifurcaria bifurcata* extracts, to be used as edible coatings. Optimal conditions for extraction considering different extraction methods (vortex, ultrasonic bath and sonicator) and solvent ratios (100:0;75:25;50:50;25:75;0:100) of water:acetone were also studied. The antimicrobial activity was investigated through the ability to inhibit microbial growth in 96-well plate of the following microorganisms: *Shewanella putrefaciens*, *Pseudomonas putida*, *Listeria innocua* and *Escherichia coli*. The antioxidant activity was estimated by DPPH and FRAP methods. *Fucus spiralis* extract (ultrasonic bath) 100% acetone and 50% water:50% acetone was effective against *Shewanella putrefaciens* (87,55% and 69,53%, respectively). As for antioxidant activity, the highest activity was found in *Bifurcaria bifurcata* 100% acetone extract in the sonicator (FRAP-144,76mmol EAA/mg extract) and *Bifurcaria bifurcata* 25% water:75% acetone extract in the vortex (DPPH92,69%). *Fucus spiralis* extracts showed higher antimicrobial activity, while *Bifurcaria bifurcata* extracts showed higher antioxidant potential. Thus, the combination of both in the formulation of coatings applicable to fresh fish in order to increase its shelf life is the best option.*

References:

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- [2] Dehghani, S., et al., Edible films and coatings in seafood preservation: A review. Food Chemistry, 240 (2018) 505–513.

Keywords: Macroalgae; Natural Coatings; Water:Acetone Extrat; Vortex; Ultrasound.

Theme: New and Emerging Technologies

Presentation: Oral

MICROBIOLOGICAL SAFETY OF FRESH BEEF SAUSAGE

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Abstract

Fresh sausages are meat products produced all over the world. They can be prepared from one or mixed types of fresh meat (e.g. pork, beef or chicken) minced, and mixed with other ingredients, such as salt, pepper or aromatic plants. Fresh sausages are a highly perishable food product that favour microbial growth of spoilage and pathogenic organisms during their production and throughout their shelf-life. They are also prone to lipid oxidation due to their high fat content. Therefore, it is very important to consider the packaging method as well as storage conditions, namely temperature control. This study aims to evaluate the microbiological safety, pH, a_w and colour of fresh beef sausages over 14 days under refrigeration, considering the use of 'Cachena' meat (beef) in the sausage formulation. Three independent batches were prepared, and analyses were performed at 0, 5, 10 and 14 days of storage. Samples were stored under vacuum at $2 \pm 2^\circ\text{C}$. Microbiological analysis, pH, a_w and colour ($L^*a^*b^*$) were assessed. Data were statistically analyzed using ANOVA and Tukey's HSD test ($p < 0.05$). The presence of *Salmonella* spp. and *Listeria monocytogenes* was not detected in any of the samples analysed. There was a significant increase ($p < 0.05$) in total mesophilic (from $6.96 \log \text{cfu g}^{-1} \pm 0.44$ on day 0 to $9.00 \log \text{cfu g}^{-1} \pm 0.65$), and psychrotrophic microorganisms, lactic acid bacteria and enterobacteria ($6.02 \log \text{cfu g}^{-1} \pm 0.55$ on day 0 to $6.52 \log \text{cfu g}^{-1} \pm 0.73$) throughout the storage period. No significant changes ($p > 0.05$) were recorded during the 14 days of storage for pH (around 5.40), a_w (around 0.93) and colour. The results show slightly high values compared to other authors, so measures should be taken to reduce contaminations throughout the manufacturing process of fresh sausages.

Keywords: Food safety; microbiological analysis; a_w ; pH; colour.

Acknowledgements: This work was supported by project PDR2020-1.0.1-FEADER-030803, funded by national funds through Fundação para a Ciência e a Tecnologia (FCT)/MCTES and co-funded through the European Regional Development Fund (ERDF), and by project UIDB/05183/2020 (MED) financed by national funds through FCT. Sara Ricardo-Rodrigues acknowledges a PhD grant from FCT (2021.07663.BD).

Theme: Food safety

Presentation: Oral

Sistemas de monitorização e de apoio à decisão em Agrobiodiversidade aplicado à viticultura: Resultados de campo do sistema BioD'Agro

Monitoring and decision support systems in Agrobiodiversity applied to viticulture: Field results of the BioD'Agro system

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Abstract: A biodiversidade tem um papel fundamental na sustentabilidade dos ciclos naturais essenciais aos ecossistemas agrários, servindo de suporte a serviços do ecossistema cruciais para a conservação do equilíbrio ecológico e à cadeia de valor da planta ao produto, permitindo resultados financeiros baseados numa maior eficiência dos recursos disponíveis, bem como à saúde e vitalidade da sociedade. Neste estudo são apresentados os resultados de campo do sistema operacional inteligente de informação e de apoio à decisão para a agrobiodiversidade, BioD'Agro, aplicado à viticultura em localizações remotas e de elevada importância ambiental. Em duas parcelas de vinha (uma em modo de produção biológica e outra em modo de produção integrada) da casta 'Touriga Nacional' localizadas na região do Douro Superior foi instalado um sistema piloto que monitoriza remotamente diversas variáveis do ecossistema vinha. A estação meteorológica automática e as ilhas de sensores (sondas capacitivas para medição contínua do teor de humidade do solo a quatro profundidades, e um sensor para medição contínua do potencial hídrico do xilema) efetuam a recolha de dados do clima, solo e estado hídrico. Por outro lado, a biodiversidade funcional - flora, artrópodes, quirópteros, é monitorizada por via de visão computacional da flora na entrelinha, uma armadilha automática para monitorização da traça-da-uva e um sistema automático para deteção da atividade dos morcegos. Apresenta-se uma descrição do sistema de monitorização instalado bem como uma súmula dos resultados preliminares obtidos em 2022, e da sua validação por amostra de dados fisiológicos e agrónomicos recolhidos manualmente a dez videiras contíguas em cada ilha de sensores. Adicionalmente, foram ainda efectuados levantamentos periódicos da flora na linha e entrelinha de cada uma das parcelas. Entre modos de produção, são identificadas importantes diferenças nas disponibilidades hídricas, no tipo (família botânica e espécies) e abundância dos táxones vegetais bem como no vigor e produção da videira. Destaca-se o fraco desenvolvimento vegetativo da videira na parcela

biológica, resultante sobretudo dos baixos teores de humidade do solo registados em todas as ilhas em consequência do ano muito seco e quente e da empresa não dispor de água suficiente para rega. Por outro lado, a validação manual dos dados da monitorização contínua do potencial do xilema parece indicar que se trata de uma metodologia promissora passível de substituir as tradicionais medições manuais. Os sistemas de monitorização automática dos artrópodes e dos morcegos também se mostraram funcionais, estando os resultados em fase de análise e validação. Em paralelo foi instalado um sistema inovador de comunicação sem fios e encontra-se em fase de desenvolvimento um sistema de suporte à decisão.

Keywords: artrópodes, disponibilidades hídricas, flora, sensorização, validação tecnológica.

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

Gestão Sustentável de Resíduos na Produção de Plantas Aromáticas e Medicinais

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Abstract: Devido à crescente procura de Plantas Aromáticas e Medicinais (PAMs), é crucial que os produtores de implementem práticas sustentáveis para otimizar a exploração destes valiosos recursos naturais de forma a gerar valor económico, garantindo simultaneamente a sustentabilidade social e ambiental. Os resíduos agroindustriais podem representar uma oportunidade e uma estratégia fundamental para o desenvolvimento de processos industriais sustentáveis. No entanto, os principais resíduos do setor de PAM não são apresentados com clareza na literatura e não foram identificados estudos sobre práticas agrícolas sustentáveis, com foco no reaproveitamento dos resíduos dos processos produtivos do setor de MAP. Por esse motivo, o objetivo deste estudo é fornecer estratégias de reaproveitamento de resíduos que possam ajudar os produtores de PAM a melhorar o seu desempenho sustentável.

Foi realizado um inquérito aos produtores portugueses de PAM para identificar os principais processos produtivos, desperdícios e pontos de melhoria no setor. Seguidamente, foi realizada uma revisão da literatura para identificar estratégias aplicáveis à promoção do reaproveitamento de resíduos. A revisão inclui práticas já aplicadas no setor PAM (benchmarking interno) e práticas que foram aplicadas com sucesso em diferentes setores agrícolas com processos produtivos semelhantes (benchmarking externo).

É expectável que este estudo facilite a implementação de práticas sustentáveis entre os produtores de PAM, fornecendo um guia prático sobre estratégias de reaproveitamento de resíduos nos processos produtivos.

Keywords: Plantas Aromáticas e Medicinais; Sustentabilidade; Economia Circular; Reutilização de Resíduos; Processos Produtivos.

Theme: Sustainability; Packaging; Energy Efficiency; Food safety.

Presentation: Oral

Bibliometric analysis about agriculture, stochastic analysis frontier (SAF), and data envelopment analysis (DEA)

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Abstract: *This work has the objective to conduct a bibliometric review of Agriculture, Stochastic Analysis Frontier (SFA), and Data Envelopment Analysis (DEA) analyzing for relationships among the research across the entire coverage of Web of Science (1900-January 2023). To select the sample a search protocol was created and applied the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach to select our sample. We were able to achieve a sample of 90 articles. The sample analysis indicates a prevalence of papers using the DEA approach. The journals with the highest highlight are PLoS ONE with the highest h-index, Omega (United Kingdom) has the highest Journal Impact Factor, and the Journal of Agricultural Economics and Agricultural Economics has the biggest number of citations. Sustainability (Switzerland) was the journal with more publications in the period. The author with the most citations is Thiam et al., 2001. The geography analysis indicates that this topic has been studied all around the world, however, the developed economies published more, and China appears as the country with more articles published. Finally, we indicate a possible gap that could be later investigated.*

Keywords: Agriculture; Data Envelopment Analysis (DEA); Efficiency; Stochastic Frontier Analysis (SFA).

Theme: Sustentabilidade / Tecnologias novas e emergentes / Tecnologias de Informação e Comunicação

Presentation: Oral

Innovative technologies, parameters and good practices in sustainable secondary packaging of agri-food products

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Abstract:

Nowadays, industry, which includes those in the agri-food sector, is struggling with the need to increase its competitiveness to survive in a global market. In this context, it is essential to ensure a strong, renewed and innovative industrial base along all stages of the value chain, capable of competing internationally and stand out for the quality of its products and services. Innovation is born out of patterns of market needs and problems to which the competition does not respond. These needs and problems must be measured, quantified and framed in international market segments.

One of the S4AGRO project objectives is to identify and disseminate among SMEs in the agro-industrial sector, good practices in the use of sustainable secondary (recyclable and/or reusable) packaging and the critical factors to their application and the most effective logistics practices. To show the agri-food industry how to be more sustainable in the packaging and logistics of their products.

This study is a cross-sectional survey of innovative technologies/parameters and good practices framed in the development of sustainable secondary packaging solutions, applied to the meat products. Priority was given to technologies that had recently entered the market, framed in granted patent processes, or technologies with maturity TRL 71 or higher.

In total, in this technological surveillance process, a total of 43 innovative technologies and parameters catalogued based on the Blue Ocean Innovation Matrix methodology, and 13 cases of good practices were selected and described for the meat industry, 11 cases for the horticulture sector, 10 cases for dairy and 9 for bakery and confectionery products. An attempt was made to cover a spectrum of technologies and cases complementary to each other, which constitutes a body of actionable information, that can reflect current trends and define lines of innovation for the future of the institutions involved in the sector of national agri-food products.

The context of research and screening of technologies and substances inherent to the application areas of this study was based on the premise of identifying and selecting a set of innovations that create a transversal vision, complementary and diversified innovation processes in the secondary packaging, logistics and freight transport.

It was concluded from this study and the research that resulted from that in this value chain, the processes of innovation and technological evolution have a strong root in the most upstream segment of the value chain – most of the innovations stem from or come from companies in this segment of the chain.

Effectively, manufacturers of packaging machines are a strong driver of innovation in the sector and in incorporation of value through innovation in each of the application areas.

In another way, another conclusion focuses on the evidence that despite the urgency and growing viability of of bioplastic and the solutions that use it in industry, it should be noted that this will not be the answer for the technological innovation of this industry and/or unique solution to the problems of the need to find alternatives to conventional plastic, as this study makes clear with the great diversity of alternative approaches and solutions found.

Keywords: Secondary packaging, good practices, sustainable, agri-food industry.

Acknowledgements: The authors thank the S4AGRO project (Sustainable Solutions for the Agroindustrial Sector). N.º 02/SIAC/2019. Project N.º 46425).

Fortification/enrichment of Sarrajão (*Sarda sarda*) fillets with hydrocolloid and vegetable and animal protein coatings

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Abstract: According to the FAO and the World Health Organization, fish consumption should be increasingly recommended in a healthy and sustainable diet, not only for the diversity of species but also for its health benefits to consumers. Fish is an essential source of nutrients, as it is low in fat content and high level of protein, vitamins, and minerals. In recent decades, this food group's consumption has increased and become available to consumers far from coastal areas.

The objective of this work was the fortification of fillets of Sarrajão (*Sarda sarda*) through the application of hydrocolloids and protein coatings, sodium alginate and agar-agar (7:3), whey protein (WP) and pea protein (PP), with a final concentrations of , 1%, 2.5%, 5% and 10% (p/p). The effect of the concentration of 2%, 3% and 4% of hydrocolloids, coating immersion time and the effect of cooking on the protein content of fillets were studied.

After filleting process, the fillets were immersed in the coating solution and packed into polyethylene bags. Samples were storage at 4°C during 0, 2, 4 and 8 days. After that the fillets were cooked in a convector oven at 180°C during 15 min. A control experiment without the immersion step was also performed, and an experiment without cooking step was also made. Protein content (AOAC method 955:04, 1995), moisture content and water activity were studied. The analysis of variance (ANOVA) and the Tukey test were used to determine statistically different values at a significant level of ($p < 0.05$).

Regarding hydrocolloids concentration results showed that the concentration of 3% in the coating solution presented the highest protein content when comparing to the samples without coating, regardless of the type of the protein used. The maximum protein content in the fillets was obtained with a 10 min immersion WP coating solution and after cooking process. There were no significant differences in protein concentration for immersion times greater than 10 min. No significant differences in water activity and moisture content during storage time were found, regardless of the protein used. Concerning storage time effect on the protein content, results showed that protein content remained constant until the end of storage time.

With this work, it was possible to conclude that it is possible to increase 1.5 times the protein content in Sarrajão fillets, after cooking, through the use of coating solutions with hydrocolloids and protein, maintaining the stability of this fortification over a shelf life of 8 days.

Keywords: Protein, fortification, coatings, hydrocolloid, Sarrajão.

Acknowledgements: The authors thank the Esposende Town Hall for accepting the master's work. The authors thank the Blue Project, Bioeconomy, People, Sustainability, Health. Iceland Liechtenstein Norway grants. Blue Growth Programme. Call2 – Business, Development, Innovation and SMEs.

Theme: Tecnologias novas e emergentes

Presentation: Oral Presentation

