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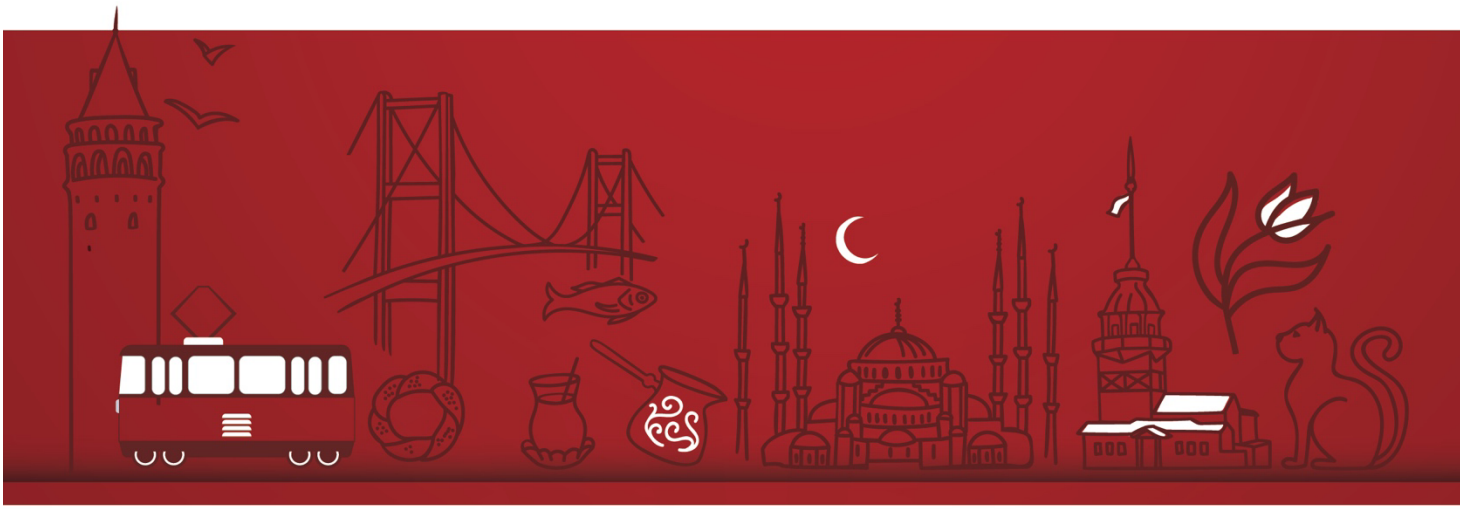
"Safe food for now and future"

ABSTRACT BOOK



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Mycotoxin contamination caused by the occurrence of fungi in different food crops leads to major issues for food and feed safety as well as food security and international trade. It results in an annual 5 – 10% loss of global crop produce as concluded by the European Commission (European Commission, 2015). This is reflected in an estimated €1.2-2.4 billion lost income in the European Union (EU) for the 133 million tonnes (MT) of wheat alone (~M€ 29038). Just alleviating these losses by 1% could save M€12-24. Hence, we have identified a pressing need to mobilise the wealth of knowledge from the international mycotoxin research conducted over the past 25-30 years, and to perform cutting-edge research where knowledge gaps still exist. This knowledge shall be integrated into affordable and practical tools for farmers and food processors along the chain in order to reduce the risk of mycotoxin contamination of crops, feed and food. This has been the mission of MyToolBox – a four-year project which has received funding from the European Commission. It mobilised a multi-actor partnership (academia, farmers, technology small and medium sized enterprises, food industry and policystakeholders) to develop novel interventions aimed at achieving a significant reduction in crop losses due to mycotoxin contamination. That task was taken on by MyToolBox (grant agreement No 678012; www.mytoolbox.eu), a four year project funded by the European Commission (EC) from March 2016 till February 2020. Taking a multi-actor and multi-disciplinary approach with 40% industry participation including five end users including one from Türkiye in the area of dried figs and three Chinese institutions to collaborate with important other stakeholders to establish contact to affected farmers. The main goal of MyToolBox consisted of the development and merging of various measures to significantly reduce the harm associated with mycotoxin contamination. Furthermore, we looked into the viable use of mycotoxin-contaminated batches e.g. to apply microbial energy conversion for the production of biogas and bioethanol. A combination of pre- and post-harvest measures was initiated to reduce the losses of crops caused by mycotoxins. This kind of intervention also takes into consideration the type of commodity that is affected. In the end, we have carefully examined the entire chain, from soil-field-crop-food to processing-waste management-alternative energy, to enable food & feed security and safety within a sustainable economic environment. A web-accessible e-platform (mytoolbox.eu) lists the outcomes of the project including novel interventions and provides additional information for all actors along the food chain (farmers, processors, feed suppliers or manufacturers from the food and feed industry) in an effort to support the decision-making process in mycotoxin management. In this paper we demonstrate the estimated individual and overall impact the described measures will have

on the control and reduction of mycotoxins in selected European food crops through the developed improved prevention measures, control and mitigation strategies.

Nonthermal Food Processing Technologies

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Conventional approaches to process foods have proven to offer very safe products but, in some cases, the quality of the final product is significantly lower to the original one and the impact on the environment might be of great concern. Over-processing implies safety, but at a high cost in terms of nutrients and other quality attributes. Nonthermal processing of foods has emerged as a viable alternative to those conventional processing techniques by offering safe products of excellent "total quality" at very reasonable cost, and in general, they are environmentally friendly, and they could be listed as "green technologies" with great confidence. It is the case; these nonthermal technologies could be used in combination among themselves or with other preservation approaches seeking synergistic effects in order to have shorter processes and very good quality food products. In addition, most nonthermal technologies are contributing to the sustainability of the production chain. This presentation analyzes some of the most relevant nonthermal technologies where some of them are already in use by the food industry and others will be adopted in the very near future.

Pulsed Electric Field Processing of Pistachio Nuts With Preservation of Quality Properties and Surface Disinfection

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Pistachio nuts (*Pistacia vera* L., Anacardiaceae family) due of their nutritional and sensory properties have been part of the human diet since prehistoric times and have been consumed by civilizations. Pistachios are a good source of vegetable protein and especially with L-arginine, rich in fiber and in Cu, Mg, Mn, vitamin A, vitamin C and B vitamins. They are rich sources of phenolic compounds such as anthocyanins, flavonols, flavonoids, flavanones, isoflavones, proanthocyanidins, stilbenes, phenolic acids and hydrolysable tannins, which are important as antioxidants. After harvesting, pistachios are usually sun dried on ground and during this period they are contaminated with food spoilage and foodborne spoilage microorganisms that resulting in quality degradation. Higher microbial load not only cause decrease in quality but also bring safety issues. Processing of pistachio nuts with heat, sanitizers such as ozone and antimicrobial agents are either cause deterioration on their quality or not allowed to be used. Thus, alternative technologies such as pulsed electric fields (PEF) are in search for surface disinfection of pistachios without adversely affecting its physical and sensory properties. Pilot scale PEF treatment system with changing energies from 2.97 to 71.23 J with monopolar square wave pulses with the maximum peak voltage of 20 kV. It has been shown that moderate electric field strengths have provided a significant increase on total phenolic substance content, total antioxidant capacity, and total chlorophyl content. While color (L*, a* and b*) values of the samples fluctuated; titratable acidity of the samples were not changed by with the applied energy. Increased energy application caused significant decrease on both total mesophilic aerobic bacteria and total mold and yeast. Sensory analyses of the PEF-treated samples had higher scores than that of the control samples in terms on appearance, color, taste, aroma and overall acceptance.

Smart Sensors and Food Safety Management Systems in the Digital Age

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Each year worldwide, unsafe food causes 600 million cases of foodborne diseases and 420.000 deaths. 30% of foodborne deaths occur among children under 5 years of age. According to these reports, only in European region, which is classified as developed countries, every year, more than 23 million people fall ill from eating contaminated food, resulting in 5000 deaths. In order to reduce the consumption of unsafe food, serious measures must be taken in the field of food safety, from production to consumption. The primary steps to be taken in this area are the integration of digital food safety systems throughout the "from farm to fork" process and ensuring traceability.

The anticipated temperature limit values for food safety must always be obtained especially in cold chain products. As a matter of fact, taking precautions to reduce food waste is becoming easier through the calculation of shelf-lives of foods, determining of best before date depending on the information on the relation between temperature and time. Moreover, thanks to this infrastructure, the documentable status of the products in supply chain throughout the processes and the traceability necessary to detect problems, if any, are also crucial factors.

The key parameter in food safety is temperature; relative humidity is very crucial for fresh and dry goods, and calculations for total polar compounds are very important in frying oil used in catering. The factors that must be considered to perform all these calculations accurately should be defined initially. The preliminary subjects that should be taken into consideration for a correct practice include selecting the right measuring devices, the compatibility of devices to the standards, the training level of the users to prevent any malpractices, and the presence of certifications from an accredited laboratory.

The developments in technology increased the expectations from measuring devices and methods and make the transition to digital food safety and quality management systems compulsory. The operating logic of these systems include, in general, 1) fixed and user-supported mobile measuring devices that collect data on site; 2) transferring these measurements to intermediate elements (hand terminal, tablet) via communication protocols such as Bluetooth, Wi-Fi, NFC etc.; 3) automatic transportation of data to cloud or user's own server through methods such as Wi-Fi, Ethernet; and 4) managing all quality-related data (digital checklists inhibiting measuring parameters, monitoring cold-frozen areas) from a single center. Thanks to these systems, it is possible to minimize food waste and loss through obtaining data integrity, traceability and compatibility to legal standards, minimizing human errors through real-time controls, establishing alarm limits and ending waste of paper. While cloud-based new technologies offer great facilitations in digitalization process, how shall we provide the data safety?

In order to prevent data loss and protect data from unauthorized access by third parties, the server used must be in one of the cloud providers whose compatibility to national and international standards (for instance PCI DSS, ISO 27001 and 95/46/EC) is approved. In such practices, the server / cloud provider itself do not have any access to recorded data. Thus, this provides food and data safety simultaneously.

This study which we prepared offers basic information about the benefits of the digital age in food safety which is one of the most important agenda items of today; we also emphasized the importance of traceability. Fast traceability of innovations will facilitate the transition to such practices which will be compulsory in future. In this respect, it is not when to switch to digitalization, but when it is started. Then it's today.

The Revtech: Pasteurization of Dry Food Products

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Challenges in the food, pharmaceutical and chemical industries are wide. Consumers are looking for good and safe products over time. “Good” refers to the organoleptical properties of the product: flavor, taste, texture and appearance. “Safe” refers to the microbiological activity of the product: bacteria, yeast and molds low levels but also absence of physical and chemical contaminations. Both properties should be preserved over the product shelf life.

The Revtech innovative heat treatment technology fulfills the requirements: reduction of microbial activity by pasteurization, reduction of enzymatic activity by stabilization, enhancing flavors and textures by toasting and roasting. The applications previously mentioned can be carried out on dry products like cereals (wheat, oat, barley, corn…), seeds (sesame, chia, hemp, flax…), pulses (chickpeas, lentils, beans…) and nuts (almonds, cashews…). The unit can also be used for torrefaction of biomass and different specialty chemicals.

The equipment consists of a smooth, continuous stainless-steel tube that is coiled around a central, vibratory support structure. Heat is generated directly in the walls of the tube using a low-voltage electrical current, and product flows continuously from the bottom to the top of the tube under the influence of two shaker motors. Air or steam can be injected at appropriate locations in the spiral tube. Four parameters can be controlled: the temperature of the different heating zones, the amount of steam injected, the residence time in the tube and the flow rate of the product.

The Revtech continuous system ensures accurate control of residence time, complete homogeneity of treatment, high heat and mass transfer, and a wide range of precisely controlled operating parameters. The absence of dead zones and plug-flow behavior inside the stainless-steel tube ensure that all particles moving through the system receive the same treatment, vastly improving the overall quality of the final product.

For pasteurization, the product is first heated up by direct contact with the hot tube and then a small amount of steam is applied. The validation consists of using a surrogate of E. Faecium. Fifty samples are used for the trials and all of them have to show at least a 5 log kill. Several units go a validation for at least a 5 log kill on Salmonella. Few critical control points are then defined for each processing runs: the temperature of each zone, the amount of steam injected, the initial temperature of the product, the maximal flow rate and few motor settings. Validation has to be carried out at the worst conditions: the lowest outside temperature, the

highest flow rate achievable in the unit, the lowest temperature and the lowest amount of steam.

Hundred twenty units have been installed all around the world running on different products and different applications. The company has started developping its market in Europe and then Asia before tackling the North American market.

Cleaning is carried out by using a pig. The pig is pushed through the tower by a water supply at a minimum pressure of 3 bars. Once out of the tower, the pig is collected and the water goes to the drain. The tower is then dried and ready for another run.

The unit comes with a fully automated PLC and a touchscreen on the electrical cabinet. This allows the control of the unit, the access to the different processing parameters: temperature, steam, flow rate etc. Different recipes can also be set up in the system for different products or different clients.

Revtech is not carrying out in depth science but the technology could be useful for many different companies. It can be used for existing processes or for new developments and applications.

Investigation of the Efficiency of Hypochlorous Acid in Reducing Losses of Fresh Fruits and Vegetables from Harvest to Consumer

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Fresh fruits and vegetables are among the products with high loss rates due to their biological properties. From the production area, fresh vegetables and fruits go through all processes open to microbial pollution. Although some basic physical precautions are taken in all harvestings, stacking, packaging/packaging, transportation, and storage processes, these measures still cannot prevent a quarter of product loss, mainly due to microbial contamination. The disinfection process to be applied to the surface of fresh products is an essential step to prevent contamination. In disinfectants used in the food industry, features such as non-toxicity, decomposition, easy applicability, economical, and not having harmful effects on the environment are sought. In this project, the effectiveness of hypochlorous acid in reducing the biological losses of fresh fruits and vegetables from harvest to the consumer will be investigated.

The related project covers the investigation of the effectiveness of hypochlorous acid in vitro and the field for its application in fresh fruits and vegetables such as strawberries, tomatoes, cucumbers, lettuce, and bananas. Parameters in the production of hypochlorous acid have been investigated in conjunction with previous studies. It has been determined that the most important feature that determines the character of hypochlorous acid produced by the electrolysis method is the salt concentration of the water used in the production phase (Turkay et al., 2016). In the same study, it was understood that the effect of electrolysis time and brine concentrations on the free chlorine concentration, which provides the antimicrobial effect of hypochlorous acid, is synergistic. The antimicrobial activity of hypochlorous acid was tested on *Escherichia coli* and *Enterococcus faecalis* in a previous study. In the study, it was shown that hypochlorous acid causes protein degeneration in bacteria, and bacterial death occurs by causing the release of other cell components, such as DNA, RNA, potassium, and phosphate, out of the cell (Turkay et al., 2018). In another study, hypochlorous acid was shown to be the most successful antibacterial agent among the other two disinfectants by killing the

Enterococcus faecalis bacteria at a rate of 95.4% in 1 minute (Ersoy et al., 2019). It has been determined that hypochlorous acid kills bacteria by damaging the bacterial cell wall, impairing the release of intracellular materials and ion concentration. Based on the relevant literature, hypochlorous acid is expected to increase shelf life by reducing microbial contamination in fresh fruit and vegetables and minimize losses in the chain from harvest to consumer.

Developed with this expectation, the project aims to investigate the effectiveness of hypochlorous acid. This broad-spectrum antimicrobial solution can be applied in post-harvest agriculture to reduce losses in fresh fruits and vegetables from harvest to consumer. An essential process in food safety will be developed by minimizing the loss of microbial origin in fresh fruits and vegetables. Especially considering that hypochlorous acid is safe, consumable, and low cost, it increases the applicability of the methodology to be developed in the field on a large scale. In addition, the methodology to be created, thanks to the properties of hypochlorous acid, will provide a cost-effective and sustainable approach within the framework of food safety rules. Saving these lost fresh fruits and vegetables and consuming them by the consumer will contribute to the country's economy and take our country one step further in terms of food safety.

Although the effectiveness of hypochlorous acid applied in the method against microorganisms on various fresh fruits and vegetables is known, these known values do not cover all fruit and vegetable species and are insufficient (Villarreal-Barajas et al., 2022). Therefore, there is a need to investigate the effect of hypochlorous acid on microorganisms living in specific fresh fruit and vegetable species. The project, which is based on a unique method, includes realizing the technology (generator) of hypochlorous acid production, which is a technological product within the scope of R&D, with our means, in vitro trials of hypochlorous on the selected food-specific microbial consortium, and simulation and pilot trials to be applied directly to foods. For this reason, the project covers a technology infrastructure that has not been developed before, especially in the food industry and food safety.

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Risk Assessment Approaches on Emerging Food Toxicological Issues

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Risk analysis is a complex process that includes three key steps: risk assessment, risk management and risk communication. Risk assessment provides the scientific foundation on which the whole risk analysis rests. It follows an international, well accepted process that is comprised of three steps: 1) Hazard identification, 2) Exposure assessment and 3) Dose Response analysis to characterize the likelihood risk of adverse health effects occurring under specified conditions of exposure.The procedure is well documented in the European Directive 93/67/EEC of 20.07.1993 and based upon the principles and practice of the risk assessment process developed within the World Health Organization, the United Nations Environment Programme and the International Labour Organization's (WHO/UNEP/ILO) International Program on Chemical. Risk assessment is a rigorous and globally accepted scientific approach to assess the severity and probability of a possible adverse effect in humans or the environment following exposure to a chemical.

The conceptual approach for scientific risk assessment is based on WHO (2009) that has defined weight of evidence (WoE) assessment as a process in which all of the evidence (lines of evidence) considered relevant for a risk assessment are evaluated and weighted. The WoE approach considers all relevant information in an integrative assessment that considers the kinds of evidence available, the quality and quantity of the evidence, the strengths and limitations associated with each type of evidence and explains how the various types of evidence fit together.

Based on the weight of evidence assessment at the time, expert judgement and previous international risk assessments health based guidance values (HBGV) or reference values (RVs) for margin of exposure (MOE) are derived. Compounds with threshold effects: comparison of health-based guidance value (e.g. acceptable daily intake (ADI), tolerable daily intake (TDI)) with exposure estimates, MOE approach for chemicals with insufficient data to establish a TDI. This is a simplified overview of the risk assessment process, which integrates several related elements such as the toxicokinetic and toxicodynamic properties of the test substance, aspects of systemic absorption, bioaccumulation potential, mechanism of action, inter-species differences, genotoxic effects in vitro and in vivo studied to elucidate the potential of the substance to interact with the cellular genetic material causing mutagenic, clastogenic or aneuploidy effects. Daily administration of the substance for 28/90 days and up to 24 months (long terms and carcinogenicity assays) may provide useful information to derive Point of

Departures. Developmental toxicity (teratogenesis) and other experiments are conducted at the same time, over generations, to understand if the substance interferes with the reproductive system of animals and on fertility. During the presentation, various protocols and procedures used internationally will be described in order to evaluate the safety of substances of synthetic or natural origin added or naturally present in food.

The cases dealt with will relate to the safety of food additives, pesticides, novel foods, nanomaterials, contaminants, endocrine disrupters and some principles underlying the safety assessment of complex mixtures such as botanical preparations will also be described.

Vegetable Oil Based Contamination Risk for Food Products

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Vegetable oils are very important part of the human nutrition. While some vegetable oils are produced using fruits such as olive and palm, a significant amount of vegetable oils are being produced from seeds. Therefore, the general quality of a vegetable oil is highly dependent on both cultivation practices of the vegetable and the production methodology that is used for crude oil production, refining and modification processes. During all these processes, vegetable oil may well be contaminated by several substances due to its nonpolar affinity. Air pollution due to existence of industrial plants near cultivation areas cause a risk of poly cyclic aromatic hydrocarbons (PAH's) and dioxin contamination on crops of which traces migrate into crude oil during production. Phthalate, mineral oil saturated hydrocarbon (MOSH) and mineral oil aromatic hydrocarbon (MOAH) contaminations are generally associated with packaging material of vegetable oil. All these types of contaminations have been explained by migration of the contaminant to vegetable oil from environment that the oil has exposed. However, recent studies showed that, processes applied to vegetable oil with extreme conditions during refining may cause formation of some toxic compounds from natural minor components of vegetable oils. Therefore, glycidyl esters (GE), 3-monochloropropane 1-2 diol (3-MCPD) and 2-monochloropropane 1-3 diol (2-MCPD) are being called as process contaminants since they form during the refining operations, in especially deodorization step. Toxicological studies have a very significant role together with the contamination levels of these so-called contaminants to develop a reliable legislative control system. Moreover, the researches that evaluate the formation mechanism of process contaminants, are useful not only for the vegetable oil producers but also for the legal bodies and consumers.

GOOINN Foodtech Report 2022

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As an innovation and consultancy company, GOOINN offers solution partnerships in terms of transferring the competencies of the innovation culture to corporate companies and intrapreneurship. In its Foodtech report, the leading technologies and usage areas of the sector, examples of Foodtech from the world and Türkiye, sustainable food, the future of food and sector trends are explained. Foodtech, also known as food technologies, is important today, especially due to the climate crisis in the world, the epidemic experienced in recent years, logistics problems, and many other reasons. For this reason, the need for reliable food, sustainable production, smart logistics systems, and effective agricultural applications is increasing day by day. Therefore, the Foodtech sector attracts a lot of attention. Industry actors use cutting-edge technologies to develop, produce, and distribute food products. In addition to this, there are also implementations for the selection, storage, processing, packaging, and use of safe foods. On the other hand, the Foodtech market, which was 220 billion dollars in 2019, is expected to increase to 342 billion dollars in 2027, and investments in Foodtech are increasing rapidly. In 2021, it is seen that the investments made in this field are more especially in Europe, where the share of the ecosystem is above 20%.

Food Safety and Artificial Intelligence

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Food safety refers to conditions and practices that preserve food quality to prevent contamination and foodborne illness. In other words, it is a precaution against the preparation and serving of contaminated or spoiled food. Going paperless for food safety and quality, digital solutions support safer, cleaner and more profitable food production. Artificial Intelligence (AI), expressed as "Artificial Intelligence (AI)" in English, is a computer science branch that deals with creating machines that are basically developed like a human. It is the process of making intelligent machines that react and react. The goal is to teach machines to think as intelligently as humans do. Until now, the machines were doing what they were told to do. But with AI machines, they will think and act like a human. There is no denying the fact that our future economy depends on AI. Today, the effect of AI is seen in almost all sectors, especially in the automobile, education and health sector. It also has a great impact on the food and beverage industry. The food and beverage processing industry uses AI to improve and evaluate operations, optimize operations and deliver a better customer experience. AI helps the machine learn from different experiences continuously.

“Food processing” is an important issue that has a very high responsibility and must be studied within the framework of ethical principles. The pressures of the legislators on food safety are increasing. Information is required for all stakeholders in food safety to make food safety decisions, from primary producers to the consumer and all actors, including risk assessors, policy makers and communicators. Despite the increasing complexity of food systems, digital technologies allow the collection of unprecedented amounts of data from an almost unlimited number of points along and around the food chain. This requires the synthesis of large amounts of data and a large amount of investment. But following the analysis of smaller isolated datasets can provide unique insights and insights that apply to food safety, public health and trade that were not possible before.

A better understanding of the factors that contribute to the emergence, survival and transmission of foodborne hazards enables the development of new, more effective, risk reduction interventions. AI and machine learning programs are also finding expanding application in food production systems and particularly in the assessment and management of food safety risk. Perhaps the most visible impact of digitalization on society in general and on food systems in particular lies in the exchange of information. Sharing digital information will offer new accountability between actors at all stages of the food chain and increase trust and confidence between commercial partners and consumers. However, the adoption of digital technologies also raises questions about data ownership, use, privacy, sharing and transparency that need to be addressed. Some practical uses of Artificial Intelligence (AI) applications have been

successfully integrated into food supply chain management to improve food classification, monitor employee personal hygiene, and evaluate equipment cleanliness. More advanced applications of AI have the potential to synthesize scientific studies and data to develop models to inform food safety decision-making that is faster and less prone to human error and bias. Sound risk assessments are the foundation for standard setting and fair trade and can be enhanced with AI as described above.

Micro and Nano Plastics as an Emerging Concern for Food Safety and Security

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Many studies indicate that plastics and micro/nano plastics (MNPs) are generally found in all environmental compartments in marine and freshwater systems, including sediment, soil, water column, and surface layers. It turns out that MNPs are everywhere we look. The possible sources are the breakdown and wear of mismanaged plastic waste, discarded/lost materials, and textile microfibers. However, in addition to this, the intentionally added MNPs to some products or the primary production of MNPs also contribute to this pollution at a significant level. Apart from being a pollutant in the environment, MNPs can also be found in beverages and foods such as table salt, drinking water, processed seafood, and plastic-packaged food products. This situation can threaten the whole ecosystem and, therefore, human health. We have now entered an era where MNPs can be found even in breast milk.

In this context, it is worth noting that apart from being an environmental crisis, MNPs now create a food safety/security risk and thus threaten society. This makes it necessary to make some restrictions and legal regulations. Both agencies like the FDA, EFSA, and organizations such as the UN, FAO, and WHO are more frequently expressing the necessity of introducing new restrictions and regulations on both plastic and MNPs. However, it should be noted that despite this, it is still a rather slow-progressing process, and even in countries like Türkiye, this issue has not yet led to any action, even at a baseline level. This study discusses the current knowledge on the MNP contamination issue in foods from food safety/ security perspectives.

Footprints of Bacterias

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Understanding Bacterias behavior is key for the food industry in order to anticipate food poisoning and food spoilage. Applying the traditional cultural methods to end products or environmental samples can lead to non reliable information because of the underdetection of stressed bacterias due to Viable Non Cultivable strains.

Next Generation Sequencing technologies such as Whole Genome Sequencing, metabarcoding or shotgun metagenomic are new tools for the food industries. Through practical exemples perspectives and limits of these technics will be presented allowing deep root cause analysis in case of pathogen contamination in a factory or spoilage characterisation of non cultival strains…

Metal Detection, X-ray Inspection or Both in Food Safety?

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Choosing the Right Control Technology for Product Safety and Quality Control…

The quality and safety of food products is directly proportional to the suitability of the control methods applied to prevent physical contamination. In this context, the right choice of protection and control equipment plays a critical role in product quality, product safety and consumer confidence.

For many years, metal detection and X-Ray control systems in food production facilities provide protection against physical foreign substances. However, extensive software and engineering developments, as well as evolving packaging diversity, can make it difficult to decide which technology will provide the best performance. In addition, critical control points on your production line will influence your choice, as well as product type and possible contaminants.

Metal detection and X-Ray inspection offer differing capabilities. In some situations, metal detection is a clear winner whilst in others, X-Ray inspection comes out on top, and sometimes the best solution may be to install both technologies at different critical control points (CCPs) on the same production line.

Determining the Number of Food Products in Bulk Packaging with X-Ray Imaging System

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X-ray control systems are based on the principle of interpreting the image taken as a result of the loss of energy depending on the density of the substance through which X-ray passes. The energy density alters when the beam passes through the materials of different density and thickness. Contrast change of the displayed objects due to the difference in density and thickness in the direction which the beam flows are utilized. X-ray is highly active and controllable, making it ideal for quickly identifying the structures of the objects on inaccessible and invisible sections. It is widely used in diagnosis and treatment, especially in the field of medicine, security, non-destructive testing techniques and quality control systems in industry. The points that make a difference here are the X-ray energy densities used and the image processing technologies used. In food processes, X-ray is widely utilized in particularly the control of non-metallic foreign matter which differ from the main product density, the control of product mass, product integrity and units per package, as well as the control of metal impurity in metallized packaging. Moreover, X-ray is also used in the food industry for the sterilization of certain products such as pulses.

Whether or not the internal components are introduced, their quantity, integrity, location and geometry are very important for food quality, specifically in applications where product components are nested or subsequently injected into the product. These quality parameters cannot always be measured with gravimeter with a hundred-percent-accuracy. Thus, it makes accurate measurability of other inputs impossible, even if the mass change in any of the food components is within the specified limits.

In this research, studies were carried out to control the presence, geometry, integrity and quantity of the components in the interior of multi-component food products by X-rays. Depending on the density and thickness of the components, the images obtained are in the range of light gray to black. Product components are defined according to the difference in these color tones. Studies have assumed that it is possible to determine the component volume, geometry, integrity and mass by using X-ray imaging and a special image processing software developed.

In the application, multi-component food products composed of a filling with a density of 1.2 g / cm^3 coextruded into the center of the aerated sugar with a density of 0.3 g / cm^3 were tested. The presence of the filling in that sugar was detected by the contrast difference by the developed method. By means of the X-ray system, component control was performed and the faulty products without or insufficient filling was sorted out.

It is possible to identify the presence, position, geometry, volume, integrity and mass of the components in food products with more than one water and/or oil-based components by the way of the method in this study, even in cases where some components cannot be detected from outside the product. There must be discernible density differences between the components.

As a result of this study, successful results were obtained in component control of fillings in the center of the product. The quality parameters mentioned before were analyzed by the image processing technique. According to the results, it is thought that it will be possible to control the existence, position geometry and integrity of the components by X-ray system and appropriate image processing technique for the multicomponent food products with density difference or with a boundary layer.

This application with low radiation doesn't contain radioactive material and not emit radiation without external energy input. When comparing with other techniques, it is more functional in terms of human health and product quality.

Role of Food Laboratories in Food Safety

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TURKLAB is the umbrella non-governmental organization of all testing inspection and certification service providers in Türkiye. It has been established in 2004 and since then TURKLAB is a member of EUROLAB which is the European organization of laboratories. There are different working groups in TURKLAB for different sectors like food, environment, calibration, consumer goods, Green Deal. We're united under Food Laboratories Working Group as the food testing laboratories. Here we are aiming to be the voice of our industry for government institutions and private organizations.

Food testing laboratories are one of the main solution partners of food industry. We play a crucial role in food safety and quality systems of our clients. Providing food safety, quality & sustainability solutions, we contribute to our customers to deliver safe and high quality food products to their consumers. Food fraud, sustainable food supply chain, reaching safe food and keeping the quality levels are great challenges of today's world. Food operators are busy with new types of threats like PFA's, microplastics, nanomaterials, packaging materials quality, MOSH, MOAH, PA/TA, ETO, mycotoxins, acrylamide, furans, together with pesticides and vet drug residues, dioxins and PCB's. We give support food operators to detect these food safety and health issues early in their supply chain and prevent potential food safety issues in their products. Other then chemical risks, pathogens are very challenging in these days for the low water activity products as well. Pathogen testing and environmental monitoring programs are one of the main agenda topics for quality teams today. In this session, we'll focus on the role of laboratories in quality and food safety management systems in food industry. New technologies, typical risks and new threats will be in our presentation.

Rapid evaluation of fish freshness with nanofiber based colorimetric sensor

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Sensory assessment requiring expertise, the intelligent packaging sensors or microbial and chemical techniques that require long analysis time are commonly used to determine the freshness of fish. For this reason, the aim of this study was to design a nanofiber based colorimetric sensor by electrospinning which can detect the freshness of fish by direct contact. Zein, poly(lactic acid) (PLA), bromthymol blue (BTB) and bromcresol purple (BCP) were used to design the fish freshness sensor. Zein solutions were prepared at 36%(w/v) concentration in acetic acid-ethanol (20:80) and then two sensor solutions, BTB-zein and BCP-zein, were prepared at 0.08% (w/v). In addition, 8.5%(w/v) of PLA solution prepared in chloroform-DMF (90:10) was used for BTB-PLA and BCP-PLA based sensor solutions. Zein-based sensors were produced by electrospinning method in vertical system working principle. These sensors were produced at 20±4.5°C and 32±7.2% relative humidity. However, electrospinning with horizontal working principle was preferred in the production of PLA based nanofiber structures, and their production was used at 17.4±1.25°C and 43±7.3% relative humidity. The voltage, flow rate and distance between the needle and the collector applied for the electrospinning during the production of the zein-based sensors were 19kV, 1.5mL/h and 20cm, respectively. These values were 9kV, 2mL/h and 15cm for production of PLA-based sensors. The pH change of fresh and spoiled fish was determined directly by using pH meter. The membranes produced for testing the designed sensors were cut to 1x2cm dimensions. It was then brought into contact with skin and meat of fresh and spoiled fish. As a result of this process, the response of the sensors to the change in the pH of the fish was monitored as color change.

Zein and PLA nanofiber based fish freshness sensors was produced by electrospinning. The color of the zein-based sensors was light yellow. However, the color of PLA-based sensors was seen to be darker yellow. The possible reason of the color difference in these sensors may be due to the solubility of the dye in the solution. The pH of the fresh fish used in this study was determined as 6.04±0.13 and the pH of the spoiled fish was 6.86±0.18. When the produced sensors came into contact with fresh fish, the color of the zein-based sensors changed from light yellow to blue. In addition, the zein-based sensors did not retain their structures when contacted with fish. When the BCP-PLA based sensor was in contact with fresh fish, its color changed from yellow to purple. Both the zein-based sensors and the BCB-PLA based sensor gave the same color change when contacted with spoiled fish. Therefore, these three sensors were not suitable for detect the freshness of fish through contact. However, the color of the BTB-PLA based sensor remained unchanged in its original color. This sensor changed color from yellow to blue when it came into contact with the spoiled fish. As a result, this sensor was successful in determining the freshness of the fish. In addition, it was determined that the structural integrity of PLA based sensors did not change during the determination of fish freshness. As a result of this study, the developed sensor is very easy to use, fast, and has the ability to directly control the freshness of fish. It is thought that the fish freshness sensor

designed by electrospinning will contribute to the development of useful sensors to determine the quality and safety of food. Electrospinning which used in the production of nanofiber based sensor can help to design design new sensors or improve existing analytical devices, such as determining the shelf life of foods, their quality control and traceability.

Optimization of a Multi-residue Screening Method for the Detection of Antibiotic Residues in Milk Products: the case of Labneh

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Labneh is a dairy product highly consumed in Lebanon, prepared from straining yogurt. Because there is a lack of surveillance of the antibiotic residues in milk and dairy products in Lebanon, a project was launched to develop a screening method for the detection of antibiotics in milk and labneh samples. In this study, we optimized a multi-residue screening method to detect 72 Antimicrobial residues based on liquid-liquid extraction using a mixture of acetonitrile and 0.2 M ammonium acetate (90:10/v:v) followed by freezing out the supernatant for 30 minutes at – 20 °C for fat precipitation. The samples were then analyzed by using triple quadrupole LC-MS/MS system with separation based on reverse phase conventional column and mobile phase composed of acetonitrile and demineralized water with ion pair agents. The performance of the analytical method showed a good specificity and sensitivity with no false positive results and capacities of detection CCβ were below MRLs for all analytes. Also, this method demonstrated acceptable recoveries estimated in the range 90-130 % for 92 % of the analytes and the precision was below 30 % except for some macrolides and some beta-lactams with a intra-lab reproducibility between 7.3-40.6 % and 2.6-84.2 % respectively, due to their sensitivity to mild acidic pH of Labneh. Our results showed that the developed method can be applied as a semi-quantitative method with acceptable variability for the majority of antibiotics. Finally, this method validated against the EU guidance for Veterinary Medicinal Product Residue screening methods (Guidance (EU) CRLs 2010/01) was applied for the detection of antimicrobial residues in milk and in labneh samples collected from different regions in Lebanon. In addition, some milk materials collected were used for the preparation of Labneh products and analysed to determine the fate of the antimicrobial residues during the manufacturing process.

How Acute and Chronic Dietary Exposure to Pesticide Residues is Assessed? A Case Study for Fresh Fruits and Vegetables

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Hypothesis: Pesticides have been widely used to control plant pests and diseases. Since pesticides may cause adverse effects on human health, regular monitoring of pesticide residues and dietary risk assessment are important tasks for the sustainability of international trade. Recently, European markets are requesting particular specifications such as pesticide residues below Maximum Residue Limit (MRL) as well as limitations for multi-residues and indexes for acute and chronic risk assessments. The goal of this study was to show how acute and chronic dietary exposure to pesticide residues is assessed for the fresh fruits and vegetables.

Methods: The fresh fruit and vegetable samples were randomly collected by official inspectors of Perla Fruit Company for the exportation to European markets. Probable pesticide residues of the samples were determined by using GC-MS/MS and LC-MS/MS. The extraction and cleaning up of the pesticides were conducted by using QuEChERS method. The validation of the multi-residue analysis of each pesticide was evaluated according to SANTE/12682/2019 Guidelines. To evaluate toxicological risks, a Pesticide Residue Intake Model (PRIMo revision 3) which is recommended by EFSA was used to assess the acute (short-term) and the chronic (long-term) exposures using the high concentrations of pesticide residues. The international estimated daily intake (*IEDI*) and the acute hazard index (*aHI*) values of each pesticide residue were calculated using acceptable daily intake (*ADI*) and the acute reference dose *(ARfD)* of a pesticide, respectively. The following input values are also used in calculation of these indexes: Large portion reported (*LP*); *MRL* for each pesticide and crops, conversion factor residue definition enforcement to residue definition risk assessment (*CV*), processing factor (*PF*) and mean body weight for the subgroup of the population (*BW*).

Results: Among the tested 700 active compounds, residues of 10 (cypermethrin, cyprodinil, deltamethrin, isopyrazam, lambda-cyhalothrin, malathion, spinosad, tau-fluvalinate, tebuconazole and thiacloprid) were detected above their *MRLs* within the 0.3-1.13% of all samples. Three of these insecticides (tau-fluvalinate, thiacloprid and spinosad) were frequently exceeded the *MRL*s since their fairly low *MRL*s such as 400, 500 and 200 µg kg^{-1}, respectively. Among these 10 pesticides, only *aHI* values of tebuconazole and lambda-cyhalothrin exceeded 100% of *ARfD* for different mean body weight for the subgroup of the population. Similarly, tebuconazole and lambda-cyhalothrin had the lowest *ARfD* values as 30 and 5 µg kg^{-1}, respectively. Although no chronic hazard was observed for all pesticides, cumulative long-term exposure to multiple residues of same chemical group such as synthetic

pyretroids (cypermethrin, deltamethrin, lambda-cyhalothrin, tau fluvalinate) raised the chronic risk.

Discussion: Results showed that the presence of pesticide residues on tested samples could not be considered as a great risk to public health. To increase international trade and decrease health risks of pesticides, following precautions must be taken into consideration during the agricultural production: limiting the use of compounds having lower *MRL*s, or extending their Pre-harvest interval, avoiding from the multiple use of chemicals within the same group especially too soon to harvest.

Antibiotics and Anabolic Substance Residues in Animal Foods

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The production and consumption of qualified animal proteins are a sign of the development of countries. The increase in the usage of food sources due to the fast increase in the population of the world is required to satisfy the needs economically. Veterinary drugs are used extensively in food-producing animals to maintain optimal health and promote growth. There are nearly 2000 licensed commercial veterinary drugs in Türkiye and almost half of them are thought to be in use. The use of drugs in animal production is mandatory. Otherwise, it is not possible to maintain current production and increase animal production. Cattle and sheep are fed for two-thirds of their lives, and poultry for their entire lives, with feeds containing antibacterial, anticoccidials, antioxidants, vitamins, and minerals. The widespread use of such a large number of drug types naturally brings along the problem of drug residues in food animals. As long as the use of drugs in animals, it is inevitable that drug residues will be found in food products such as meat, milk, eggs, and honey. In this case, it is necessary to try to minimize the risk of drug residues in animal foods by ensuring the conscious and controlled use of veterinary drugs in animals. In this case, veterinarians who have the authority to administer drugs to animals have two kinds of responsibilities: They must treat the animal effectively and while doing this, they cannot ignore food safety and public health in animals raised for food.

Residues and contaminants that can be found in foods of animal origin are various, they can contaminate in lots of ways. Among these, natural (mycotoxins, pathogen microorganisms, etc.) or chemical toxic compounds (dioxin, DDT, polychlorinated biphenyl compounds, etc.) and heavy metals (lead, arsenic, mercury, cadmium, etc.) and veterinary drug residues (synthetic hormones, antibiotics, etc.) can be led to residue risks in foods as an important group as well. For healthy and safe manufacturing and consumption of foods of animal origin, raw materials and products should not be contaminated with any residue or contaminants. Nowadays consumers have concerned about various compounds but especially the veterinary drugs used in animals lead to residues at the level of comprising health risks since it is known that foods of animal origin that are contaminated and contained residue risks constitute serious health hazards in terms of human health. The risk related to the presence of residues in food of animal origin has to be carefully evaluated. For those drugs that require a withholding period to ensure that residues in the food products are below established tolerances, methods of analysis are required.

In this context, this presentation deals with the purpose of emphasizing the safety and reliability of resources of proteins from animal origin which has great importance in human nutrition, in respect of some residue and contaminants, especially antibiotics and anabolic substances.

Food Safety Issues Related to Raw Milk Production and Suggestions for Solutions

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Safe food is simply a food that has not lost its nutritional value, and is physically, chemically and microbiologically clean and safe for health. Food safety, on the other hand, refers to the process that defines the processing, preparation, storage, and its presentation of food to the end consumer in a way that prevents biological, physical and chemical factors that cause food-borne diseases. In recent years, Turkiye has made important breakthroughs on the solutions of these issues and progress has been made in the awareness level of the society. However, not all segments of society have food safety awareness.

Milk is a food product that is highly susceptible to microbial growth and spoilage due to its content and production. Even if it is obtained sterile during milking, it can be contaminated after the process due to the environment and the equipment used. Not all microorganisms that can grow in milk are spoilage factors. On the contrary, many technologically-important microorganisms can abundantly be found in milk. Raw milk is at the center of the most important debate about milk. There is a negative impression of processed dairy products as a result of lack of knowledge or prejudice about food processing techniques.

As mentioned above, even if the milk that is ready to be milked from the udder of the animal is pure, it is normal for the milk to become open to pathogens if appropriate conditions are not provided during milking, either from a person or from the materials used, or during the storage and transportation of the milk for processing. Furthermore, chemical residues such as detergents and disinfectants, antibiotics, pesticides, heavy metals, durable polyhalogens, radioactive substances, dioxins are also important in terms of raw milk safety. In particular, these chemical contaminants are important because they pass into milk and then to humans, although they do not have significant effects on animals.

To minimize the mentioned biological, chemical and physical risks, one of the main food safety problems in raw milk is the failure to ensure the integration of agriculture and food industry. Unregistered businesses, insufficient efficacy in food control and inspection, inadequacies in border custom controls, presence of many small producers, inadequacy of milk-cooling systems in some regions, street vendors selling raw milk, consumption/processing at source, inadequate correspondence with international organizations (WHO, FAO), inadequate consumer knowledge on food safety comprise other issues. Added to these are the global economic developments in the last year and the instability in Türkiye's agricultural policy.

If we are to list our solution suggestions against these problems in raw milk production; supporting producer organizations (organizational, technological, laboratory and economic), governmental support for cooling and delivery time incentives, establishment of dairy regions by analyzing the current state and region-based development of milk quality improvement action plans in these regions, follow-ups for the animal diseases, antibiotic milk purchase

funds, hygiene, and cleaning incentives and trainings,. In addition to educating the producers on the implementation, legislation and benefits of quality and reliability, consumers should also be educated about the laws, rights, and authorities of institutions and organizations.

The Importance of Feed Safety for Safe Food

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Over the last years, the feed sector started gaining the attention of the food sector regarding its role towards food safety.

Even though we are talking about two sectors (feed and food) with similar characteristics and complexity, there is one big difference regarding who is the end user of the output of each sector. For the feed sector, the end user is the food-producing animal which, on its turn, will be the main input for the food sector. On the other hand, the end user for the food sector is the *"human"*.

The quality and safety of feed for animals intended for human consumption will have a direct impact on the quality and safety of the food produced from these animals. Given the anticipated growth of the world's population to around 9 billion people by 2050, and the associated higher demand for animal proteins, it is vital that the feed industry, as well as the wider agricultural chain, can meet this challenge in a sustainable and safe way.

From a regulatory perspective, regulators over the last decade started to be more attentive to the feed hygiene requirements. In 2003, the Feed Hygiene Regulation – EC 183/2003 laying down requirements for feed hygiene – was introduced in Europe. The breakthrough of this regulation was that HACCP became a mandatory regulatory requirement for the feed sector. Following the implementation of the Feed Hygiene Regulation, a number of sector specific schemes (deriving from different feed industry sectors) was developed with the view to support the feed industry in implementing this regulation. Gradually, other regions like Australia, Canada, and U.S.A. started developing further their regulatory requirements for the feed sector.

Feed safety risks have changed as to their likelihood to happen, and a holistic approach regarding how to manage those risks is necessary. Given that the feed sector today is part of the global value chain, additional effort for the management of these feed safety risks is required. The implementation of a feed safety management system provides the necessary assurance that the associated feed safety risks will be managed properly. An example of a feed safety management scheme for the sector of Specialty Feed Ingredients can be found in the FAMI-QS Certification.

Recent scandals in the worldwide food and feed sector have highlighted the need to strengthen fraud prevention measures across the entire supply chain. Not only is this necessary to protect the health of consumers, but corporations and regulators both know that trust is the foundation upon which efficient, functioning markets are built. In addition, there is public concern that the food or feed sector is being used for intentional acts that could harm an individual or the public for ideological or financial purposes.

Third-Party Certification (TPC) and particular feed schemes are becoming an important feature of the global feed chain. Nowadays, Feed Business Operators' operational activities take place

in a rather complex legal and business environment. Today we have moved from local sourcing to global sourcing. This affects the level of controls which are required. Although TPC is voluntary, it is an important requirement for a Feed Business Operator to gain market access and to communicate all aspects related to the safety of the feed ingredient, in a uniform language. FAO defines the food chain approach as: *"Recognition that the responsibility for the supply of food that is safe, healthy & nutritious is shared along the entire food chain – by all involved with production, processing, trade and consumption".* The same approach can also be applied to the feed chain.

TPC eg FAMI-QS could be seen as a mechanism for the development of feed safety culture, minimising risks entering the feed/food chain, enforcing feed safety regulatory requirements and supporting global fair trade

Food Safety Risks Related to Heavy Metals and Pesticides in Seafood from Turkish Waters

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Fish is a high-value protein source rich in essential amino acids, micro and macro elements. It has a quality fatty acid profile with essential polyunsaturated fatty acids content. Therefore, it is recommended to consume fish at least twice a week due to the health benefits. However, fish as such a beneficial food may pose a risk to human health. The aim of this study is to determine the status of some heavy metals and pesticide concentrations which has been detected in fish species living in marine and inland waters in our country in recent years in terms of human health risks. Fish living in the contaminated aquatic environments accumulate the contaminants such as heavy metals and pesticides in their bodies. These compounds are resistant to degradation and have the potential to bioaccumulate in living organisms, and enter the human food chain. Therefore, the accumulation of heavy metals and pesticides in fish and seafood has been an important concern due to fish and seafood consumption and health risks. Depending on the consumption rate of fish and seafood, toxic metals such as mercury (Hg), lead (Pb), cadmium (Cd), arsenic (As), chromium (Cr), nickel (Ni), aluminium (Al), tin (Sn) may lead to toxic effects in people when daily intake exceeds permitted levels. Pesticides enter food chain due to agricultural activities, industrial wastes, ship traffic, harbors, urbanization and overpopulation. Since pesticide use in agriculture prevented food loss and increased food production efficiency, they are among the most used chemicals worldwide with an annual production exceeding 3 million tons. The most commonly found pesticides were DDT, HCH, endosulfan, heptachlor, lindane, dieldrin, aldrin, endrin, and PCBs although most of their use was banned. The average fish consumption per capita in our country is low compared to other countries in the world and this value has decreased even more in recent years. So the presence or absence of these contaminants below or below the limit values do not necessarily pose a risk to human health in our country. It is important to evaluate the target hazard quotients (THQs) and estimated dietary intake (EWI) which are used to indicate whether toxic elements are hazardous for human health. The news about heavy metals and pesticides in fish and seafood products terrifies the consumer, resulting in a decrease in fish consumption, which is already low in our society. In this study, pesticide and heavy metal concentrations in fish and seafood detected in Türkiye in recent years were assessed comprehensively in terms of suitability for human consumption and public health. Thus, it will be revealed whether the news in our society constitutes scientific accuracy about heavy metals and other contaminants in seafood. The information will be provided about fish and seafood consumption particularly in terms of human health. Continuous monitoring is required to ensure food quality and consumer safety, and to minimize health risks. Besides, additional studies would be necessary to evaluate future conditions of fish and seafood in marine and inland waters.

Trace Elements Profile and Health Risk Assessment of Black Sea bivalve species *Mytilus galloprovincialis*, *Chamelea gallina* and *Donax trunculus*

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Research hypothesis: The bivalves species such as mussel (*M.galloprovincialis*), striped venus clam (*C.gallina*), wedge clam (*D.trunculus*) are among the ones most harvested in the world. Their capacity to absorb trace elements not only from the food but also from the surrounding waters makes them a good bioindicator for monitoring of heavy minerals in many areas of the world.
This study aimed to assess the trace elements (Cd, Cr, Cu, Fe, Ni, Pb, and Zn) concentration and health risk in those three economically important bivalvia species collected from the Bulgarian part of Black Sea.

Method: The study was performed in northern part of Bulgarian shore of Black Sea during June 2019. The harvest mussels and shell were rapidly washed and the meat was removed from the shell with a Teflon knife. The samples were stores in polyethylene bags until analysis. Each tissue sample (around 1 g wet weigh) was weighted and places in Teflon digestion vessels. Acid wet digestions using concentrated HNO3 and H2O2 were performed using a microwave closed-vessel digestion system at certain temperature and pressure. The concentrations of Cd, Cr, Cu, Fe, Ni, Pb and Zn in the samples were determined using ICP-OES Spectrometer. Accuracy of the analytical method was monitored by analyzing certified reference materials. The descriptive statistics and one-way analysis of variance (ANOVA) were calculated using Microsoft Office Excel 2010 software with a significance at $p < 0.05$.

Results: The mean concentrations (mg/kg wet weight) of trace elements in muscle tissues of *M.galloprovincialis* were the following: Cd, 0.699-0.0845; Cr, 0.314-0.429; Cu, 2.408-3.187; Fe, 54.462-64.924; Ni,0.096-0.169; Pb, 0.314-0.628 and Zn, 19.537-23.368. The corresponding values for *C.gallina* were the following: Cd,1.110-1.154; Cr,1.423-1.556; Cu, 8.879-9.763; Fe,451.728-513.953; Ni, 0.610-0.748; Pb, 0.522-0.579 and Zn, 19.126-20.089. Additionally the values for *D. trunculus* were as follows Cd, 0.099-0.125; Cr, 0.324-0.572; Cu, 23.843-27.875; Fe, 105.824-165-641; Ni,0.025-0.099; Pb,0.075-0.298 and Zn, 25.386-31.585. The concentration of heavy metals Pb, Cd and Ni in *D. trunculus* were significantly lower than *M. galloprovincialis* and *C. gallina*.

The assessment of the risk posed by the occurrence of trace elements in foods is performed by calculation the estimated daily intake of elements (EDI), target hazard quotients (THQ) and hazard index (HI). The EDI separately for females and males for the three bivalve species ranged as following: Cd, 0.001-0.014; Cr, 0.004-0.019; Cu,0.028-0.327; Fe, 0.605-5.954; Ni, 0.001-0.009; Pb, 0.002-0.007 and Zn, 0.200-0.338.

The HI for *M. galloprovincialis* was calculated as 0.077 for males and 0.093 for females, 0.153 for males and 0.185 for females for *D. trunculus* and 0.563 for males and 0.684 for females for *C. gallina*.

Discussion: The highest average concentration for all samples were those for Fe (483.74 mg/kg w.w), followed by Zn (27.46 mg/kg w.w). The concentration of Cd in *C.gallina* (1.13 mg/kg w.w) exceed the maximum permissible level of Cd in bivalve mollusks of 1 mg/kg set by Commission Regulation (EC) No1881/2006. EDI values were below the published RfD values. THQ and HI were below 1 so it could be concluded that consumption of Black Sea mussel (*M. galloprovincialis*), striped venus clam (*C. gallina*) and wedge clam (*D. trunculus*) caught in the northern part of Black Sea, did not pose any risk for the health of adult people as copper, iron, lead, zinc, cadmium, chromium and nickel were concerned.

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Packaging for Sustainable Food Safety

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In today's economy there is an important question to be answered: What should we give priority for sustainable social welfare? "More consumption for economic development" model? Or conservation of resources? A few grams of packaging materials are considered as an important environmental problem when we view, several kilograms of rotten fruit are ignored. According to WPO World Packaging Organisation, the target should be better quality of life through better packaging for more people.

We all see that Packaging Industry is more dynamic than before and Packaging has not been so necessary in the modern life style because of the pandemic. Packaging for food, beverage, cleaning, health and medical products have never been as important as today. Because Consumers, we, want to survive. Products without packaging are exposed to risks. We better understood those risks during this pandemic. We also understood how important & necessary barrier packaging like plastics, metal and glass to protect our food from contamination or viruses.

Packaging receives much negative publicity because of environmental issues. There is a need for packaging. When food waste is considered, packaging is part of the solution, not the problem. Reducing material consumption, using recyclable materials and recycling more will be important as in the past. There is a growing pressure from consumers & regulators such as plastic tax, waste reduction, recyclability and environmental footprint. Therefore, there will be more demands on mono-materials and food packaging having more recycled content. We have to empower consumers with the ability to lead their lives in a more environmentally positive way by using sustainable packaging.

The key drivers affecting and directing the Packaging Industry are sustainability, food safety and other industry related topics, regulations & standards. Packaging Industry must focus on the next 25 years. Automation and Industry 4.0 are becoming more important in every county. Active and intelligent packaging, nano materials, digital labels will be frequently used. During the pandemic, we stayed at home, did online shopping through small screens. Packaging and Logistics will be the key industries for the Future. Health consciousness increases. Consumer demands an Increase in Life Expectancy. Increase in Life expectancy can be achieved by using packaging! There is no way back from Packaging. Let us redesign and use it Properly!

Sustainable Packaging and Food Safety: Opportunities and Challenges

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The traditional role and definition of packaging is continuing to evolve in response to changing market and consumer needs as well as its impact on the environment and human health. During the last hundred years the preservation and marketing functions have been the focus for packaging development. Thereby barrier function of the packaging materials has been significantly improved by developing new materials and processes to protect the quality of the food from environmental influences such as oxygen, moisture, light and chemical and microbial contaminations. Going beyond the passive barrier function of the packaging, new packaging technologies such as active packaging has been designed to better protect the quality of the food and ensure its safety actively by releasing or absorbing substances into or from the packaged food or the environment surrounding the food. Today we can select and combine different packaging materials and processes to achieve the right preservation for the selected food and fulfill the marketing functions. Such developments in packaging processes and materials enabled efficient transport of food within the whole supply chain, preventing food waste and ensuring the food safety. Despite these benefits, the food packaging we use currently is strongly criticized due to its environmental impact throughout its life cycle. As a consequence, during the last decade sustainability became one an integral part of the packaging requirements indicating the need for redefining the packaging. Most of the packaging materials we use for food packaging is based on non-renewable materials resulting in depletion of the natural resources and emitting additional green-house gasses into the atmosphere. Furthermore, due to the fact that most of the food packaging is designed for single use lacking circularity and packaging waste is not well managed, food packaging causes enormous environmental pollution.

Currently packaging and food industry mainly focusses to make the packaging recyclable to reduce its environmental impact by using recyclable mono materials such as paper or plastics. This generates certain challenges for food safety. On one hand it is challenging to achieve the right barrier with mono materials for most of the food products, and therefore use of such materials may result in food loss, on the other hand migration of chemical substances from recycled materials into the food can endanger the health of the consumers. Another strategy to improve the sustainability of the packaging is to use renewable resources. Here the processes have been established on industrial scale to produce drop-in materials that are chemically identical to their fossil counterparts (PE, PET, etc) and hence not biodegradable. This might be a better option in terms of carbon gas emission and energy usage, however it cannot contribute to solve the environmental pollution caused by packaging materials. Another alternative is to use biobased materials for packaging that are also biodegradeable. Even though there have been a lot of research done in this area, poor mechanical and barrier properties of the biobased materials remain unsolved issues for food packaging applications. Although they promise a better sustainable options for packaging, preservation of food quality and ensure its safety using such materials is still challenging.

Adhesion of *E. coli* on Commonly Used Kitchen Worktops: Wood, Granite, Melamine and Teflon

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The aim of the present study was to investigate the *Escherichia coli* ATCC 25922 strain adhesion ability on commonly used kitchen worktop materials, namely European beech wood, granite, melamine coated chipboard and Teflon. This study hypothesis was that surface hydrophobicity and roughness would significantly influence the number of adhered bacterial cells.

For the adhesion assay coupons of four kitchen top surface materials with an area of 4 cm² made in the dimensions of 2 cm × 2 cm and 0.5 cm of thickness were used. Contact angle and roughness measurements were performed for surface characterization. Prior to adhesion assay, coupons of selected materials were sterilized by autoclaving at 121°C for 15 min. To enumerate the viable adhered *E. coli* ATCC 25922 cells four coupons of single material were transferred to a sterile petri dish. The working bacterial solution (1×10^8 CFU/mL) was then homogeneously spread in drops of 10 µL on the surface. The petri dishes were left open under the laminar flow until the dryness of surfaces. After the incubation at room temperature (25°C) for 24 h coupons were separately transferred into a sterile falcon tube and washed three times with a water solution containing 0.9 % NaCl. On surface attached bacterial cells were removed by sonication method using an ultrasound bath. The number of viable bacteria in suspension was determined by serial dilutions followed by the drop plate method. The adhesion ability of *E. coli* ATCC 25922 was presented as the logarithmic number of colony forming units in the volume of bacterial suspension (log CFU/mL). All the statistic analyses were performed using the SPSS software, version 26.

Among tested surfaces, the roughness measured as Ra and Rq was significantly higher ($p < 0.001$) in the case of European beech wood surface, followed by Teflon, melamine coated chipboard and granite. However, based the contact angle measurements results, the granite surface was characterized by the lowest hydrophobicity which was the highest in the case of the Teflon surface. The adhesion ability of *E. coli* ATCC 25922 was shown to be statistically significant ($p < 0.05$) higher on Teflon (5.41 ± 0.38) or melamine coated chipboard (4.86 ± 0.23) as compared to beech wood (2.97 ± 0.33) or granite (2.33 ± 0.57). There were no statistically significant correlations between a number of adhered *E. coli* ATCC 25922 cells and surface roughness. On the other hand, there was an intermediate statistically significant ($p < 0.05$) positive correlation between *E. coli* ATCC 25922 adhesion rate and surface hydrophobicity ($r_s = 0,64$).

While roughness is most often considered as a key factor of surface selection, here hydrophobicity was shown to be intermediate positive correlated to a number of adhered *E. coli* ATCC 25922 cells on four various kitchen worktop surfaces. The findings of this study confirmed that the properties of selected kitchen worktop material play a crucial role in the surface attachment of common food containment and should not be overlooked when equipping a domestic kitchen.

The Safety of Food Packaging and Its Effect on Consumer Habits During the COVID-19 Pandemic Process

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The World Health Organization announced that the pandemic that emerged in various regions of China at the beginning of 2020 is a pandemic that causes respiratory tract infection caused by the new type of coronavirus (SARS-CoV-2). So far, the number of cases has reached 650 million, and approximately 6.5 million people have died.

The SARS-CoV-2 infection spreads mainly from person to person; it has been reported that it has been detected several times during the current pandemic, primarily in food and packaging materials. Concerns have been expressed about the possibility of transmission through food and food packaging following the onset of the pandemic and whether the virus poses a risk to food safety.

To date, there is no reliable evidence that it is directly transmitted to humans through contaminated food and food packaging, and it has been stated that no case has been encountered. However, it has been stated in the studies that the possibility of contamination by swab infection from surfaces is not ignored and does not always reflect the danger of direct contamination (natural contamination).

Food safety is defined as providing healthy and reliable products that have undergone necessary controls at every production stage, from field to table. The importance of food packaging against microbiological, physical, and chemical hazards is known. The significant increase in trust in packaged foods during the pandemic has revealed the value of food safety and packaged foods.

An online survey was conducted with 514 people to measure consumers' literacy (general culture) regarding packaged foods and food safety during the pandemic process. In this context, the validity and reliability tests of the research, factor analysis results, demographic results, and what type of food (packaged and unpackaged) the participants preferred during the pandemic process, the interest in food safety and hygiene increased with this period and the impact of the COVID-19 epidemic on the nutrition of individuals. Evaluations were made based on the findings regarding the effect of With the measures taken at the beginning of the pandemic, it was observed that 84% of the consumers preferred packaged foods, but 65% paid attention to the label information and expiration date. It was stated that during the pandemic, 72% of the participants increased their confidence in packaged foods, and packaged food expenses increased by 84%, but 75% were affected economically. In addition, it was understood that 65% of the participants increased their interest in food safety during the epidemic period, and 90% of them paid attention to the SKT and TETT dates during the

purchase, but 1 out of every 4 people did not know the difference between these dates. 78% of the participants have been aware of coronavirus contamination from food and food packaging since the pandemic, and 55% have disinfected the packaging.

As in the rest of the world, the COVID-19 epidemic in our country has significantly impacted the changing consumer habits, especially on consumers' perspectives on packaged foods and food safety. Public institutions and organizations, visual and printed media, and relevant non-governmental organizations that include food safety are essential in increasing food safety literacy in the following processes.

Food Safety Requirements and Sustainability Studies in Carton Packaging Industry

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Paper and Cardboard packaging is a preferred type of packaging in terms of convertability and cost. With its recyclability and re-usability characteristics it is also wellknown the best nature friendly packaging.

Paper Packaging are nowadays used for direct food contact products as cups, plates, chocolate bars ect… which is raising the necessity of composition and testing. Today, various regulations are put in place to determin the parameters, requirements and constraints of the food contact packaging.

Printed paper and cardboard and Packaging made of recycled content cannot be used for Direct food contact purposes.

Basically, this type of packaging should not contain any contamination risks for consumers and should not impact the quality of the product. To secure this, converters should follow the GMP rules and put in place a performant tracability system in-house. From incoming raw material up until finished product all processes should be followed by GLP laboratories (Good Laboratory Practices).

World Population Growth and Consumer Economy strategies have reinforced the sustainability targets in Food market. This is considered as a great opportunity in paper and cardboard packaging industry as it will replace the plastic packaging.

The targetted paper packaging should not contain polymer but should have the same barrier characteristic as plastic. Hence it will become a biodegradable, compostable and sustainable packaging.

Ongoing Research and Development activities are held by leading packaging converters.

Using of Material Recycled from Post Consumer in Food Contact Material

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The target which recycling / using of recycled material from post consumer of packaging producers was determined as %50 until end of 2025 according to packaging and packaging waste directive (94/62/EC). Turkish regulations do not allow that post consumer recycled material is used in food contact material. In addition there are some particular statuation that it could be used. The post consumer recycled material using in PET packaging production could be used if it is produced only by depolymerization method. The use of recycled plastic is not banned for food packaging in Europe. Directives have been issued to manage the issue. Companies that want to produce recycled material that can come into contact with food must have a registration number and prepare a technical file for it. This technical file has been prepared in parallel with the HACCP steps. When creating the new product, there should be product specs/descriptions in which the materials to be used are defined, flow charts showing productin processes, including chemical and physical decontamination from the product, and a risk analysis that defines physical, chemical, biological, migration and toxicological hazards and defines the precautions. Residue and migration analyzes of the final product should also be included in this technical file. After the technical file is completed, a report is submitted to EFSA, and if the authority considers that your system has no effect on food safety, your permission is published. In our country, there were no laws, regulations or communiqués yet published to manage this issue. However, organizations wishing to export to Europe should apply the steps of EFSA

EU Food Law- Microbiological Hazards

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Recent Experiences of Pathogen Recall in Food, Impact on the Industry and Implications

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Foods can cause health problems in consumers due to pathogenic bacteria contamination. *Salmonella* and *Listeria* are the two most important pathogenic bacteria that cause these health disorders, evaluated under the food-borne diseases. Although different types of *Escherichia coli* (Shiga toxin-producing *E. coli*, STEC), and *Campylobacter* spp. have come to the fore from time to time, data have been obtained that *Salmonella enterica* serovar Typhimurium and *Listeria monocytogenes* cause a long-term multicountry outbreak that seriously affects the food sector in recent years, and recalls have been announced on a global scale. The fact that one of the *Salmonella*-related outbreaks that emerged in 2022 is related to a food consumed by children such as chocolate, and the other is the main food item consumed by all age groups, such as cheese, increases the seriousness of the issue. The spread of the outbreaks caused by *Listeria monocytogenes* to an extent that includes not only meat and meat products, but also fresh fruits and vegetables, and durable foods such as dried fruits

and nuts, causes concern both in the food sector and in health authorities. *L. monocytogenes* causes listeriosis in humans. Although it is a rare disease, it is considered as a serious disease due to the high number of cases resulting in death. The primary reservoir for the bacterium is animals, including cattle, sheep, and goats, and is commonly found in crop-growing environments. In addition, due to its psychrotrophic feature, it thrives in moist and cool warehouses and food processing facilities. Once, *L. monocytogenes* contaminated the processing facility it adapts to the food environment and maintains its vitality for a long time. Within the scope of this presentation, it is aimed to share information about the causes of food-borne outbreaks in recent years, their effects on the health of consumers and the sector, and studies and precautions in this field.

Salmonella From a Public Health Perspective: Process, Risks and Solutions

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Salmonella, a Gram-negative animal and human pathogen, is the one of the major cause of are the bacterial food-borne infections worldwide. *Salmonella enterica* subsp. *enterica* serovars pose a significant threat to public health with their presence in the consumption chain from farm to fork. In particular, it differs from other foodborne pathogens by its ability to cause disease at varying levels and its relationship with different hosts. *Salmonella*, which is a zero-tolerant microorganism in foods, should be removed from the farm/farm to fork chain in order to ensure consumer safety. The increase in the drug resistance capacity of *Salmonella* in recent years is a concern for human and animal health. Treatment of infections caused by multidrug-resistant (MDR) *Salmonella* isolates has become more difficult in recent years. This situation poses a great risk for human health, especially for individuals in the risk group. In addition, such pathogens may share genes encoding drug resistance with other closely related human pathogens. For this reason, serious steps should be taken urgently to monitor and prevent the antimicrobial susceptibility of *Salmonella* in the chain from farm/field to fork with one health approach.

How Do You Really Know Your Plant Is Clean?

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In a world where an estimated 1 in 10 people get sick and more than 400,000 die from foodborne illness each year, public health focus aimed at decreasing these incidences is needed. The United Nation's Food and Agriculture Organization has stated that the primary goal of the management of risks associated with food is to protect public health by controlling them as effectively as possible through the selection and implementation of appropriate measures.

Failures in the key preventive control of sanitation and good manufacturing practices have led to many serious food safety incidents that have had significant public health impacts and barred some exports from crossing borders. Increasingly, there are much higher regulatory bars being imposed by government agencies such as the United States Food and Drug Association.

Preventing post process contamination from contaminants like *Salmonella* and cross contact from food allergens that have caused such incidents rely on applying various risk management strategies including effective sanitation. This means that sanitation must be performed flawlessly. But what are optimal considerations to ensure that this occurs?

At a minimum, it is crucial that food processing equipment be sanitary prior to producing food. This must start with a definition of "clean". This presentation will explore how various experts

define this concept based on expected outcomes. However, the consistent reality is that proper cleaning relies on effective implementation of a valid process. This includes several steps of sanitation including both Cleaning and Sanitizing, that must be done well in a defined order. In addition, there are several important considerations that need to complement these steps to ensure sanitation is optimally carried out. Among these are sanitary design, choosing the right products, and following the proper procedures. In addition, we need to be aware of sanitation challenges such as biofilms. So, the presentation will also explore what biofilms are, how to combat them using sanitation, and how certain microorganisms could react against cleaning chemicals especially with prolonged use. This knowledge can be leveraged to address and defeat biofilm concerns. Finally, to ensure that sanitation is effective, verification must be done. This relies on application of methods, procedures, tests, and other evaluations, in addition to monitoring, to determine compliance.

All of these factors applied together will help to make certain that the plant is clean and public health is better assured.

Biofilm Forming Bacteria in Meat Processing Facilities

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Industry environments could be a carrier of a wide range of microbial contaminants which can cause adverse effects on food deterioration as well as compromise the safety of food products. Meat processing facilities are particularly important as a potential source of contamination, not only with food spoilage bacteria but also with food-borne pathogens. Considering that, the cleaning process can remove 90% or more of microorganisms associated with the surface, but they cannot be completely destroyed with the cleaning process. Hence, the aim of this study was to determine residual bacteria after cleaning and disinfection and the ability of isolated strains for forming biofilms.

Method: Swab samples from the food contact surfaces were taken after cleaning, washing and disinfection procedures. Sampling was conducted after cleaning and disinfection which increased the likelihood of targeting residential bacteria, according to the standard method using swab-sampler, with neutralizing buffer. Swabbing was conducted on 60 surfaces in meat processing facilities (slicing machines, cutting boards, knives or hatchets). From each surface of the equipment and tools, were performed microbiological analyses of aerobic plate count, total Enterobacteriacee count, *Staphylococcus* spp., *Listeria monocytogenes, Pseudomonas* spp., and *Salmonella* spp. following standard ISO methods. The results of the microbiological analyses were expressed as a number of bacteria per cm2 (CFU/cm2). Isolated microorganisms were further tested for biofilm-forming ability using biofilm biomass formation (crystal violet) assay at 25°C, the optical density of the wells was measured at 595 nm (OD595 nm).

Results: The results showed that the washing and disinfection procedures were not effective enough to eradicate microorganisms in most retail facilities. Out of 60 swabs examined, 20 (33.3%) were positive to the presence of microorganisms. Next to high aerobic plate count and number of *Enterobacteriaceae* the most of the tested surfaces were positive to presence *E. coli*, (10), *S. aureus* (5), and *Pseudomonas* spp. (2). All tested isolates were capable of biofilm production on polystyrene microtiter plates after 48h incubation at 25°C but to various extents. The highest biofilm ability was shown in strains of *Pseudomonas* spp. followed by *S. aureus*, and *E. coli*. On the basis of the obtained ΔOD595 values at 25°C tested strains were classified into two categories – strong and moderate biofilm producers. At the temperature of 25°C *Pseudomonas* spp. and *S. aureus* isolates were classified as strong biofilm producers with ΔOD595 that ranged from 0.802 to 1.222. *E. coli* isolates were classified as moderate biofilm producers with ΔOD595 values that ranged from 0.301 to 0.418. According to results obtained, it can be concluded that proper sanitation will be a very important step for food safety. Disinfection and sanitation of food contact surfaces in meat processing facilities is a challenging task, aggravated by the great antimicrobial resistance of biofilm-associated bacteria. Furthermore, the existence of bacteria in biofilms in the food industry may cause cross- and post-process contamination and economic losses by reducing the shelf life of food products, increasing food spoilage, impairing heat transfer, and increasing corrosion rate.

Nitrite-free Products as New Challenges for Food Safety: Growth Potential of *Clostridium botulinum* and *Clostridium perfringens* in Ham Model During Cooling in Thermal Abuse Conditions

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Research hypothesis: Proteolytic *Clostridium botulinum* (*Cb*) and *Clostridium perfringens* (*Cp*) are spore-forming bacteria, which can contaminate meat products and their growth is usually inhibited by conventional additives such as nitrites. The increasing demand for clean label products has prompted the food industry to study non-conventional additives or to provide nitrite-free products. The objective of this study was to evaluate the growth of *Cb* and *Cp* in cooked ham during the cooling in thermal abuse conditions.

Methods: Two different challenge tests were performed separately for each pathogen. For each test, two batches of 15 kg of minced meat were divided in a) Meat (M), b) Meat with Salt (2.5%) (MS), c) Meat with Salt+Sodium Ascorbate (0.03 %) (MSA), d) Meat with Salt+Sodium Nitrite (0.015 %) (MSN) and e) Meat with Salt+ Sodium Ascorbate (0.03 %)+Sodium Nitrite (0.015 %) (MSNA). Each group was separately inoculated with 1 % v/w of spore suspension (mix of three strains). Samples (100 g of vacuum-packed meat) were cooked at 75°C for 20

minutes, cooled until 54.4°C using a cold water bath and then all samples were cooled in a programmable water bath until 10°C in 6 hours (Cooling A) or in 21 hours (Cooling B) (both linear cooling profiles). Positive controls in Broth (TPGY) were prepared to verify the spore-outgrowth of tested strains. Three replicate samples were tested before and after the cooking stage, and at the end of cooling scenarios. The Clostridia enumeration was performed according to ISO 15213 (2003). The growth potential (Δ) was calculated according to ISO 20976-1 (2019) as difference between the mean log concentration after the cooling treatments and the mean after the cooking stage, and the Δ_{max} was the highest value from the tested batches.

Results: During the cooling A, the Δ_{max} of *Cb* was <0.2 log CFU/g in Broth and negative for the other tested groups, while the Δ_{max} of *Cp* was 2.08, 4, 0.82, 0.61, -0.17 and -0.15 Log CFU/g in Broth, M, MS, MSA, MSN and MSNA respectively. Thus, the linear cooling for 6 hours is enough to preserve the product safely from proteolytic *Cb* in meat it-self but not from *Cp*, and the presence of antimicrobial compounds are needed to preserve the product safety. Extending the abuse condition during the cooling for 21 hours, the Δ_{max} of *Cb* was 2.85, 2.5, 0.11, -0.62, -0.26 and -0.85 Log CFU/g in Broth, M, MS, MSA, MSN and MSNA respectively, while growth of *Cb* was inhibited only when nitrites (0.015%) were added to the meat. This study provides data about the growth ability of *Cb* and *Cp*, supporting the scientist and the Food Business Operators in the study and development of products / formulations / processes that consider the real risks concerning the suppression of nitrites in cooked meat products. Although the consumers' demand is for meat products with low or no additives, Food Business Operators must consider the possible increase of risk of illness caused by Clostridia.

Discussion: It is not realistic to rely on temperature control to ensure microbiological safety of cooked or processed meat products. The reduction or the suppression of nitrites in foods can increase the risk of illness caused by foodborne pathogens if additional hurdles other than the control of fast cooling or low storage temperature are not included.

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Consumer Involvement a Prerequisite for Successful Food System Transformation

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Engaged consumers play a critical role in making the food system more transparent, accountable, and effective, and contributing innovative solutions to societal challenges.

Consumers are at the heart of EIT Food's (www.eitfood.eu) mission to make the food system healthier and more sustainable. Helping to build trust between consumers and the food sector is critical to enabling working together to improve the food system. In this session we will dive into some or our data on trust in the food system from our annual EIT Food TrustTracker® survey (20,000 consumers from 18 countries). Do consumers trust our current food system? What can the actors in the food system do to improve consumer trust?

With trust as our backdrop, we will also look at how consumers play a vital role in shaping the food system, their openness towards different types of food innovation and what the food system can do to increase adoption of food innovations. However, even the most motivated of consumer can get derailed when faced by unforeseen societal circumstances such as the recent Covid-19 pandemic and the situation in the Ukraine leading to much uncertainty as well as increased food and energy prices. We will explore what happens to consumer motivation during a societal crisis.

Join us in this session which presents unique insights from our most recent consumer studies and social media listening at a global level, to explore the role of consumers in transforming the food system.

Effects of Direct and Indirect UHT Milk Processing Technologies on Protein Conformation and Digestion

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The aims of the project were to investigate the possible effects of different UHT processing technologies (direct or indirect heating) and order of homogenization (prior to or after heat treatment) on milk proteins at molecular level and to see if such technologies had an effect on *in vitro* gastrointestinal digestion and cell absorption efficiencies of milk proteins.

In this frame, the possible changes in milk proteins' conformations were monitored using conventional analytical techniques (individual amino acid determinations, zeta potential

measurements, particle size determinatons), electrophoretic (SDS and native-PAGE), microstructural (Confocal Laser Microscopy) and vibrational techniques (ATR-FTIR, Raman spectroscopy). Digestion studies were done using *in vitro* static digestion model. Gastric digestion studies were carried out at three different gastric pH's (pH 2, 4 or 6) followed by intestinal (pancreatic) digestion at pH 7.0. Absorption of total and individual free amino acids was monitored using human colon epithelium Caco-2 cell line.

Overall, vibrational analysis methods (ATR-FTIR and Raman) have demonstrated that the combination of UHT application and homogenization differentiated the distribution of soluble proteins in milk serum phases and caused changes in protein conformation compared to raw milk. Considering ATR-FTIR spectra of the milk samples, it has been determined that UHT technologies (direct or indirect) and homogenization applications used in UHT milk production were effective on protein conformation. Although there were no significant differences between the Raman spectra of the samples in terms of peak profiles, it has been determined that the peak intensities varied according to the UHT application model. After 5 months of storage at 4 °C or 25 °C, the milk proteins were hydrolysed into small molecular weight fragments and this degradation was independent from storage temperature. Homogenized and UHT treated samples had finer microstructures compared to raw or boiled milks. Digestion studies revealed that gastric digestion at pH 2 yielded more remarkable protein hydrolyzation than that of pH 4 or 6. The protein hydrolyzation profiles of the samples subjected to gastric digestion at pH 4 or 6 were fairly similar to each other. The protein hydrolyzation profiles obtained after gastric digestion were found to be similar after intestinal digestion as well. Compared with raw milk, β-Lactoglobulin were hydrolyzed at higher levels in the heat-treated milks. The levels of protein digestibility and total free amino acids were higher in the samples subjected to gastric digestion at pH 2 than the samples digested at pH 4 or 6. This trend was also noted after cell absorption and the samples subjected to gastric digestion at pH 2 had almost twice as many amino acids after cell absorption than the samples subjected to gastric digestion at pH 4 or 6. Regarding the absorption efficiency of individual free amino acids, no clear diferences were noted among the samples and glutamic acids was found to be the most efficiently absobed individual amino acid by Caco-2 cell line in all sample groups. Finally, UHT milk processing technologies were effective on milk protein conformation and digestion/absorption efficiencies but the major factor affecting milk protein digestion and absorption was gastric digestion pH.

Evaluation of the Effects of Mucilage on Public Health in Seafood from the Marmara Sea

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The formation of mucilage in the seas is an increasing environmental problem, and besides its environmental effects, it carries the risk of adversely affecting marine life and ultimately the health of people consumiraggng fishery products. A serious mucilage problem was experienced in the Sea of Marmara in 2021. The aim of our project, which was supported by the TÜBİTAK call opened within the scope of the emergency action plan for the mucilage problem; evaluation of certain fishery products caught from the Marmara Sea in terms of food safety and consumption risk during the 2021-2022 fishing season after mucilage.

In this regard, microbiological and toxic metal analyzes were carried out by sampling pelagic fish such as anchovy, horse mackerel, sole from demersal fish, mussels from shellfish and shrimps from crustacean in the 2021 September-2022 April fishing season. In our study, Total Viable Count, total *Enterobacteriaceae*, *Bacillus cereus*, *Clostridium perfringens*, *Aeromonas*

hydrophila, *Salmonella* spp., *Listeria monocytogenes, E. coli* O157:H7, *Vibrio cholerae* and *Vibrio parahaemolyticus* analyzes were performed to detect microorganisms that are risky for public health due to the consumption of fishery products. Toxic metal analyzes (Cd, Pb, Hg, As) in fish and mussel samples caught from the Sea of Marmara were performed according to the AOAC (2002) 999.10 method.

In the samplings made in the 2021-2022 fishing season, it was determined that the microorganism load and diversity were higher in the samples taken especially in September and October when the sea water temperatures were high, compared to the winter months. The highest total viable value determined during the whole fishing season is in mussels sampled from the Dardanelles in September (7.27 log cfu/g). The total viable load of sole fish, which is a dermersal species, was recorded as 6.32 log cfu/g in September. The average of total viable load in January and February, when the air temperatures are low, is 3.69 log cfu/g. *E.coli* O:157 in 40%, Listeria monocytogenes in 13%, *Salmonella* spp. in 11% of the samples obtained during the fishing season detected.

Heavy metal levels were found below the permitted limits in Turkish contaminants regulation. The THQS levels for all samples were well below 1, indicating no potential risk for Turkish consumers with different body weights. However, the potential risk for excessive consumers must be considered.

Marine mucilage, which was first seen in the Sea of Marmara in 2007 and emerged as an environmental disaster in the past 2021, has adversely affected sustainable food security in the Marmara Sea, one of the most important seas of Türkiye in terms of fisheries. With this project, the microbiological and toxicological status of the fishery products obtained from the Marmara Sea after mucilage was determined. As a result; This project gave information about what kind of risk we are under and what measures will be taken for the coming years.

Traditional *vs*. Industrial Divle Obruk Cheese Production: Quality, Risk Factors, Health Effects

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In this study cytotoxic effect to human intestinal cells, antibiotic susceptibility, and mycotoxin production of bacterial and fungal species isolated from traditional Divle Cave cheese were determined. The cell-independent extracts of bacterial strians did not cause any toxic effects on human intestinal CaCo-2 cells at doses of 10, 100 and 1000 µg/mL. Similarly, it was determined that CaCo-2 cells did not exhibit a viability loss as a result of stimulation with viable cells and heat-inactivated cells of bacteria. The antibiotic susceptibility tests showed that the strains were sensitive to some of the antibiotics, while being resistant to others. *Lactobacillus* strains were mostly resistant to 6 out of 10 antibiotics, while *Lactococcus lactis* was found to be resistant to 2 different antibiotics, *Enterococcus faecalis* and *Enterococcus faecium* to 3 and 5 antibiotics, respectively. It is considered a potential health risk for a strain to have an antibiotic resistance with transmission potential to pathogenic species in the food chain. In

terms of mycotoxin production of fungal strains, it was determined that individual strains in medium have different mycotoxin production potentials, however in cheese environment they showed a limited mycotoxin formation in terms of variety and amount. It was determined *that P. roqueforti, P. verrucosum, P. biforme* species produced a small amount of mycotoxin, while *P. chrysogenum* and *P. corylophilum* produced a large number of toxins. Moreover, penicillic acid and Roquefortine-C was determined to produced by almost every species.

Peanut Butter Consumption and Hepatocellular Carcinoma in Sudan

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Hepatocellular carcinoma (HCC) is the sixth most common cancer in the world with 80% of cases occurring in developing countries in sub-Saharan regions in Africa, South-East Asia and China. The cancer is highly fatal and survival is generally less than 1 year from diagnosis. Clinical records suggest that the incidence of this cancer is high and increasing in Sudan. Major risk factors of HCC have been identified as dietary exposure to aflatoxins, chronic infection with hepatitis B virus (HBV) and other hepatitis viruses and the intake of alcoholic beverages. Climatic conditions, agricultural practices and the dietary patterns in Sudan, as well as in many of the sub-Saharan African countries, are contributing to the contamination of food with aflatoxins and possibly to the incidence of HCC.

The aim of this study was to investigate the role of aflatoxins from peanut butter in the etiology of HCC in Sudan, and to substantiate this by studying polymorphisms of potential relevant genes for aflatoxin metabolism. The ultimate goal of this study was to find clues for prevention and control of HCC in Sudan, by investigating the relative importance of aflatoxins

(peanut butter intake) and hepatitis infections. Accordingly, implications for agricultural and public health policy can be substantiated.

First, an explorative study was conducted among 24 cases and 34 controls. This study confirmed that high amounts of aflatoxins (20 times above the guidelines of the World Health Organization) are present in Sudanese peanut butter and suggested that humid storage conditions might contribute to the risk of HCC. Furthermore, procedures for the main study were tested and adapted, (Article 1).

In the main study 150 cases with HCC and 200 controls, matched for sex, were enrolled from West and Central Sudan. In this study, an about four-fold increased risk of HCC was observed among subjects with a high daily consumption of peanut butter. This association was considerably stronger for subjects having genetic polymorphisms of glutathione S-transferase M1 (GSTM1). For the polymorphisms in glutathione S-transferase T1 (GSTT1) and microsomal epoxide hydrolase (EPHX), no association was observed. This might indicate that GSTM1 is a more important rate-limiting factor in the metabolism of aflatoxins. In addition, we observed a positive association between the intake of peanut butter stored in humid storage conditions although less clear than it was in the explorative study. Regarding hepatitis infections, a fifteen-fold increased risk was found for those who had experienced HBV infections, (Article 2).

The results of our study point at both exposure to aflatoxins through peanut butter intake and hepatitis B infection as important risk factors of HCC in Sudan. Although hepatitis B infection was a much stronger risk factor as compared to aflatoxins/peanut butter, the latter was almost equally important to public health because of the high prevalence of aflatoxin contamination. About fifty percent of all cases of HCC might be attributable to contamination of peanut butter, (Article 3).

In order to reduce HCC in Sudan, pre and post harvest measures in agricultural policy need to be reinforced. At the community level, specific attention should be given to selling and processing of peanuts and their products at local markets. In addition, immunization of infants and high-risk groups against HBV infections has to be considered as a short-term strategy. Finally, future research would benefit from improved hospital and population registries. Other staple food grains, such as sorghum and milit which are subject to mycotoxins contamination, are needed to be investigated in relation to the etiology of different chronic and fatal diseases in Sudan.

From One Health to One Welfare Where are We?

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Although many researchers studied about "OneHealth" approach, which is based on the cooperation of human and animal health scientists, it dates back to the first ages of the first human existence. Famous German physician and pathologist Prof. Rudolf L.K. Virchow discovered in 1855 during his research on Trichinella spiralis in pork that veterinary medicine and human medicine complemented each other. As a result of this scientific research, he expressed the relationship between both professions with the following historical explanation "between animal and human medicine there is no dividing line – nor should there be. The object is different but the experience obtained constitutes the basis of all medicine". After that Dr. William Osler, who taught Canadian students on "OneMedicine" explained that "veterinary medicine and human medicine complement each other and this concept should be perceived as a single medical concept". He supported Virchow with his statement.

In the 21st century, Prof. Dr. Calvin W. Schwabe, known as the father of veterinary epidemiology, drew attention to the increasing number of zoonotic pathogens in the world

and to the pandemic danger shortly before his death in 2006 and called on the American Veterinary Medical Association (AVMA) and the American Medical Association (AMA) to act jointly under the roof of "One Medicine, One Health" in order to prevent possible pandemics. Following this call, both organization took action and after a long study, a proposal as "One Health Initiative" was adopted and declared to the world with the participation of more than three hundred scientists at the meeting held in Washington DC in 2007. "One Health: a collaborative, multisectoral and trans-disciplinary approach that takes into account the relationships and interconnections between people, animals, plants and their shared environment, collaborating at the local, regional, national and global levels with the aim of achieving optimal health and well - being".

One Welfare is an extension concept of One Health, where the focus is on climate change and the animal and human welfare issues related to climate change are addressed together with environmental sustainability. This concept includes not only zoonotic diseases and food security, but also many emergency relief and evacuation practices, including animal cruelty, humane behaviour between farmers and animals, and possible problems related to climate change. This practice involves veterinarians, animal educators and owners, environmental scientists, human psychiatrists and many specialists related to animal services. It is difficult to separate the well-being of an animal from its health. One Welfare promotes not only animal welfare, but also human and community welfare. We cannot say that the whole world is at the desired point in terms of both One Health and One Welfare.

Trust in the Food Supply Chain Program

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Within the scope of food consumption in restaurants, one important reason for the lack of trust in the food supply chain is that consumers do not know where the food ingredients are sourced from and which brands are used. Consumers expect transparency when they order and especially Covid-19 pandemic impacted the purchasing behaviors of consumers significantly in terms of healthy choices and food safety.

Trust in Supply Chain (TZG in Turkish) program has been designed and developed in collaboration with Etüder(Food Service Suppliers Association) and other industry associations to meet the requirements of customers by providing a smart tool for consumers through which they can learn details of the ingredients used by reading the QR code in the restaurants. Restaurants, suppliers, and recognized food audit companies are all a part of the TZG program. A software platform has been developed for the TZG program details of which will be demonstrated through a live case during the presentation.

Pest Control in the Future

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Food Safety may be at its highest level these days, thanks to the combined partnership of the pest control industry and food producers and manufacturers. However, the risks that pest species pose to food security are ever present, requiring constant vigilance and frequent reappraisal of the tools and techniques at hand. This is all the more important as these solutions are under pressure from a need to be more sustainable, and to adapt to the new digital environment we find ourselves in.

Sustainability is defined by the OECD as '*Using control means that avoid the depletion of natural resources in order to maintain an ecological balance. Meeting the needs of the present without compromising the ability of future generations to meet their needs*'. It is important to recognise that saving the planet does not mean completely eliminating the use of chemicals and pesticides - it does however mean using them as part of a suite of solutions, only when necessary, and in as targeted a way as possible.

One example of this is Rentokil's Autogate unit. This is placed inside an external bait box, and only opens the compartment containing rodenticide when sensors detect the presence of a rat. This means bait can be placed outside, with access restricted to non target wildlife, and targeted to become available only when pest rodents are present.

Another example is Rentokil's Lumnia Insect Light Trap, where the old-fashioned Fluorescent lights have been replaced with new LED technology that can actually output more of the Ultra Violet light that attracts flies into the trap, but with a much lower power demand (between 40-60% depending on the model) - meaning the same level of customer protection from fly risks can be delivered for a much lower environmental footprint.

Sustainability in many parts of the world is also synonymous with humaneness, and there is considerable pressure to restrict rodenticides considered inhumane, and to ban inhumane techniques like rodent glueboards. The pressure to find novel solutions to deliver the same level of protection is real, but poses problems for a consistent approach for a global pest control provider or a food manufacturer facing different demands from different parts of the globe.

The other increasingly important trend is for 'digital pest control', as witnessed by the ever growing number of rodent and insect monitors coming onto the market. Monitoring is a vital part of an IPM programme - and what could be more sustainable than a monitor that means you only have to apply a pesticide when you detect a pest? However, the resources to produce electronic devices mean that the environmental benefit is not always clear, and the cost is a considerable challenge to gaining market acceptance for this form of preventive approach.

Electronic control devices, usually for killing rodents, take things one step further, ie. Rentokil's RADAR unit that catches mice and rapidly and humanely kills them. Where the cost is acceptable, these can be attached to a 'connected' communication network, resulting in real time information on pest and unit status being at the fingertips of the pest technician (and giving the customer unprecedented levels of information and transparency).

Finally, and this is a newer development, this digital environment also provides a new opportunity: Harnessing the data. In an increasingly digital environment, there are massive amounts of information being gathered on each service visit, being sent to 'the cloud' and stored forever. Pest Control companies are only now starting to investigate the hidden insights inside this data, in order to improve their own productivity, but also to give new insights into pest behaviour and the effectiveness of various control techniques. This new Digital Frontier may yet turn out to deliver the greatest advances towards a sustainable and effective pest control future yet.

The Effects of International Transportation Processes on Food Safety in Export of Crop Products and Sample Application in an Export Oriented Organization

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Today, healthy life and access to safe food, which is one of the prerequisites for healthy life, and sustainability and traceability of safety, contain great importance. Particularly, the control points to be carried out in the processes related to loading, transporting, transporting to the points of sale, unloading and storing when necessary from the collection of fields, greenhouses and similar production areas of crops covered by crop production should be determined correctly. Today, it is necessary to carry out these controls according to the relevant food safety legislation and standards applied within the scope of food safety and customer demands, and to evaluate the results obtained for prevention and improvement purposes. Within the specific area of this study, Kropy Fruit Hungary Kft. has been analyzed by

taking into consideration the specific product types and the problem areas that contain a threat to food safety during the implementation of the establishment activities have been identified.

In this context, the data related to the processes from the collection of crops from production areas to the wholesale are defined primarily based on the export data of Kropy Fruit Hungary Kft. in 2018 and 2019 and international transportation and storage application records. During the identification and classification of process data, process parameters, process objectives and results, which come from Kropy Fruit Hungary Kft, for all control points in these processes, were evaluated. Transportation processes for export activities carried out by the organization in the relevant years are classified on the basis of product types and examined considering the storage conditions required by the products. The data used in the study consist of the classification of similar crops transported under different conditions (heat, hygienic, loading conditions, etc.). Statistical Process Control Methods, Histogram, Pareto Analysis and Cause-Effect Diagrams were used to evaluate the results. Transportation methods, storage conditions and durations regarding to the types of products and performance parameters of the processes for unloading and storage were used as data. The evaluation results of these data include deviations from process performance parameters, their causes, and the consequences that affect food safety. In addition, the corrective actions, which have taken against nonconformities resulting from the operation of the processes, were evaluated and the risks that may be accrued in the operation of all processes were evaluated.
In this study, the identification, classification, implementation of corrective activities and the improvement of the processes that are important in food safety during the international transportation and storage of crop products from the production areas and which threaten food safety are covered by certain product types of Kropy Fruit Hungary Kft. developed based on application records. The results of this study were also examined by taking into account the common requirements and customer demands of the management system standards used for food safety purposes.

As a result, the used data in this study is the analysis results from Kropy Fruit Hungary Kft. and the application of the relevant Food Safety standard requirements, the implementation of the legal requirements within the scope of the transportation processes, the identification and elimination of the elements threatening the food safety in the international transportation and storage processes. As an improvement, reduction of the losses at these stages and recommendations for similar organizations for safe food transport were discussed. In addition, the risks and non-compliances arising from the employees of the organization were also examined and the effects of human factor on food safety in these processes and recommendations for improvement were developed.

The Effects of Animal Welfare Practices on Food Safety in the Production of Red Meat Products

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It is known that the quality of red meat production and the beginning of food safety start from the animal as the main raw material source.

After the animal is slaughtered, various physical and chemical events occur in the muscles during the transformation of the muscles into meat. This whole process is called post-mortem changes. The formation of post-mortem changes at the desired level is very important in terms of ensuring meat quality and safety. It is possible to improve post-mortem changes with some ante-mortem (pre-mortem) applications.

For this reason, it has gained importance to work in accordance with animal welfare during the period until the slaughter of animals.

In this presentation, information about how animal welfare should be handled at which stages is given and the positive effects of these animal welfare practices on meat quality and food safety are explained.

Gastronomy and Food Safety

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From a gastronomic point of view, first of all, the taste of the food is important. However, for the consumer, it is important that the food is safe and healthy as well as being delicious. According to a study, the number of food poisoning incidents covered in the media in Türkiye during 2014-18 was 155. About 9000 people were affectedby these cases, of which 28,9% occurred in a school, 21,4% in a workplace, and 12.3% in a restaurant (Çetin & Durlu-Özkaya, 2019).

It is a fact that gastronomy businesses are often fragile from a food safety point of view. The main reasons for this are; manual processes are applied, the process flow is not continuous, and the bacterial degradation time is very short at normal temperature. While this phenomenon increases the possibility of contamination, it complicates the implementation of automatic cleaning systems and requires avoidance of keeping the food within a certain temperature range(7 -65^{o}C).

On the other hand, the application of quality assurance in gastronomy enterprises is not sufficient. Therefore, process contaminants are a potential hazard.Of these, especially hydroxy-methyl furfural (HMF), acrylamide (AA) and epoxy fatty acid (EFA) are important. The way to avoid process contaminants is to constantly control the cooking conditions with the right criteria.

In 2021, there are around 720 000 food establishments in Türkiye and about 280 000 of them are food consumption places. The majority of these establishments are small-scale restaurants. The education level of the personnel working in these establishments is generally low and the awareness of food safety is weak. Therefore, it is important to increase the number of gastronomy undergraduate programs in universities. However, priority should be given to food science and safety courses in undergraduate programs. In addition, short-term training programs should be implemented for the personnel working in the sector with public support.

Reference

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Industry 4.0 in Relation to Food Safety

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Industry 4.0 has become a buzz word that is widely used to introduce new technologies especially in the automation and digital area. It may be so, but the reality is that behind the word there are a vast number of things that has been developed over the last couple of years that really has had a huge impact on the digital journey companies are going through today.

There are several areas within the framework of Industry 4.0 that has a big impact on the Food and Beverage industry. In this presentation I have chosen to pick some of them that has an impact on the food safety aspect at food producers.

In my presentation I use the term “Factory of the future”, where I give several examples where digitalisation will provide new and additional values for the industry.

New digital technologies such as the possibility to collect and compare vast amount of data in the cloud (big data) provides values operators can be guided with better accuracy and data than before. Linked to this, the area of Artificial Intelligence can assist operators, quality and maintenance managers to make the right and best decisions.

Improving food safety is very much linked to the ability of operators to make less errors. By integrating solutions and make use of advanced software solutions operators are guided and operations is prohibited.

In the area of IoT we now have the possibility to connect intelligent sensors in parallel with existing IO-installations, i.e., a separate data channel linked to Edge functionality. These sensors can provide information and status that helps solutions to make advanced analysis so that we can predict errors and breakdowns. This not only secures product quality but also makes sure that maintenance is performed in the optimal way.

Digitalisation would be nothing without an extensive implementation of Cyber Security. Most of the new digital solutions require some level of integration to the net (or cloud) and thus opens up for cyber-attacks.

In summary, food safety can absolutely be enhanced by using modern digital solutions. With the exception of Cyber Security, the biggest threat against a fast implementation of digital solutions is the installed base. Most managers at food factories needs to see the real value of implementing digital solutions, thus the pace of change is quite slow.

Lactose Hydrolysis and Protein Fortification Pose an Increased Risk for the Formation of Maillard Reaction Products in UHT Treated Milk Products

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Milk is important in daily human diet as it has a balanced protein, carbohydrate, lipid and mineral content. Over the years, lifestyles have changed and various fluid milk products including skimmed milks, semi-skimmed milks and flavored milks have become commercially available in the market. Lactose intolerance and increased protein consumption due to active

lifestyle of people doing sports promoted the production of lactose-hydrolyzed and protein-fortified milks. In order to increase the shelf-life of these milk products, higher temperatures (130-150oC) in ultra-high-temperature (UHT) processing, is commonly applied. Such high temperatures do not provide only the inactivation of bacteria and enzymes, but also lead to chemical changes decreasing the nutritional value of milk. Maillard reaction is responsible from the major changes in milks as a consequence of UHT-treatment. Maillard reaction occurs between lysine residues and lactose in milk, resulting in formation of different Maillard reaction products such as dicarbonyl compounds, 5-hydroxymethlyfurfural, advanced glycation end products (carbxymethlylysine, carboxyethyllysine).

Because the formation of these compounds has potential effects on health and leads loss of nutritional quality of milk in terms of lysine loss, determination of their levels in milks is of importance. As lysine residues and lactose are the main responsible components for the formation of all these potentially harmful compounds, fortification of UHT-treated milks might promote their formation. This study aimed to survey the content of Maillard reaction products in different UHT-treated milk products and to assess how formation of these products and lysine blockage is affected by the composition.

In this study, different commercial UHT milks including regular milk (whole, semi-skimmed and skimmed), lactose-hydrolyzed, protein-fortified, lactose-hydrolyzed protein fortified and follow-on infant milks were analyzed. Among the Maillard reaction products, dicarbonyl compounds, 5-hydroxymethylfurfural, furosine, carboxymethyl-lysine and carboxyethyl-lysine were monitored.

The results showed that fortification of UHT milks with protein and carbohydrates as well as hydrolysis of lactose promoted the Maillard reaction. Among the dicarbonyl compounds, 3-deoxyglucosone formation, which was the dominant dicarbonyl compound in milks, was found to be varying between 3.12-12.67, 13.45-21.98 and 4.59-40.38 in lactose hydrolyzed, lactose-hydrolyzed protein-fortified and follow-on infant milks whereas it was 0.22-0.40 in milks, respectively. Similarly, 5-hydroxymethylfurfural could not be detected in milks, whereas mean 5-hydroxymethylfurfural concentration was found to be 56.3 mg/L and 31.5 mg/L in protein-fortified milks and lactose-hydrolyzed protein-fortified milks, respectively. Blocked lysine was calculated varying between 8.5 and 26.8% for lactose-hydrolyzed milks, whereas this ratio was found ranging between 13.9 and 43.0% for lactose-hydrolyzed protein-fortified milks. Accordingly, carboxymethyllysine and carboxyethyllysine content of different UHT milks were found to be significantly higher than milks ($p<0.05$).

This is the first study reporting the Maillard reaction products in protein-fortified and infant milks. The results of this study revealed that formation of these Maillard reaction products in UHT milks was mainly affected by the fortification of different ingredients. Infant milks which are fortified by honey or sugar syrups contained higher amounts of dicarbonyl compounds. Additionally, protein-fortified UHT milks had higher levels of Maillard reaction products. Hydrolysis of lactose resulted in promotion of Maillard reaction. Most importantly, blockage of lysine in protein-fortified and follow-on infant UHT milks were found to be comparably higher than UHT milks.

Mitigation of Acrylamide by Asparaginase Applications in Bakery Products with Different Dough Types and Properties

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Acrylamide is a carcinogenic compound formed from asparagine in the presence of carbonyl compounds during food processes. Asparagine is originated from the flour in the formulations of bakery products. Depending on the formulation of bakery product and heat treatment

applied, the concentration of acrylamide formed could change. The European Commission set benchmark levels for acrylamide in food products including bakery products to assist food manufacturers to reduce acrylamide formation. However, it is a challenge to reduce acrylamide formation in bakery products without affecting the sensory and textural properties of bakery products. Additionally, the mitigation strategy should be feasible for the food industry to apply. In this respect, the usage of asparaginase enzyme in the dough of bakery products is a promising approach to mitigate acrylamide in bakery products. The effectiveness of the asparaginase enzyme could depend on the dosage of asparaginase, pH, water activity, and the parameters related to the process such as dough resting time, temperature, mixing procedure, etc. Therefore, this study aims to investigate the effectiveness of the asparaginase enzyme on the mitigation of acrylamide formation in different bakery products, namely rotary cut biscuits, rotary molded biscuits, wire cut cookies, crackers, and wafer batter by addition of asparaginase in varying concentrations and under the different processing conditions.

Sweet/semi-sweet hard dough with low fat and high-water content (rotary cut biscuits), soft dough with low water and high-fat content (rotary molded biscuit), and dough of wire cut cookies, crackers, and wafer batter was prepared without asparaginase as control. Asparaginase added to dough of bakery products changed from 1000 to 12000 ASNU depending on the type of the bakery product. Effect of changes in the mixing procedure, speed of mixing, mixing time, dough resting time, and dough resting temperature were tested in the formulations where applicable. Initial pH and water activity values of dough were measured. The baking of products was performed in a conventional oven except for wafer batter. Spread ratio and color were the quality-related measurements performed in biscuits and crackers. Analysis of asparagine and acrylamide was performed in LC-MS/MS after triple-stage extraction. The dough was prepared twice for each formulation and each dough was baked separately. Analysis of bakery products was also performed twice. Data were subjected to one-way ANOVA analysis of variance and Tukey's test by using SPSS ($p<0.05$).

The reduction of acrylamide formation achieved was 96% in rotary cut biscuits after a combined application of 3000 ASNU asparaginase and 30 min of dough resting time. An 80% reduction was found in crackers after a combined application of 3000 ASNU asparaginase and 15 min of dough resting time. Acrylamide formation was prevented by 54% in wire cut cookies after a combined application of 5000 ASNU asparaginase and a change in the mixing procedure of ingredients. There was a positive correlation between asparagine content and acrylamide formation except for rotary molded biscuit doughs. Acrylamide could not be mitigated in rotary molded biscuits due to the low water activity of dough (0.70) and high-fat content. In the wafer batter with the highest water activity (0.97), asparagine reduction greater than 95% occurred after asparaginase treatments. Overall, the water activity of the dough was found to be more important than pH for the activity of the enzyme. The addition of a resting period and prolonging dough resting time, by themselves or in combinations were suggested to be applied to the bakery products by considering the activity of the enzyme. Asparaginase did not affect quality-related parameters, surface color and spread ratio, of bakery products. The results reported here could help guiding the food industry on how to reduce acrylamide below benchmark levels.

Vacuum Baking Mitigates Acrylamide Formation

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Since the discovery of acrylamide in a variety of foods, acrylamide mitigation strategies have been extensively studied. Decreasing thermal load was reported as one of the most effective ways to control acrylamide formation. Therefore, this study aimed to test vacuum baking in baked potato chips due to its lower thermal load. Reformulated potato chips were prepared with the potato dough including potato flakes, wheat flour, salt, sugar, sodium hydrogen carbonate, monocalcium phosphate, canola oil, soy lecithin, and water. The dough was rolled into the diameter of 3 cm and the weight of 3.00 ± 0.05 g. The chips were then baked either

in the conventional oven at 180, 190, or 200°C for different times (2-8 min) (CB) or in a vacuum oven (10 mbar) at 120 - 160°C for 6 - 14 min (VB). Combined baking was also performed starting by partial conventional baking for 2, 3 and 4 min at 180°C and vacuum post-baking for 6, 5 and 4 min at 130°C (10 mbar). The acrylamide content of the reformulated potato chips was analyzed by LC-MS/MS. The color analysis was performed by computer vision-based image analysis. Sensorial properties of the potato chips, including color, smell, taste, texture, and overall acceptability, were evaluated by the panel.

The amount of acrylamide in CB-chips increased by increasing temperature or time reaching to a concentration up to 4863 ng/g. On the other hand, vacuum baked chips (59–555 µg/kg) except baked ones for 9 min at 150 °C (1399 µg/kg), for 7 min at 160 °C (907 µg/kg), and combined baked chips (230–397 µg/kg) contained acrylamide lower than the benchmark value which was set by European Commission for potato chips. Vacuum baking led to the reduction levels of acrylamide in potato chips up to 98 % compared to conventional baked chips. This reduction is the result of the fact that vacuum baking allows baking the potato chips at lower temperatures due to the lower boiling point of water. Similar to vacuum baking, combined baking reduced acrylamide formation by up to 90 % compared to these conventional baked samples. The color of the potato chips was greatly affected by the baking process. The surface browning in CB- and VB-potato chips was not homogeneous; however, VB potato chips baked at low baking temperatures and for shorter time, were found to be homogenous in color. The color analysis showed that L* and b* values of the conventionally baked potato chips decreased, conversely a* and ΔE values increased with increasing baking temperature and time. Higher L* and lower a* values were observed in vacuum and combined baked chips compared to conventional ones. According to the sensory analysis, VB-chips (130°C x 10 min, 10 mbar) were more appreciated than the control (180°C × 5 min) and the combined baked samples (180 °C × 4 min + vacuum post baking 130 °C × 4 min, 10 mbar) in texture and overall acceptability ($p < 0.05$).

All the results clearly showed that the vacuum baking and combined process were highly effective in reducing the acrylamide content in baked potato chips compared to conventional process. These alternative techniques also provide acceptable sensorial and visual characteristics of the potato chips.

Importance of Hygienic Design Audit in Certification of Food Safety Standards

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For the produced food to be of commercial value, it must be produced in accordance with food safety principles, and it must be evidenced by audits that all production steps are done accordingly. In this process, food safety standards certification schemes which are carried out by the Global Food Safety Initiative (GFSI) Benchmarking Requirements and GFSI recognized auditing companies come into play.

A food facility consists of a building, equipment/lines, and their associated installations. During the construction of the facility, solutions are introduced by architects, civil engineers, mechanical engineers, and installation engineers. Equipment/line designs are made by design teams of the manufacturing companies, taking into account the customer requests relatively. The solutions are introduced based on the knowledge of the relevant organizations. The first aim is to build a functional facility or an equipment. In applications where the principles of hygienic design are not a priority, food safety may not be ensured under all circumstances.

In general, the company's food safety team comes into play when the facility is commissioned, and the production is begun. That is the time, when the main problems related with the facility structure made up to that date arose and creates obstacles in auditing for the food safety standards. Unfortunately, at this stage, the chance of intervening the building and already purchased and installed equipment is very limited. In this context, any improvement to entrance and exit of the facility and production area; modifications to the infrastructure requirements such as changing rooms, toilets, drainages, ventilation, etc. is more costly than the initial construction. It is more difficult to comply with the requirements of the purchased and installed equipment. Even if, a solution is tried to be produced, it may not be possible to fulfill all the measures of food safety rules in food production facilities.

In order to minimize the problems that arise in construction of a plant and purchase of equipment and to improve food safety measures, titles related to hygienic design principles have been defined within the scope of GFSI 2020 Benchmarking Requirements.

Under title of GFSI 2020 JI Hygienic Design of Food Buildings and Processing Equipment (for building constructors and equipment manufacturers), companies that supply equipment/lines to and build of food production facilities are required to have a JI certificate. For this, on per-person basis, any architect, engineer, designer, and constructor who works in food related facilities projects, including farms, food manufacturers, storage and retail buildings; will need to be trained and audited from hygienic design perspective.

In JI, Section 1: Hazard and Risk Management Systems Requirements, under the first subheading “a competent multidisciplinary team shall assess the hygienic design and risk assessment of new buildings/equipment” has been stated as a first item. Since food safety is not only the duty of the quality team. Finding and maintaining a solution on food safety is only possible with the cooperation of a multi-disciplinary team.

Under the scope of GFSI 2020 JII Hygienic Design of Food Buildings and Processing Equipment (for building and equipment users), the buildings and equipment/lines constructed within the compliance of JI hygienic design will be checked together at the food production facility.

It is planned to use the facility and the equipment purchased at least for 15-20 years. In order to reach this target and the right solution, hygienic design and engineering principles must be jointly applied in the first place. Afterwards any possibility of applying these principles remains very limited and costly. Within the scope of the study, the issues that should be considered under the GFSI 2020 Benchmarking Requirements Hygienic Design related JI and JII titles, which will be more in the agenda in the coming years, will be emphasized, and information will be given about the measures that can be taken from today.

Trans Fatty Acids and Food Safety

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Trans fatty acids (TFAs) are geometric isomers of cis double bonds in unsaturated fatty acids, which are generally formed in partial hydrogenation. Therefore, they are called as a group of process contaminats. Some desirable physical properties and oxidative stability of TFAs result in positive effects on physical and chemical properties of final products. However, in the beginning of 1990's, it was explained that TFA intake increases the risk of coronary hearth

diseases by lowering HDL cholesterol, while increasing LDL cholesterol, which stimulated the food industry to eliminate the TFAs from their products. Removal or elimination studies of TFA were then started by food industry in many developed countries and also in Türkiye. Adoption of voluntary TFA labelling (no TFA if less than 1.0% on fat bases) in Türkiye in 2007 has made great contribution to this reduction which was achieved by using alternative hardening techniques such as interesterification and fractionation.

The states showed various approaches in reducing TFA content in food products. USA and Canada banned using partially hydrogenated fats and oils in the products while European Union including Türkiye prohibited TFA in food products, exceeding 2 grams per 100 g of fat except that naturally occuring in fat of animal origin, which will be very helpfull to reduce TFA intake and risk of coronary heart diseases. Because of the great efforts to reduce TFA in the food products by the food industry in last two decades, this regulation is believed to be easily adapted by the industry.

Effects of Nanomaterial Reinforced Fibrous Casing of Sugarcane Bagasse on the Adsorption of Polycyclic Aromatic Hydrocarbons (PAHs) in Smoked Sausages

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Novel nanocomposites containing nano-carbon and nano-clay nanoparticles (0.5 and 1% wt.) were developed to evaluate the adsorption effects of 4 carcinogenic polyaromatic hydrocarbons (PAH4, benzo[a]anthracene, Chrysene, benzo[b]fluoranthene, and benzo[a]pyrene) during the smoking process of sausages. The mechanical, water vapor

permeability (WVP), film opacity, thermal properties, morphology, and the adsorption efficiency of produced films were assessed. It was observed that both nano-carbon and nano-lay additions to the film formulation led to significant improvement in tensile strength, elongation at break, maximum load stress, and elastic modulus values compared to control film. The WVP of the films was significantly reduced by the addition of nanoparticles. Film opacity, melting temperature, crystallization temperature, crystallinity degree, and glass transition temperature were remarkably increased. These improvements were more highlighted when nano-clay nanoparticles (1% wt.) were used compared to nano-carbon. The nano-clay nanocomposite indicated uniform and well-distributed nanoparticles. Based on the GC-MS analysis, nanocomposite nanoparticles efficiently adsorbed the PAH4 compared to control and nanocomposite film with nano-carbon nanoparticles.

International Activities and Developments in the Area of Food Fraud

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Food fraud has gained high prominence within the food sector in recent years due to high profile incidents that have undermined businesses and eroded consumer trust. At present it is very difficult to estimate how much "food fraud" has taken place as prosecutions are long and often difficult or, more commonly, prosecuted through other regulations e.g. as food safety incidents, tax evasion, theft etc. Food fraud is poorly defined with many international

organisations currently working on an agreed definition and related terms so that it food fraud can be addressed more effectively. It is acknowledged that fraudsters look to exploit weak links in the food chain, with todays extremely dynamic trading patterns providing an additional source of uncertainty. Predicting food fraud is difficult with current systems reliant mainly on profiling historical incident information such as that held within the Rapid Alert System for Food and Feed. The lack of efficient early warning systems mean that mitigation is difficult and often an inefficient process. "Big data", Digitalisation, Blockchain and Artificial Intelligence, offer new sources of confidence and transparency in term of authentication and enhancing consumer confidence. Such technologies when combined with online measurement technologies such as non-targeted analysis offer a real prospect of efficient systems of assurance. An overview of international efforts to standardise terms and conditions will be presented together with an analysis of how recent events have impacted on international food trade and presented opportunities for food crime. Finally a summary of some of the new technologies and research activities that are being developed to provide greater confidence in the integrity of our food will be presented.

Honey Regulations Applied in the World and Rules Applied by Authorities and Their Effects on World Bee Products Trade

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According to the reports of EFSA (European Food Safety Authority), honey ranks 6th among the most adulterated product groups in the world. Although there are differences between the regulations applied from country to country, different parameters are also analyzed by the laboratories, who are accepted as authorities on honey and other bee products, based on the rules that are not included in the regulations as one-to-one parameters, but are only in

the text part of the regulation. This situation directly affects product reliability and also plays an important role in the world honey trade.

According to the framework of "*Programme for Alignment with the EU Acquis*" between Türkiye and the European Union the communiques and regulations applied in Türkiye for the food sector were matched with those applied in the European Union. In this context, the honey communique was matched on 20 December 2001 with the 2001/110 / EC Honey regulation. For the products within the scope of the Turkish Food Codex (TGK) Honey Communique, it is clearly stated that the provisions in the Pharmacologically Active Substances and Their Classification Regarding Maximum Residue Limits in Foodstuffs of Animal Origin shall apply. However, within the scope of the circular published in 2007, with the prohibition of Erythromycin, the only antibiotic type permitted in Beekeeping at that time, the use of Antibiotics in Beekeeping has been prohibiteds since. Based on this information, it is seen that no veterinary medicine can be used in beekeeping according to the Turkish Food Codex Honey Communique. In this context, antibiotics detected in honey and their degradation products pose a risk on the basis of reliable products and detection limits are gradually lowered with the implementation of new developed technologies (eg. 0,5 µg/kg). In addition, the provisions in the Turkish Food Codex Regulation on Maximum Residue Levels of Pesticides In or On Food and Feed of Plant and Animal Origin published in the Official Gazette dated 29/12/2011 and numbered 28157 are applied for the products within the scope of the Turkish Food Codex Honey Communique. The use of 172 Pesticide is strictly prohibited in Türkiye. In the aforementioned regulation, the maximum residue limit was specified for a total of 81 pesticides for honey. Although Amitraz is on the list of banned pesticides in plant production, it is classified as a permitted pharmacological active substance for beekeeping with a maximum limit of 200 µg/kg. However, the number of pesticides analyzed in honey and other bee products by the authorities accepted in the world is more than 300. On the other hand, with new developing technologies and new adulteration methods developed, the number of quality parameters that are being analyzed by the authorities are increasing day by day. For example, based on the detection of "foreign" enzymes that do not exist naturally in honey, judgment are made that the product analyzed is not püre and natural honey.
In case of the presence of degradation products of antibiotics at the level of 0.5 µg/kg, the analyzed products are defined as honey containing residues. In addition, as the use of new technologies in laboratories increases, thanks to the new detection methods, fingerprints of the products can be seen and clear diagnoses can be made.

Our country is a beekeeping country. According to the data retrieved from the databases of The United Nations Food and Agriculture Organization (FAO) and the Türkiye Statistical Institute (TSI), Türkiye ranks second in world honey production after China and the beekeeping sector in Türkiye is is growing every year, thanks to the incentives and support given by the Ministry of Agriculture and Forestry. When the statistics of the Food Agriculture Organization FAO are analyzed, it is reported that 1.66 million tons of honey is produced in the world. World total honey export amount is 493.000 tons. Beeing the second biggest honey producing country in the world after China, Türkiye unfortunately does not rank among the top 15 countries in the export of honey. It is thought that this is mainly due to the average world honey price being lower compared to average Turkish honey priceour. However, it is also very important to carry out studies whihc raise awareness in order to increase the quality in our country based on product safety.

Product safety should be ensured from hive to spoon not only for honey but also in other bee products such as propolis, pollen, royal jelly which are approved by the Ministry of Health as a food supplements.

Increasing efficiency in honey and other bee products production, measures to be taken to improve quality and increase product reliability, compliance with regulations and method development studies by following the controls applied by the authorities is important..

Detection of Heat-Stable Peptides of Non-Muscular Origin in Boiled Sausages by LC-MS

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The quality of incoming raw materials to the plant is considered significant for the meat processing industry. The use of low-grade raw materials makes it possible to reduce the initial cost of the final product and increase its yield. Therefore, the actual task is the authentication of raw materials, which is closely related to the quality and safety of food products.

In our study, heat-stable peptides of non-meat ingredients in cooked sausages were tested. As objects for determining heat-stable peptides, we used model mixtures developed using the technology of boiled sausages with a given powdered milk content of 2.5% (w/w) without and after cooking. Proteins were extracted from the samples and digested with trypsin based on previously published studies (Khvostov et al., 2020). Peptide mixtures were analyzed by Triple Quadrupole LC/MS (6410, Agilent Technologies, Santa Clara, California, USA) (Khvostov et al., 2020). Using biomodeling in the Skyline software (https://skyline.ms/project/home/software/Skyline/begin.view), theoretical protein digestion was performed and selected reaction monitoring (SRMs) list per each peptide was obtained. STATISTICA 10.0 software was used for statistical analysis. Data were extracted from bioprograms in Microsoft Excel (USA).

To identify the presence of milk powder, two heat-stables from the α-s1-casein protein were selected (https://skyline.ms/project/home/software/Skyline/begin.view). Of the two peptides, only for **YLGYLEQLLR** were all SRM transitions obtained for the heat treated sample. The peak area for the curve was 4.5 * 10^6 cps. Under the condition of a linear decrease in signal intensity, it is possible to determine powdered milk to a level of 0.05% (w/w). The **YLGYLEQLLR** peptide can be used to quantify milk powder in cooked sausages. In the sample without heat treatment, there was a 30.0% decrease in intensity ($p<0.05$). For the second peptide **FFVAPFPEVFGK**, all SRM transitions were obtained only for the heat-treated sausage meat in the casing. Accordingly, the given marker contains the analysis of minced sausages, missed heat treatment.

Our studies show that heat treatment has a significant effect on peptide yield. This indicates the availability of cleavage sites under denaturing conditions. The **YLGYLEQLLR** peptide is well suited for measuring the level of milk powder in cooked meat products. As part of our current work, we provide a useful tool for both regulatory authorities (for assessing the authenticity of products) and for the food industry (for monitoring the supply of raw materials).

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Investigation of Ethyl Alcohol and Ethyl Ester Changes in Aegean Region Extra Virgin Olive Oils

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Research Hypothesis : Fatty acid ethyl esters in the extra virgin olive oil are an important parameter used in the determination of mild oil adulteration and quality. Hence, determining

the amount of ethyl ester above the legal limit is considered as a quality and purity problem. In this study, ethyl ester and ethyl alcohol which are the source of this formation in the virgin olive oils of the main olive varieties in the Aegean Region were investigated on the basis of region and variety.

Method : Extra virgin olive oil produced in the harvest years of 2020/21 and 2021/22 belonging to five different varieties from the local varieties of the Aegean Region were examined. The samples were collected from provinces ın the region by considering the district, maturity index, olive harvest time and duration of olive fruit after harvesting, technology of the olive mill, malaxation temperature and duration. Thus, the samples were guaranteed to be of extra virgin olive oil quality and were stored at 4 ^{0}C until the analysis were performed. For the purpose of the study, in order to the quality of the examined virgin olive oil samples; free fatty acid (FFA), peroxide value, absorbency in ultra violet, fatty acid ethyl and methyl esters (FAEE, FAME), ethanol and methanol contents were determined according to TGK Olive Oil and Pomace Oil Analysis method. The International Olive Council COI/T.20/Doc. No. 36 was used for determination of ethanol and methanol. The sample, which was heated at 110 ^{0}C in a hermetically sealed bottle until complete desorption of methanol and ethanol into the gas phase, was injected into a gas chromatography device with a flame ionization detector and a static headspace injection system when equilibrium was reached. All analysis were performed in 2 parallels. Evaluation of the results was done by SPSS program using two-way analysis of varience (factor1=region, factor 2= variety). Statistical significance was tested at the $\alpha = 0.05$ level.

Conclusion: In recent years, many studies have been carried out on how the whole process from the formation of the fruit to the storage conditions of virgin olive oil affected for the formation of alkyl esters, whether there is a relationship between sensory properties and alkyl esters and the effect of the amount of ethyl alcohol formed in the fruit on this esterification mechanism.

As a result of the analysis, it was determined that all olive oil samples were in the quality of virgin olive oil and there was a significant ($p<0,05$) difference between them in terms of quality parameters. When the ethyl and methyl alcohol levels of the samples are examined; a significant ($p<0,05$) difference was detected between the years 2020/21 and 2021/22.Within the scope of the study, the amount of ethanol was found to be between 0,30 mg/kg and 14,64mg/kg with an average of 3,15mg/kg. These results were found to be consistent with the findings of the study conducted by Garcia-Vico et al (2018). When the ethyl ester levels of the samples are examined, a significant ($p<0,05$) difference was detected between the years 2020/21 and 2021/22. Within the scope of the study, the amount of ethyl ester was found to be between 4,21 mg/kg and 27,36 mg/kg with an average of 15,17 mg/kg. The data obtained from the study showed that ethanol is found naturally in the fruits of Olea Eurupaea species, which are the main local varieties of our country, and therefore in all the oils obtained from them and its concentration is compatible with the theory that it is a function of variety, ripening index, climatology and growing conditions. However, considering the level of fatty acid ethyl esters of the samples and amount of ethyl alcohol that can be esterified during storage, it should not be overlooked that the finding of the possibility of exceeding the legislative limits in 25% of the samples is compatible with other international studies.

Argument : Determining the ethanol content, which is the source of fatty acid ethyl esters, which are indicators of quality and purity of extra virgin olive oil, before packaging the extra

virgin olive oil, will make agreat contribution to our industry in terms of predicting the shelf life in accordance with the legislation and will shed light on future studies.

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Ministry Works on Food Fraud

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The main goal of the Ministry of Agriculture and Forestry is to protect the consumer's health at the highest level. In line with this goal, The Ministry of Agriculture and Forestry has been carrying on its work continuously with the food safety perspective from field/farm to table.

In our country, the implementations for food safety are based on the European Union acquis, FAO/WHO standards and globally accepted scientifically-based approaches. The legislation studies has been carried out with a team of approximately 1000 persons, including the Ministry of Agriculture and Forestry, the Ministry of Health, the other relevant Ministries, universities, consumer representatives, NGO's (non governmental organizations) and industry representatives.

In addition, the studies are carried out with scientific commissions which are established in matters of certain food components and novel foods, plant health, biological hazards, contaminants, food additives, plants that can be used as food, feed, articles and materials in contact with food in order to make a risk assessment.

In order to ensure food safety, to prevent food fraud, to protect people's health and consumer interests, and to prevent unfair competition in the sector in our country, the official control activities are carried out with great care by our Ministry at all stages of the production, processing and distribution of food and food contact materials and articles.

In food official controls, the food production establishments, food sale establishments and food mass consumption places are subject to inspection 24/7 by our Provincial and District Directorates with approximately 7500 of our control officers. All necessary analyzes are carried out on the samples taken during the inspection in our 41 laboratories of our Ministry which have accreditation certificate. In addition to ensure domestic food safety, there are 105 Private Food Control Laboratories authorized by our Ministry for the control of foodstuffs which will be exported and imported.

Due to the use of very different chemicals (flavours, dyes, additives, water retainers, thickeners, etc.) in food fraud, sensory perception of the consumers is very limited, often impossible, to detect these chemicals. In the samples taken as a result of official controls, imitation-adulteration are detected with laboratory results.

Consumers/Individuals may convey all kind of complaints, feedbacks, requests for foodstuffs to the Alo174 Food Line and WhatsApp 0501 174 0 174 Call Center from anywhere in Türkiye. The denouncement and complaints received by these call centers are forwarded to the relevant Units of our Ministry, according to their content, by web-based software. Incoming applications are evaluated as soon as possible and the applicant is informed about the procedures.

In addition to the inspections carried out by our Ministry, the inspections carried out as a result of denouncement, complaints, the applications to CIMER and Alo 174 Food Line and WhatsApp report line made by consumers, also play a major role in detecting non-conformities in a timely manner.

In accordance with the "Veterinary Services, Phytosanitary, Food and Feed Law" numbered 5996 and the "Regulation on Official Controls of Food and Feed" prepared within the scope of this Law; the information icluding the name, brand, batch and/or serial number of the product, the name of the establishment produces/imports the foods that are confirmed to be imitated or adulterated by laboratory results and the establishment produces and/or sells the spoiled or imitated foods that endanger people's life and health is declared to the public. In this

context, 26 public announcements have been made since 2012, when the first public announcement was made, and 3,605 batches of products belonging to 1,609 establishments were presented to the information of consumers.

With the Law published on 04 November 2020 in order to protect the health and interests of consumers at the highest level and to prevent unfair competition in the sector, the sanctions regarding imitation and adulteration in foods have been aggravated. In this context, administrative fines changing from 50 thousand TL to 2 million TL, imprisonment, judicial fine and ban from food sector activities have been imposed on food business operators who imitate and adulterate, depending on their gross income. As a result of the legislative arrangements we have made and the measures we have taken, the number of noncomformities in the inspections has been reduced.

Food Safety Research in the EU: Consumers' Perception

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The European Food Safety Authority (EFSA) is scientific agency of the European Union - delivering trustworthy scientific advice and communication of risks from farm to fork is at the core of its mission. Risk communication is a key component of EFSA's work and the authority is committed to employing an audience- first approach, working closely with the European Commission, the Member States and other EU agencies working in the realm of "one health-one environment". What this means in practice is that EFSA generates and uses insights from social research, analyses the impact of its communication activities and focuses on personalising user experience across its communication tools, while accounting for cultural differences across the EU and extending multilingual approaches.

Social research at EFSA is organised in three areas/tracks: i) the "society" track that allows periodic monitoring of the factors required for audience segmentation and tailored communication with the public at large when it comes to human health, plant health, animal health and welfare as well as the environment; ii) the "ecosystem" track that includes targeted quantitative or qualitative studies to generate insights on a specific topic or from a specific audience group among EFSA's customers, partners, or stakeholders; and iii) the "personal" track that focuses on personalising user experience across EFSA's digital tools and channels.

Following the introduction of EFSA's audience-first approach and the three research tracks forming the basis for risk communication, the presentation will focus on the findings of the recent Eurobarometer study (a "society" track example). This study, commissioned by EFSA and published in September 2022, examines Europeans' perceptions of and attitudes towards food safety and provides insights in terms of: i) interest in food safety-related topics and factors affecting food-related decisions; ii) awareness of and main concerns about food safety topics, as well as attitudes towards healthy diets and food-related risks; iii) main information channels on food-related risks; iv) levels of trust in different actors from farm to fork; v) awareness of different aspects of the EU food safety system; and vi) behaviour in the area of food safety, using an example of a foodborne disease outbreak.

The survey was conducted in the 27 EU Member States and covered 26,509 respondents from different social and demographic groups. It provides a wealth of findings to support all actors in the EU food safety system in their public information and outreach efforts about food safety.

Ensuring Food Safety – Is Communication the Missing Link?

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Creatıng Food Safety Culture

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Culture is the way of thinking and behaving that characterize a social group. Effective integration of food science and behavioural science is needed to establish a behaviour-based food safety management system. For this, we need to change the way people do business, that is, their behaviour. A culture of food safety has been formed in businesses that have established this integration. In order to create an effective food safety culture in our organization, we must adopt an approach based on the food safety system. At this point, the most critical process is to establish a food safety culture in institutions. A food safety management system is generally process-oriented, while a behaviour-based food safety management system is both process- and behaviour-oriented. Instead of simple cause-effect thinking, it requires a complex structure based on an understanding of the role, feedback relationships, and relevance of all components in the system. It is very difficult to change behaviour, especially with regard to health and safety, and food safety professionals have developed methods in this regard. Many different communication channels can be used to adopt the Food Safety culture as a part of our corporate culture, the most important issue missed in these models. These are environmental and physical factors that affect the individual's desire to adapt, such as facility design, equipment selection. A lot can be said about the Food Safety culture by looking at the communication quality of an institution. Interactive communication should be established, not unilateral information on Food Safety, and employees should be listened to, asked questions and shared their ideas. Leaders have great duties and responsibilities in creating an effective food safety culture or improving the existing culture. It requires the voluntary commitment of leaders at all levels, starting with the most authoritative.

Food Safety Awareness in Cooking Programs on Turkish Television Channels

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Purpose: In recent years, in our country, as in many other countries, several different concepts of cooking programs in which both professional chefs, amateur chefs, and non-chefs, have

started to take part on TV channels to show and teach consumers appropriate food preparation and processing methods while cooking. It has been observed that consumers are not only able to learn various food preparation and processing methods through these programs but also can resolve some of the contradictions in their subconscious about whether foods and their preparation and processing methods while cooking are healthy or not. Considering that consumers directly adapt the behavior shown in these cooking programs to the food preparation and processing practices in their homes, it becomes more and more important each day to determine how much attention is paid to hygiene and sanitation rules and how accurately the consumers are informed about food safety through these cooking programs on TV channels. Since the potential effects of these programs on consumers are observed to be quite high, this study, which was carried out for the first time in our country, evaluated the wrong practices in terms of food safety in the cooking programs on Turkish Television Channels and also aimed to reveal the potential differences in hygiene and sanitation practices between professional chefs, amateur chefs, and non-chefs in these cooking programs.

Methodology/Approach: Between October 2019 and December 2020, a total of 100 cooking program episodes with different-concepts broadcast for the longest duration with high audiences, were selected from 3 different cooking program series (33 programs in which the meals are prepared by professional chefs in the form of interviews, 33 programs in which the meals are prepared by amateur chefs in the form of competition, and 34 programs in which the meals are prepared by non-chefs in the form of competition), and these programs were analyzed by 30 trained evaluators with the help of an observational food hygiene behavior measurement questionnaire showing the risk potential, risk level, and frequency of recurrence of 30 different malpractices made in terms of food hygiene.

Findings: In terms of food safety, an average of 4011 malpractices were detected in cooking programs with 100 episodes broadcast on Turkish Television Channels, which means 0.5 hygiene errors per minute. In other words, professional chefs, amateur chefs, and non-chefs in these cooking programs were found to make food safety mistakes at 0.98, 2.48, and 1.98 minutes, respectively. The most common mistakes made by professional and amateur chefs are analyzed as not covering their hair with a bonnet, not wearing a kitchen apron, and not removing jewelry such as their rings and watches, while it was analyzed that non-chefs generally do not wash their hands before they start preparing food and/or after touching raw food or after sneezing and coughing.

Originality: This study analyzes the food safety awareness of not only professional or amateur chefs but also non-chefs in cooking programs on Turkish Television Channels to take the existing literature on TV cooking programs one step further.

GFSI Principles in Supply Chain Management

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As the world's leading consumer goods companies, we are collaborating across borders and barriers to help ensure safe food for everyone. The Global Food Safety Initiative (GFSI; the Coalition) is a Coalition of Action from **The Consumer Goods Forum** (CGF), bringing together **42 retailers and manufacturers** from across the CGF membership and an extended food safety community to oversee food safety standards for businesses and help provide access to safe food for people everywhere. GFSI has engaged in a complete strategic overhaul for 3 years called the Race to the Top based on 5 features. The Race to the Top (RTTT) Framework proposes a collaborative enhancement of the oversight of the GFSI ecosystem with the aim of improving trust, transparency and confidence in GFSI-recognised certification and audit outcomes. Additionally, GFSI is seeking to stay true to its core purpose as a benchmarking and harmonisation organisation responsible for the 'what' – not the 'how' – of food safety. The first four fundamental features of the RTTT Framework were shaped with the support of a broad range of GFSI stakeholders and GFSI Board member companies, following an extensive consultation that focussed on our benchmarking and harmonisation activities. Phase 2 of the RTTT was launched in the Autumn 2020 and is focussed on driving improvements in our capability building tool, the GFSI Global Markets Programme. The presentation will give an overview of the RTTT.

Traceability in the Food Supply Chain by Blockchain

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The goal of our presentation is to give a synthetic yet clear comprehension of the blockchain technology, its technical, functional and organizational characteristics and its benefits. We will explain why we use blockchain, in the food industry to better trace food supply chain. We will go through the extent of the possibilities offered by this technology thanks to the collection of traceability data from the different actors of a food chain. We will present a usecase we developed with Mérieux NutriSciences to help Burger King France better prevent and control health risks. We will conclude on the key success factors of a blockchain traceability project in the food industry and the operating mode of a project deployment.

Food Safety in a Changing World and the BRCGS Food Safety v:9 Standard

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BRCGS improves brand and consumer confidence through its rigorous supply chain assurance services. They enable brand owners to confirm the safety, quality and authenticity of the goods and services, as well as evolving drivers such as health, human welfare and ethical performance. BRCGS's standards are used by over 32,000 manufacturers across 130 economies.

With the increasing population in the world, the reduction of resources, the supply chain becoming more complex, and the consumer expectation gradually improving, the concept of risk in the food sector is changing more and more every day. Manufacturers aim to manage the risk not only in their own facilities, but also by considering the entire supply chain.

It has been 24 years since the BRCGS, established by British Retailers in 1996, created the Food Safety standard to audit suppliers. With the complex supply chain and changing risks, the requirements and structure of the standard have changed to the same extent over time. The latest of these changes was announced in August 2022, when the 9th version of the Standard was published. The factors behind the updates of the standard, which will be audited from February 1, 2023, are the data collected during BRCGS audits, audit nonconformities and the reasons for the recalls made as well as GFSI benchmark document and Codex Alimentarius HACCP guidelines being upated.

There are changes not only in the content of the standard, but also in the audit protocol All facilities are required to receive one of the three inspections unannounced, even if they are registered within the announced program.

These changes are made with the aim of encouraging proactive, self-control mechanism high systems in the facilities. BRCGS is constantly innovating to create a quality eco-system that connects the supply network and embraces digital tools

Food Safety Development Program for Local Producers

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Procuring our products and services from those companies respecting human and the environment, is the cornerstone of our responsible business approach.

We identify the value, reputation, and positive and negative impacts of our suppliers in environmental, social and governance areas and support our suppliers with regard to their areas of development accordingly. We raise the level of awareness of our suppliers in this development roadmap on subjects such as quality standards, occupational health and safety human rights, ethical principles and environmentally friendly production methods, and we develop sustainable solutions together.

As Migros, we believe that regional development depends upon supporting local production and we developed models upon prioritization of the sales of reliable products purchased locally, in the same region.

Food Traceability

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The term traceability is defined as the ability to identify and trace the history of products, distribution network, origin and any applications made to the product in the areas of food and product safety, human rights, labor, environment and anti-corruption to ensure the credibility of claims regarding sustainability, food safety and quality.

As Metro Türkiye, by further expanding the definition of Traceability; We define it as a system where we present all stages of the food we offer to our customers, including the production, processing and distribution, to our consumers in a transparent and honest manner, thus tracking the process where the food comes from the source such as field, farm, cage, to our customer. Traceability, which is at the center of both our food safety and sustainability efforts; It is a way of working that we have been working on since 2014 and that we continue to build on it every year. We also carry out pioneering work to encourage all segments of traceability. "What's On Your Plate?" with his movement; As a pioneer in the sector in terms of traceability, we provide 100% traceability in meat, fish, fruit-vegetables and honey on the widest scale in Türkiye. And we continue to expand the scope every year.

POSTER BİLDİRİLER

Method Optimization for the Detection of Acidic Pesticides Using Alkaline Hydrolysis of their Esters and Conjugates in Tomato Matrix

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Hypothesis: The residues of acidic pesticides, 2,4-D, dichlorprop, fluazifop, haloxyfop and MCPA, on fresh foods should be monitored because their high health risk potentials in the mammals. The aim of this study was to validate an analytical method for the determination of these acidic pesticides using alkaline hydrolysis of their esters and conjugates such as 2,4-D-ethylhexylester, dichlorprop-butotyl, dichlorprop-methylester, dichlorprop-ethyl-hexylester, fluazifop-P-butyl, haloxyfop-ethoxyethylester, haloxyfop-methylester, MCPA-ethylhexylester and MCPA-methylester, in fresh tomato fruits by using LC-MS/MS.

Methods: The fresh tomato samples without pesticides were provided by Perla Fruit Company. The validation of the multi-residue analysis of each compound was evaluated by using LC-MS/MS according to SANTE/12682/2019 Guidelines. The extraction of the compounds were conducted by using modified QuEChERS method without PSA-clean up. Same samples were also analysed with standard QuEChERS method (AOAC 2007.01) for the comparison of the results. In the alkaline hydrolysis method, 15.0 ± 0.1 g of homogenized tomato sample was weighed in 50 mL polypropylene centrifuge tube and spiked with the standard mixture of the pesticides to prepare matrix-matched calibration. Then, 15.0 mL of acetonitrile and 1.5-3.0 ml of 5 mol/L NaOH was added to sample tube for simultaneous extraction and hydrolysis. The tubes were shaken for 30 min in a water bath set at 40 ± 1°C. The reaction was neutralized by the addition of 1.5-2.1 mL of 2.5 mol/L H_2SO_4. After the addition of buffer-salt mixture, the sample was immediately shaken vigorously and centrifuged for 5 min at 3000 g. After centrifugation, the upper supernatant layer were transferred to HPLC vials. To compare differences between the alkaline hydrolysis method and the standard QuEChERS method, the chemical residue levels of fresh tomato fruits were analysed in three replicates.

Results: With the alkaline hydrolysis method, the detection time for these compounds was found between 6.19 min to 8.12 min and no interference was observed. The linearities of all compounds were quite confident (R^2 = 0.991-0.998). The LOD and LOQ values were (2.67-3.06 µg kg^{-1}) and 3.08-4.38 (µg kg^{-1}), respectively. The values were under their MRL (10-60 µg kg^{-1}) for all pesticides. The recovery percentages of compounds for two spike levels (10 and 50 µgkg^{-1}) were calculated between 105.94-114.43% and 96.78-103.95%, respectively. The highest repeatability RDS_r and reproducibility RDS_R values were 19.04 and 19.08%, respectively. With the alkaline hydrolysis method, the concentrations of 2,4-D, dichlorprop, fluazifop, haloxyfop and MCPA were detected as free acids. Higher concentrations of 2,4-D, dichlorprop, fluazifop, haloxyfop and MCPA (418, 541, 99, 417 and 592%, respectively) were detected with alkaline hydrolysis method compared with the standard QuEChERS method.

Discussion: The findings obtained with the evaluation of all validation parameters showed that, the optimized alkaline hydrolysis method was compatible with the SANTE/12682/2019 and was reliable and effective enough to use for the detection of acidic pesticides in tomato samples using LC MS/MS. To increase export potential of tomato and decrease health risks of acidic pesticides, the wider use of optimized alkaline hydrolysis method in Food Control

Laboratories is highly recommended. This study was funded with as a research project (grant number ULUTEK STB079417) by Perla Fruit Company.

Assessment of Synergistic Effect of Aloe-Vera and Sunflower Edible Coating on Quality Attributes of Strawberry

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Strawberry (*Fragaria × ananassa*) belongs to the Rosaceae family and has gained worldwide popularity, but its marketability has been limited owing to its short life. Several approaches have been explored to address the alarming situation of postharvest losses. Recently, edible coating has gained a lot of attention because of their ecofriendly nature. In present study, gelatin-based edible coatings with varying concentrations of aloe-vera and sunflower oil were prepared. Moreover, a ternary edible film was also prepared to check their effect on strawberry fruit with respect to their postharvest loss and allied nutritional attributes. Six conducts were carried on fruit with the treatments: T_0 (control), T_1 (5%gelatin), T_2 (5%gelatin, 45% aloe), T_3 (5%gelatin, 90%aloe), T_4 (5%gelatin, 5%SO), T_5 (5%gelatin, 10%SO), T_6 (5%gelatin, 90%aloe, 5%SO) respectively using storage intervals of days 0,3,6,9,12 for (4℃) control climate and 0,1,3,5,7 for room temperature (20℃) condition. Results showed that significant variations were expounded in physiochemical analysis; maximum weight loss occur for fruit kept at 4℃ in T_0 (0.00-6.80)g minimum for T_6 (0.00-3.15)g and for 20℃ maximum weight loss occur in T_0 (0.00-9.22)g and minimum for T_6 from initiation to termination of trial. However, pH differed appreciably with respect to treatment and storage mean value varying for control ranged (3.26- 3.72) among different treatments and for room (3.29-4.40). Acidity value for control trial varied from (0.418-0.521), and for room (0.387-0.499). However, TSS differed appreciably with value ranged from (8.94-10.74)°Brix for control whilst for room trial (8.89-12.51)°Brix. Meanwhile, ascorbic acid level differed appreciably as factor of storage among all treatments value varying from 42.84-53.75(mg/100g) for control and for room 36.15-49.95(mg/100g). Value for total pate count varying significantly value range from 3.01 to 5.82 CFU/g for control and for room trial 3.02-8.15 CFU/g. Likewise, colour of treated strawberries differed appreciably as function of treatment and storage. Furthermore, sensory evaluation of both the experiments indicated a significant interaction with respect to treatment and storage. The result exhibited that all gelatin-based coating treatment have capacity to show resistance against factors that affect the quality of fruit, but much encouraging treatment was (T6) gelatin with addition of antimicrobial (aloe-vera) and water-resistant ingredient (sunflower oil) that not only extended the shelf life but also remained the quality parameters at suitable level in physiochemical analysis. Conclusively, it may be inferred that T6 (gelatin + aloe + SO) have better potential to curtail postharvest and nutritional losses of strawberry.

Opportunities for Recovery of Waste From Olive Meals

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Olive oil production is one of the main agricultural branches in the Mediterranean region. The olive meal is among the by-products of the olive oil manufacturing process. It is obtained in large quantities. This waste can be added to broiler feed without harmful effects (Sayehban et al., 2016), it can be a potential raw material for biofuel production (Volpe et alç, 2018) or it can be used as compost material. Composting is actually considered to be one of the best waste management processes, the product of which in application into the soil systems leads to improvement of the basic soil characteristics and properties (Papafilippaki et al., 2015).

The **aim** of the present study is to evaluate the micro- and macro components, the organic and inorganic contents of olive meals as a preliminary stage towards its utilization as an additive to livestock fodder and compost materials.

Methods: For determination of the main nutrients (N, P, K, Ca, Mg, C), some microelements and heavy metals (Al, Co, Cu, Fe, Zn, Ni, Cd, Mn, Mo, Pb, Cr, As, Se, and Sr), were used the analytical methods of FAAS, ISP-MS and ATR-FTIR spectroscopy. For analysis of parameters as moisture and contents of volatile compounds, raw oil, raw fibers, raw proteins, ash residues and insoluble ash, some classical chemical analysis, were applied.

Results and discussion: The physicochemical parameters obtained show that the olive meals studied are characterized by high contents of moisture, volatile compounds (71.8 %) and raw oil (24.1 %). while that of the basic nutrients (N, P, and K) indicates that potassium (K) has the highest concentration (2.24 %). The presence of nitrogen is not enough in terms of using this product as compost, which is why this will lead to some problems in connection with its implementation. Most probably additional quantities of nitrogen have to be introduced. The content of heavy metals and metalloids in the product studied is determined by the olives themselves. The wet olive meals are usually characterized by low mineral content. It is worth noting that Fe content amounts to 13,4 mg kg^{-1}, while no Se is found. Most of the toxic elements are not found, while those which are present have concentrations lower than the limit values. The characteristic signals of the IR spectrum of the olive meal indicate the main organic constituents of the sample. The high moisture and polyphenol contents are evident from the characteristic peak centered at 3325 cm^{-1}. The presence of lipids could be evaluated from the signals at 2926 cm^{-1} and 2857 cm^{-1} attributed to CH_2 antisymmetric and symmetric stretching, respectively. The cellulose content can be estimated on the ground of the COC, CC, and CO stretching signals at 1157 cm^{-1}, 1102 cm^{-1}, and 1028 cm^{-1}, respectively.

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Probing the Nutritional and Safety Assessment of Infant Formula Available in Pakistani Market

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The purpose of the current work is to explicit the nutritional profile of different infant formula available in the Faisalabad-Pakistan local market and also to determine their safety status. For the purpose, different infant formula brands were procured. In 1st phase, nutritional profile *i.e.* moisture, protein, ash, fiber and fat were elucidated via their respective processes, whereas the microorganisms detection such as *Salmonella,* Yeasts and Molds Count and Total Bacteria Count was carried out through their methods. Additionally, amino acids were assessed via paper chromatography. For amino acid profile, different infant formula showed highly significant results. Mean value varied from 2.91 to 7.02%, 5.01 to 7.02% and 2.42 to 2.974% among lysine, valine and cysteine, respectively. Moreover, moisture content, crude proteins, crude fat, crude fiber, ash content and nitrogen free extract (NFE) varied from 1.52 to 4.03g/100g, 11.05 to 15.07g/100g, 10.03 to 27.03g/100g, 1.05 to 3.98g/100g, 2.03 to 3.97g/100g and 49.45 to 70.02g/100g, respectively in different infant formulas. Moreover, Salmonella was not present in infant formula. Whereas yeast and mold counts were found in amounts of ≤2 cfu/g to ≤10cfu/g in different infant formula brands. Moreover, total bacteria count was exhibited in the range of 2.3×10^3cfu/g to 6.2×10^3cfu/g among different infant formula brands. Infant formula brands contained high amounts of heavy metals i.e. 0.91PPM of lead content followed by cadmium and aluminum as 0.28PPM to 0.42PPM and 1.48PPM to 1.72PPM, respectively. Conclusively, it is evident from whole research that obtained results regarding nutritional and safety assessment of different infant formula brands will be beneficial for consumer level as well as industrial level.

Effect of Chitosan and Lauric Arginate Edible Coating on Bacteriological Quality, Deterioration Criteria, and Sensory Attributes of Frozen Stored Chicken Meat

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This study was carried out to investigate the effects of using chitosan, a natural polycationic linear polysaccharide derived from chitin, as an edible coating alone and its incorporation with the cationic surfactant lauric arginate at two different temperatures on the bacterial quality, deterioration criteria, and organoleptic characteristics of chicken meat. Therefore, six groups of chicken drumsticks were treated as follows: 20 g/kg chitosan at 25 ºC and 50 ºC ($CH_{25;}$ CH_{50}); 20 g/kg chitosan mixed with 20 g/kg lauric arginate at 25 ºC and 50 ºC (M_{25}; M50); and control untreated samples in DW at 25 ºC and 50 ºC ($C_{25;}$ C_{50}). All treated and control untreated chicken drumsticks were exposed to bacteriological examination for the enumeration of total mesophilic aerobic bacteria, presumptive Staphylococcus *aureus* and enterobacteriaceae. Values of pH, total volatile base nitrogen (TVBN, mg %), and thiobarbituric acid (TBA, mg/kg) were also measured to assess deterioration criteria. Sensory examination was implemented on cooked samples and assessed by an odd number of experienced panellists for the following attributes: appearance, flavor, tenderness, juiciness, and overall acceptability. All data were statistically analysed with SPSS 17.0 for Windows, and significance was determined using the least square difference test (LSD) at the $P < 0.05$ level. The results revealed a significant ($P < 0.05$) reduction of all investigated bacterial counts (more than 2 $\log_{10}$ CFU/g reduction) in all treated groups as compared to control groups at all examination times. In addition, *S. aureus* and enterobacteriaceae counts (in CH_{25} and CH_{50}) and all investigated bacterial counts (in M_{25} and M_{50}) were under detectable levels at all times. All treated chicken drumsticks showed significant ($P < 0.05$) reductions in pH values as compared to untreated ones. In addition, all chicken drumstick samples exposed to 50 ºC had significantly ($P < 0.05$) higher pH values; especially in C_{50} as compared to 25 ºC treated samples. Regarding the results of TBA values, all treated chicken drumsticks showed a significant ($P < 0.05$) lower in TBA values at 25 and 50 ºC as compared to control groups. Moreover, the TBA value in C_{50} was significantly ($P < 0.05$) higher than that in C25.There was no significant ($P < 0.05$) difference in TVBN value among groups at any examination time. Coating of chicken drumstick samples with chitosan and chitosan incorporated with lauric arginate showed significant ($P < 0.05$) improvements in appearance (at the 3rd month), flavor (at the first, 2nd, and 3rd months), and tenderness, juiciness, and overall acceptability (at all examination times). Moreover, chicken drumsticks treated with M_{25} and M_{50} showed significant ($P < 0.05$) improvements in all sensory attributes, especially flavour and tenderness, as compared to those treated with CH_{25} and CH_{50}. In addition, the obtained scores were higher in all treated groups at 50 ºC. It could be concluded that chitosan coating alone or in combination with LAE could decrease the microbial load and improve the oxidative stability along with the sensory characteristics of frozen stored chicken drumsticks. Therefore, such a novel application can be used as a prospective decontamination intervention in poultry processing plants.

Enhanced Immunochromatographic Test Systems for Sensitive Detection of Two Aquatic Toxins in Water and Food Products

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Among food contaminants, a special place belongs to aquatic toxins – hazardous compounds produced by microalgae and cyanobacteria living in the world ocean. Human consumption of food products contaminated with aquatic toxins may lead to acute poisoning and long-term adverse effects. Priority toxins include microcystin-LR (MC-LR) and okadaic acid (OA) released by cyanobacteria and dinoflagellate algae, respectively. Concern about food quality necessitates the control of aquatic toxins in raw materials and foodstuffs. Therefore, the development of analytical methods, which enable quick obtaining information about the presence and level of aquatic toxins, is of fundamental importance. Such opportunities are provided by immunochromatographic analysis (ICA), which is characterized by simplicity, rapidness, specificity, and low cost. These advantages determine its effectiveness for mass point-of-care screening of real samples. The demand for the ICA largely depends on its sensitivity. Therefore, the approaches aimed at reducing the limit of detection (LOD) of aquatic toxins are the relevant issue.

In this study, several techniques to increase the sensitivity of the ICA of MC-LR and OA have been implemented. All of them were based on the enhancement of the colorimetric signal of the marker, which, in turn, allowed reducing the concentration of specific antibodies thus decreasing LODs. In all ICAs, the indirect introduction of the label (its conjugation with anti-species antibodies) was used, which, according to our previous studies, provided more sensitive detection of the analyte compared to the direct ICA, where labeled specific antibodies were applied. In the first approach, gold nanoparticles (AuNPs) with a developed surface (nanoflowers) were used instead of traditional spherical AuNPs. This provided more intense and contrasting coloration of the zones of test strips. As a result, the LOD of MC-LR decreased by 2 times (down to 0.1 ng/mL).

The second technique was based on magnetic nanoparticles (MNPs) as a label and a carrier for anti-species antibodies. The amplification of the colorimetric signal of the brown-colored MNPs was provided by the peroxidase tag immobilized on their surface. A colored product of the enzymatic reaction contributed to the signal intensity. Such a combination allowed reducing the LOD of MC-LR down to 2 pg/mL.

In the third method, the additional stage was introduced, which ensured the coloration enhancement by hydroquinone-based reduction of silver ions on the surface of AuNPs. As a result, the MC-LR LOD of 0.05 ng/mL was achieved. In the fourth approach, OA was detected using the ICA with a cascade amplification of AuNPs' colorimetric signal. Its intensification was provided by a cascade of sequential immune reactions that occurred as a result of the passage of labeled and free antibodies along the membranes. These reactions promoted the formation of aggregates with a branched structure, where one antigen-antibody complex induced the binding of a large amount of the gold label. This format enabled a reduction of the OA LOD by almost 7 times (down to 30 pg/mL) and a cutoff by 2 times (down to 1 ng/mL). In the fifth technique, the ICA of OA based on nanozymes was implemented. Au@Pt core@shell nanoparticles having peroxidase-mimicking activity were used as a label. The achieved OA LOD was 10 times lower than that in the ICA with traditional AuNPs.

Overall, the developed ICA formats led to a decrease in the LOD of aquatic toxins from 2 to 100 times. The universality of the proposed approaches allows for recommending them for the highly sensitive detection of other contaminants. All variants of the enhanced ICAs have been successfully tested for the detection of MC-LR and OA in samples of seawater, fresh water, fish, and seafood.

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Successful Preservation of *Helichrysum plicatum* L. Flowers Extract Using Novel Carriers by Spray Drying Method

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Research hypothesis: Everlasting flowers (genus *Helichrysum*) represent a significant source of pharmacologically active secondary metabolites (flavonoids naringenin, kaempferol, apigenin) related to proven spasmolytic, antioxidant, and antimicrobial activity. A critical point in development of polyphenol rich extracts of *H. plicatum* is their limited stability, which can be solved using microencapsulation technique spray drying.

Method : *Helichrysum* flower extract was spray dried using four different carriers, and their combinations. Besides the conventional ones (maltodextrin-MD, whey protein-WP, 20%, w/w), innovative carriers, cyclodextrins (beta-cyclodextrin-BCD, hydroxy-propyl-beta-cyclodextrin-HPCD, 15%, w/w) have been proposed to overcome the extract limitations. The liquid feed was spray dried in a Labtex ESDTi spray dryer, under following conditions: inlet 130 ± 5°C and outlet 70 ± 5°C temperatures, spraying air flow rate (75 m^3/h), liquid feed (11 mL/min rate), atomization pressure (2 bar). The spray-dried *Helichrysum* extract (HE) was obtained and used for further analyses: total polyphenols and flavonoids contents, spectrophotometrically and individual components by HPLC method. The dried extracts were stored in brown glass tubes for 6 months under room temperature in order to determine changes in the content of total and individual compounds during period of real storage. Samples were placed at in stability chamber (Memmert, Schwabach, Germany), in the absence of light, during one month in order to determine the effect of storage during accelerated stability test. All experiments were executed in triplicates. One-way ANOVA was conducted to test the individual factors AND Duncan *post hoc* test for differences between the mean values detection (STATISTICA v.7.0.3, MS Office Excel v. 2010).

Results : Obtained powders manifested high encapsulation efficiency (more than 80%), confirming spray drying as adequate microencapsulation technique. Spray dried HE, without a carrier addition, exhibited 97.32% and powders microencapsulated using carriers ranged from 80.07 (HE+HPCD+MD) to 96.45% (HE+HPCD) of EE%, suggesting HEs active compounds are successfully microencapsulated into examined carriers. Spray-dried HE exhibited 106.32 mg GAE/g of polyphenol content, and powders produced using different polymers ranged from 83.25 (HE+HPCD+WP) to 100.28 mg GAE/g (HE+HPCD). The highest total flavonoids content was achieved in spray-dried HE. Among powders obtained using carriers, total flavonoids ranged from 15.66 (HE+HPCD+WP) to 21.55 (HE+HPCD) mg catechin/g. HPCD complexes exhibited the highest polyphenols and flavonoids content. Results of HPLC method confirmed that mainly presented flavonoids in obtained powders were naringenin, kaempferol, quercitrin, isoquercitrin, apigenin, and apigenin and naringenin derivates. Kaempferol-3-O-glycoside was the most dominant compound presented in all tested samples. Analysis of total polyphenols, flavonoids and individual compounds were carried after one

month of accelerated and 6 months of real storage conditions. After one-month, total polyphenols and flavonoids increased in all examined samples. During the accelerated storage, water migrate from CDs and other carrier complexes, resulting the higher concentration. After 6 months, total polyphenols and flavonoids increased compared to the contents before storage tests, while decreased compared to 30 days without statistical significance. Content of individual compounds did not decrease significantly after 6 months, indicating that process of spray drying was suitable for stabilization of HE active compounds and indicating good preservation using polymers.

Discussion : Spray drying of *Helichrysum* flower extract to obtain powders with high retention of bioactive compounds was evaluated. All microencapsulated bioactive principles reached high content and preservation during storage, based on good preservation. This could be important for further use in pharmaceutical and food industry due to its confirmed health benefits.

Fate of Verocytotoxin-Producing *Escherichia coli* During the Cheese-Making of Provolone, a Traditional Italian Stretched Cheese

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Research Hypothesis: Raw milk cheeses are possible vehicles of Verocytotoxin-producing *Escherichia coli* (VTEC), being healthy cattle a reservoir of this microorganism. Since VTEC can causes severe illness, aim of the study was to follow the behaviour of VTEC, experimentally inoculated in raw milk, during the cheese-making of Provolone, stretched raw milk cheese.

Methods: Wild strain VTEC, isolated from raw milk, was sub-cultured two times in BHI at 37 °C for 18-24 h. Provolone was experimentally produced in a pilot plant. About 400 L of raw milk was collected. Milk was inoculated either with physiological solution (1 % v/v) (control samples) or with VTEC (1 % v/v) (contaminated samples). Rennet and starter cultures have been added to the milk, after 30 min at 32°C the coagulum was broken and extract, then, after 4 h at 45°C, mature curd was cut in strips and stretched for 10 minutes with water at 68 °C. Stretched curd was cooled in 5 kg steel moulds, salted in brine, Provolone cheese was, then, aged for 60 days at 10 °C. Temperature, pH and concentration of lactic acid bacteria (LAB) were monitored in control samples; while VTEC concentration in contaminated ones. VTEC concentration has been determined by surface plating on CT-SMAC agar incubated at 37 °C for 24 h. Analysis were carried out in raw milk, mature curd, stretched curd and Provolone cheese at 60 days of aging. Bacterial counts were converted to log CFU /g. The individual means and standard deviations were determined from the average of two samples (n = 2; N = 1).

Results: In control samples, the temperature of the stretched curd was 60 °C. pH value decreased from 6.73 ± 0.01 in raw milk, to 4.99 ± 0.04 in the mature curd and was 5.02 ± 0.01 and 5.12 ± 0 in stretched curd and Provolone cheese respectively. LAB concentration was 3.58 ± 0.01 log CFU / ml in raw milk, 7.7 ± 0.54 log CFU / g in the mature curd and was 6.99 ± 0.44 log CFU / g and 7.41 ± 0.25 log CFU / g in stretched curd and Provolone cheese respectively. In contaminated samples, VTEC concentration was 6.1 ± 0.02 log CFU / ml in raw milk, 4.86 ± 0.08 log CFU / g in the mature curd and drop under the detection limit (<1 CFU / g) in both stretched curd and Provolone cheese. In synergic way, low pH, LAB presence, heat implement the safety of the Provolone cheese. VTEC concentration, in fact, decreased during the cheese making. Monitoring the water temperature and the time of the stretching phase could be a good strategy to increase the safety of stretched cheese made by raw milk.

Discussion: Curd stretching phase, in raw milk cheeses, still plays an important role in implementing the safety of this type of products. This study suggested that VTEC experimentally inoculated in milk decreased more than 5 log CFU / g during the cheese-making. The results of the presented study can be useful for producers and Competent Authorities to evaluate the safety of Provolone cheese according to the production process.

Effect of Chemical Interesterification and Post-Adsorption On 3 – MCPD & GE Levels in Palm Olein Oil and Investigation of the Melting Characteristics

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Research Hypothesis: 3 – MCPD (3-Monochloropropane-1,2-diol) and glycidyl esters (GE) are contaminants with carcinogenic and/or genotoxic properties, which are formed as a result of heat treatment in refined oils and/or fatty foods and have negative effects on human health. In this study investigated the reduction of these contaminants as a result of chemical interesterification and post-adsorption process in palm olein oil, which contains higher 3-MCPD and GE than other vegetable oils.

Method: Within the scope of the study, pre-refined (RBD) palm olein oil obtained from Küçükbay Yağ ve Deterjan Sanayi A.Ş. was used. Chemical interesterification was applied using sodium methylate to palm olein oil for 30 minutes at 80°C. After the interesterification process, reaction was stopped using 2 different earth types (natural and acid-activated) and 2 different earth amounts (3% and 6%) for post-adsorption under vacuum for 45 minutes. Samples were collected by filtering and stored at -18°C until the analyzes were performed. Before and after chemical interesterification with post-adsorption, 3 – MCPD and GE amounts of the samples and palm olein oil were determined in the GC-MS device using the DGF C-VI 18(10) standard method and solid fat contents of samples were measured at 4 different temperatures (10, 20, 30 and 35°C) using an NMR device. All analyzes were performed in 2 parallels. The results were evaluated in the SPSS program using a two-way analysis of variance (Factor 1 = earth type, Factor 2 = earth amount). Statistical significance was tested at the α = 0.05 level.

Results & Discussions: As a result of the analyzes, a significant ($p<0.05$) difference was detected between both the earth type used and the amount of earth added at 3 – MCPD levels. When the decreases in the 3 – MCPD amounts of the samples were examined, there was an 80.5% decrease in acid-activated earth compared to palm olein in 3% earth content, while a 96.56% decrease was found in the same amount of natural earth usage. At 6% earth content, samples showed a 56% reduction in the amount of 3-MCPD in acid-activated earth compared to palm olein. At the same time, a decrease of 98.3% was detected when natural earth was used. In the GE results, it was determined that acid-activated earth provided a 38.4% decrease in 3% earth content, while the same amount of natural earth caused an 82.9% decrease. In 6% earth content, it was determined that acid-activated earth caused a 97% reduction, while the same amount of natural earth provided a 98.06% reduction. When the 3-MCPD and GE results of all samples are examined; It has been determined that natural earth performs better than acid-activated earth. Based on the difference between the amounts of earth, it was determined that 6% earth content caused a more effective decrease. When the solid fat contents of the samples at 10, 20, 30 and 35°C were examined, it was determined that there were no differences between the samples, so the amount of earth and the type of

earth used did not have any effect on the solid oil content. In addition, according to the regulation of the European Union dated January 1, 2021; It has been determined that both the amount of earth and the type of earth used are by the limit values of 1.25 ppm and 1 ppm, for 3 – MCPD and GE in oils, respectively.

Conclusion: As a result of the study, it was revealed that palm olein with high 3-MCPD and GE content could be reduced below the limit values with chemical interesterification and post-adsorption process. The lowest values were obtained with the use of 6% natural earth. The fact that palm olein oil, which is widely used in the food industry, is low in harmful contaminants, will make a great contribution to the literature and will shed light on future studies.

Investıgation of 3-MCPD & GE Levels in Potatoes Obtained After Frying Process Using Palm Olein Oil With Artificial and Natural Antioxidants

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Research Hypothesis: 3-MCPD and glycidyl esters are carcinogenic and genotoxic food contaminants composed as a result of heat treatment. These contaminants hurt health due to the high temperature applied during the frying process. In this study, the changes in 3-MCPD and GE levels of potato samples were determined during the deep frying process with palm olein oil.

Method: In the study, palm olein oil supplied from Küçükbay Yağ ve Deterjan Sanayi A.Ş was used. BHT and BHA as synthetic antioxidants; as natural antioxidants lyophilized nettle and olive leaf extracts prepared using 70:30 (v/v) ethanol/water were added into palm olein oil. 100 g sliced potatoes were subjected to a frying process for 3 days using 180°C/2.5 min process parameters in 4L oil and potato samples were taken periodically. Fried potato samples were stored at -18°C until the extraction process was carried out. First of all, Potato samples were homogenized using a waring blender and extracted using 100 mL of 1:1 (v/v) diethyl ether/petroleum ether. The oils obtained after extraction were stored under nitrogen gas at -18°C until analysis. 3-MCPD and GE quantities of the samples were determined using the DGF C-VI 18(10) standard method in the GC-MS instrument. During the study, the frying process was performed in 2 replication, and the analyzes were made in 2 parallels. The results were evaluated using a two-way analysis of variance in the SPSS program (Factor 1 = sample difference, Factor 2 = process difference). Statistical significance was tested at the $\alpha = 0.05$ level.

Results: As a result of the analysis, when the 3-MCPD results were investigated, a significant difference ($p<0.05$) was determined between both the antioxidants used and the frying processes applied. Among the antioxidants used, 3-MCPD quantities were found to be the highest in the potato samples taken on the 3rd day of the 16th frying fried with frying oil containing nettle extract. On the other hand, 3-MCPD quantities were found to be the lowest in the potato samples taken on the 3rd day of the 16th fried with frying oil containing BHT+BHA. When the 3-MCPD quantities were investigated, they were sorted as BHT+BHA<BHT<Control<Olive Leaf Extract<Nettle Extract. When all 3-MCPD results were investigated, the group with the highest 3-MCPD degradation was determined as BHT+BHA. As well, when the results of Glycidyl Ester were investigated, a significant ($p<0.05$) difference was found between the antioxidants used no significant difference was detected between the frying processes applied. Glycidyl Ester quantities were found to be the lowest in the potato samples taken on the 3rd day of the 16th frying fried with control group oil. The lowest Glycidyl Ester amount was found in the sample used nettle extract. When sorted by GE results, Nettle Extract<Olive Leaf Extract<BHT+BHA<BHT<Control was determined. When both 3-MCPD and Glycidyl Ester results were investigated, it was determined that Stinging Nettle Extract had the

highest protection against 3-MCPD degradation and kept the formation of Glycidyl Ester at a minimum level. When compared with other antioxidants, it was determined that Nettle Extract had the highest protection against the formation of Glycidyl Ester. Besides, as a result of the 3-MCPD decomposition with the frying process, not only Glycidyl Ester but also other thermal source contaminants are formed. In general, when all the results are investigated, the frying process reduces the quantities of 3-MCPD in the products and causes the formation of Glycidyl Ester.

Conclusion: In the study, it was determined that the industrial frying process using Nettle Extract prevents the formation of 3-MCPD and GE, which are harmful to health contaminants in the product. The fact that potato fries which are frequently consumed all over the world are low in these contaminants is an important finding in terms of health, and it is thought that it will shed light on future studies.

The Actinometric and Radiochromic Film Dosimetry Techniques for Determining UV Fluence (Dose)

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Research hypothesis: Widely used for surface decontamination, UV-C irradiation is challenging when applied to non-planar and rough surfaces due to uneven UV fluence (dose) distribution. Radiochromic films (RCFs) can be an alternative to existing biodosimetry and actinometry techniques for non-uniform UV fluence measurement on food surfaces.

Method: In this study, the actinometry UV fluence measurement technique was compared with radiochromic film (RCF) dosimetry technique. Potassium Iodide/Iodate actinometry was used with some modifications in the actinometry technique (Rahn, 1997). UV irradiance values at the specified distances (2-12 cm) were estimated according to Bolton et al. (2011). Then, UV fluence values were calculated by multiplication of the UV irradiance values and different exposure times (2-20 s). In the RCF dosimetry technique, radiochromic films (FWT-60-00, Far West Co., Goleta, CA, USA) were exposed to UV rays at different vertical distances from the UV lamp with exposure times ranging from 2 to 20 s. At different levels of UV irradiation, the color of the RCF changed from light blue to dark blue. UV fluence was determined depending on the total color change of RCFs. The color change of RCFs was measured with a computer vision system via MATLAB program and a chromameter (CM, Konica Minolta CR-400).

Result: It was shown that the UV fluence measured with the actinometric method decreased exponentially with increasing vertical distance but linearly increased with exposure times. The minimum UV fluence (Hact,minimum= 1.77 mJ/cm2) value was obtained at a 12 cm distance and 2 s treatment period, while the maximum UV current (Hact=124.4 mJ/cm^2) was reached at a 2 cm distance from the lamp and 20 s treatment time was applied. In the radiochromic film dosimetry experiments, films turned from transparent blue color to deep blue color so quickly and irreversibly under the UV-C light and reached a constant color intensity. The lighter colors were obtained at the furthest distance, which means the minimum irradiance value and the shortest exposure time, but the darker colors were obtained at the nearest location (higher irradiance) and the longest exposure time. It was revealed that there was a linear correlation between the color change of RCF and UV fluence. The maximum UV fluence determined using the RCF dosimetry technique at 254 nm was approximately 60 mJ/cm^2.

Discussion: It was concluded that the UV dose distribution on the surfaces could be found by considering the changes in the colors of the RCFs. However, the usability of RCFs on food surfaces needs to be tested.

Antioxidant and Antimicrobial Activities, and Its Application for Shelf-life Extension of Refrigerated Asian seabass (*Lates calcarifer*) Slices

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Research hypothesis: Chitosan (CS) considered as an excellent biopolymer for bioactive films, however it is soluble in aqueous acid, which results in strong smell and flavor in foods. To avoid this, CS-epigallocatechin gallate (EGCG) conjugate (CEC) possess with enhanced water solubility and bioactivities was incorporated in CS film solution to develop CS/CEC composite (CS/CEC-COMP) film. CS/CEC-COMP film was prepared to enhance the bioactivities of CS films and its application for shelf-life extension of Asian seabass slices (ASBS) stored in air or under vacuum packaging at 4 ºC.

Methods*:* CS (1%, w/v) and CEC (1%, w/v) were dissolved in acetic acid (1%, v/v) and water, respectively. Both solutions were mixed in ratio of 8:2 (v/v) to prepare CS/CEC-COMP film. CS film (without CEC) was used as control. Antioxidant (AO) and antimicrobial (AM) activities of resulting CS and CS/CEC-COMP films were determined. Further, ASBS were packed in CS and CS/CEC-COMP films for shelf-life extension, in which microbiological, chemical, and sensory properties were monitored during storage at 4 ºC for 15 days.

Results*:* CS/CEC-COMP film had higher total phenolic content (18.69 mg EGCG equivalent/g sample) and AO activities than CS film ($p<0.05$). CS/CEC-COMP film showed enhanced growth zone inhibition toward *Pseudomonas aeruginosa* (18.3 mm) and *Listeria monocytogenes* (21.3 mm) ($p<0.05$). The SEM images of tested bacteria confirmed the antimicrobial activity of CS/CEC-COMP film. ASBS wrapped with CS/CEC-COMP film and packed under vacuum (ASBS-COMP-VP) conditions resulted in the lower microbial loads ($<10^6$ CFU/g) than other samples ($p<0.05$) up to 15 days. ASBS-COMP-VP possessed the lower oxidation of polyunsaturated fatty acids, which was mainly caused by free radical scavenging and antimicrobial activities of CS/CEC-COMP film.

Discussion*:* TPC increase of CS/CEC-COMP film was associated with the augmented reducing ability. This was more likely due to the donation of hydrogens from CS at C-2 (NH2), C-3 (OH) and C-6 (OH) as well as hydroxyl groups from EGCG. EGCG has 8 OH-groups, with OH-groups at carbon 3, 4 and 5 and a gallate moiety at C-3 considered as excellent electron donors and cause disruption of bacterial cell wall, which plausibly related to higher AO and AM activities, respectively of CS/CEC-COMP film. Moreover, the ability of EGCG to delocalize electrons might contribute enhanced bioactivities. Microbial growth in ASBS was decreased because of antimicrobial activity of CS/CEC-COMP films. Moreover, vacuum atmosphere and bioactive films synergistically acted towards bacterial inhibition.

Significance*:* CS/CEC-COMP film had higher the bioactivities than CS film. Furthermore, shelf-life of ASBS with sensory acceptability prolonged for at least 12 days at 4 °C.

Partial Characterization of Bacteriocin-like Compounds Isolated From *Petroselinum crispum* Fermented Juice

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Nitrate-reducing bacteria can convert vegetable nitrate into natural nitrite allowing clean label status. In the fermentation process, nitrate reduction is accompanied by the biosynthesis of natural antibiotics, called bacteriocins. Bacteriocins are synthesized by almost every bacterial species and are defined as biologically active proteins or peptides able to inhibit the growth of similar or closely related bacterial strains.
The aim of this work was to find out if nitrate-reducing bacteria *Staphylococcus carnosus,* has an efficient fermentation process to generate bacteriocins, in parsley (*Petroselinum crispum*) juice and to partial characterization the biosynthesized bacteriocins.
Parsley roots juice, sterilized and inoculated with 10^7–10^8 CFU/mL activated strains of *Staphylococcus carnosus* at 37 °C for 24±2 h, was centrifuged at 9000 rpm for 30 min. The obtained supernatant free of cells was used for isolation and partial characterization of the bacteriocins. The proteins and the peptides present in the supernatant were subsequently precipitated with 60 – 90% ammonium sulfate. The precipitated proteins and peptides were collected by centrifugation at 9000 rpm for 30 min and dissolved in phosphate buffer (0.01 M PB, pH 7.0), and dialyzed overnight.
Heat treatment of dialyzed fractions of bacteriocins was conducted at 30, 50, 70, 90, 100, and 121°C for 15 min. The pH sensitivity of dialyzed fractions of bacteriocins was performed at pH of 1.0, 4.0, 7.0, 10.0, and 12.0 for 2 h at 37°C. Different concentrations of sodium chloride (2, 4, 6, 8, 10, and 12%) were added to dialyzed fractions of bacteriocins for 2 h at 37°C to test the effect of sodium chloride.
The antimicrobial activity of all the treated dialyzed fractions of bacteriocins was determined by agar well diffusion assay, using *Listeria monocytogenes*, as indicator bacteria. The solid agar medium pre-inoculated with the indicator microorganism was purred into Petri dishes and wells of 5 mm diameters were cut. The dialyzed fractions of bacteriocins were placed in wells and Petri dishes were incubated at 37 ºC for 24 h. Positive results, concerning the growth inhibition of indicator microorganisms, were assessed by measuring a clear zone around the well in the vertical and horizontal direction by using a ruler. Measurements were done in duplicate and an average was calculated.
The results revealed that 90% ammonium sulfate precipitation fraction showed higher antimicrobial activity. Heat treatment at 30 °C, 50 °C, and 70 °C has no effect on dialyzed fractions of bacteriocins. The influence of 90, and 100 °C for 30 min on dialyzed fractions of bacteriocins were moderate, while 121°C for 30 min reduced the antimicrobial activity of dialyzed fractions of bacteriocins. The antimicrobial activity of dialyzed fractions of bacteriocins was almost stable for 4.0, 7.0, and 10.0 pH values. Instead, 1.0 and 12.0 pH value treatments for 2 h at 37 °C reduced the antimicrobial activity of dialyzed fractions of

bacteriocins. Also, a higher concentration of NaCl (concentration between 8-12%) inhibited the antimicrobial activity of dialyzed fractions of bacteriocins.
In conclusion, dialyzed fractions of bacteriocins exhibited good thermal stability for temperatures between 30-70 °C. As it was shown, the pH stability was good for 4.00-10.00 pH values, but extreme pH values, namely 1.00 and 12.00 pH values seem to have an inhibition effect on bacteriocins stability. Bacteriocins were sensitive to 121°C for 30 min and were moderately inhibited by the sodium chloride treatment.

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Research and Development in Food Safety

Gamze Çakıtlı

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Communities are responsible for maintaining their health in the best possible way by providing an adequate food supply and access to safe food that will promote healthy eating habits. Food production is directly related to human health. This brings to mind the concepts of food security and food safety.

According to the 2001 report of the United Nations Food and Agriculture Organization (FAO), food security is defined as 'Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'.

At the "World Food Summit" held in 1996, food safety was defined as people's physical, social and economic access to sufficient and healthy food that meets their nutritional needs for a healthy and active life at all times. Food safety is also defined as the elimination of physical, chemical and biological risks during the shelf life of food by following the necessary rules and taking the necessary precautions during the production, processing, storage, transportation and distribution stages. In addition to the production stages of food, climate change, income levels of countries and political reasons are also factors that affect food safety.

According to FAO, situations that prevent food safety in developing countries are usually producer-related, while in developed countries, consumer-related. Scientific research and development (R&D) studies are an important factor in the development of countries and an area that countries tend to develop their economies. R&D; when considered as efforts organized to reach data based on scientific knowledge, its positive contribution to food safety is an undeniable fact. The aim of this study is to discuss the role of R&D in food safety. The aim of this study is to discuss the role of R&D in food safety and the effects of R&D studies on food safety in the whole 'from farm to fork' process. It is a fact that food safety is a sub-component of food security and that food safety will be ensured by the sustainability of this process. The contribution of R&D studies to the individual and society at every stage of the process of reaching safe food has not been fully clarified. With this study, R & D studies that can be done at each stage and as a result of this, the gains of the individual and the society were mentioned.

The sustainability of the raw material, which is the starting point of the food production consumption chain, can be increased with a scientific approach, and insufficient R&D expenditures on this subject will adversely affect the competitiveness of the sector and thus its sustainability. Loss rates of pre-harvest food products cause price increases and cause sales value losses. High rate of food losses can also cause an increase in the risk of unhealthy food production. While R&D studies support product efficiency and food safety, they also contribute to economic growth. Since this will bring about changes in the social structure, new demands are expected to occur. For this reason, R&D studies supporting agricultural activities will both maintain the supply-demand balance, contribute to the sustainability of the sector and increase the food safety. The physical, chemical and microbiological properties of the

grown food are directly related to food safety and pre-harvest agricultural activities can affect these properties of the food.

Within the scope of R&D activities, product losses can be minimized by working on product-specific methods of protection from pests before harvest, and R&D studies can contribute to a healthier harvesting process in order to prevent less water or insufficient nutrient management, which may also cause a decrease in product quality. Supporting analyzes such as pesticide residue analyzes, risk assessments, and maximum residue limits before or after harvest with analysis methods developed with R&D studies can minimize food safety risks.

Risks that may occur in food safety can be minimized thanks to the fast, reliable, economical, diverse and multiple analysis methods that can be developed specifically for the product with the support of R&D studies during the food production. The contribution of increasing R&D processes to quality control and management systems after production is an important step in ensuring food safety sustainability. Regarding food safety; In applications such as Good Agricultural Practices, HACCP, Good Laboratory Practices, Good Hygiene Practices and Good Manufacturing Practices, R&D studies can determine which process in which product may pose a risk to food safety. Studies that can be done within the scope of R&D, such as new technologies for important processes that threaten food safety, or action plans based on microbiological results, or changing or developing processes related to the problem, support food safety.

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The Influence of UV Irradiation on Physico-Chemical Properties of Ethanol *Rosa Canina* L. Extract

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Rosa canina hip is known for its preventive and curative activities against a wide range of renal, inflammatory, gout, and gastric diseases. However, the functionality, stability, and bioavailability of its active compounds, particularly polyphenols, within products mostly depend on several factors, among all, UV irradiation, which is widely used in food and pharmaceutical industries.

In the present study, *R. canina* extract was prepared using percolation, 70% ethanol, and solid-to-solvent ratio of 1:2 at 25°C. Physico-chemical properties of the extract before and after UV irradiation were determined *via* analyzing total polyphenol content (TPC, Folin-Ciocalteu assay), total flavonoid content (TFC, colorimetric assay), total protein content (Bradford assay), antioxidant potential (ABTS and DPPH assays), extraction yield, pH value, zeta potential, conductivity, density, surface tension, and viscosity. Zeta potential and conductivity were determined by photon correlation spectroscopy (PCS); each sample was measured three times at room temperature. Density and surface tension were measured using silicon crystal (as the immersion body) and Wilhelmy plate, respectively, in Force Tensiometer. Viscosity was determined using Rotavisc lo-vi device equipment with the chamber, adapter, and spindle. Each sample (6.7 mL) was examined three times at room temperature. The statistical analysis was performed by using the analysis of variance (one-way ANOVA) followed by Duncan's post hoc test within the statistical software, STATISTICA 7.0. The differences were considered statistically significant at $p<0.05$, $n=3$.

TPC of non-treated extract was 9.64±0.98 mg gallic acid equivalent (GAE)/mL, whereas in UV irradiated extract TPC was 9.54±0.30 mg GAE/mL; no statistically significant difference in TPC between native and UV irradiated extracts. TFC of the non-treated extract was 1.65±0.18 mg catechin equivalent (CE)/mL, while in UV irradiated extract TFC was 1.75±0.13 mg CE/mL. Total protein content was 0.827±0.039 and 0.800±0.030 mg/mL for non-treated and UV irradiated extracts, respectively. ABTS radical scavenging potential was 0.676±0.023 and 0.538±0.012 mmol Trolox/mL for non-treated and UV irradiated extracts, respectively. In DPPH assay, IC_{50} was 10.74±0.48 and 17.78±1.03 µg/mL for non-treated and UV irradiated extracts, respectively. The extraction yield was 32.8±0.2 and 31.3±1.0%, and pH values amounted 4.33

and 4.49 for native and UV irradiated samples, respectively. Zeta potential was -0.587±0.020 and -0.052±0.001 mV, while conductivity was 0.046±0.002 and 0.650±0.012 mS/cm for non-treated and UV irradiated extracts, respectively. Density was 0.931±0.001 and 0.969±0.001 g/mL, the surface tension was 25.4±0.2 and 23.3±0.4 mN/m, and viscosity was 4.21±0.01 and 5.49±0.07 mPa/s for non-treated and UV irradiated extracts, respectively.

UV irradiation did not influence total polyphenol, flavonoid, and protein content, but statistically significantly decreased the antioxidant potential of the extract. Additionally, UV irradiation caused the increase in conductivity, density, and viscosity of the extract, and the decrease in zeta potential, i.e. the stability of the system and surface tension. The presented study provides evidence of the influence of UV irradiation on physico-chemical properties of *R. canina* extract that can add value and improve the quality of the existing food, and functional food products.

Effect of Lipid Nanoparticles Loaded with Parsnip Fermented Juice Rich in Bacteriocins on the Shelf Life of Romanian Boeuf Salad

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Lately, ready-to-eat products tend to meet consumer demands because they are easy to use (some products do not need to be cooked), very tasty and available for many types of food, even traditional ones. But there is a very important debate about the shelf life of those products. Researchers and producers are working to find natural ways to preserve these products to prolong their availability. Liposomes are lipid nanoparticles which have a phospholipid bilayer as a coat and may play a vital role in providing food preservatives to extend the shelf life of those products. Romanian Boeuf salad, a popular recipe usually made during the holidays, is a combination of finely chopped beef, vegetables, and mayonnaise.

This study aimed to encapsulate in liposomes a concentred parsnip fermented juice rich in bacteriocins and to test their activity as natural preservatives that induced superior shelf-life extension on Romanian boeuf salad.

Parsnip roots juice was sterilized, inoculated with *Staphylococcus carnosus* 10^7–10^8 CFU/mL, fermented at 37 °C for 16 h, centrifuged, and obtained fermented juice containing bacteriocins. Bacteriocins present in supernatant were precipitated with ammonium sulfate, after which the precipitates were collected by centrifugation at 10000 rpm for 30 min and dissolved in phosphate buffer (0.01 M PBS, pH 7.0). Concentred parsnip fermented juice rich in bacteriocins encapsulated in liposomes was dispersed in Romanian boeuf salad. Treated Romanian boeuf salad was compared with the producer's recipe and untreated salad for 15 days. Investigation of bacteria associated with the spoilage of salad took into consideration total bacteria loads, *Lactobacillus fructivorans, Listeria monocitogenes*, and *Bacillus vulgatus.* TBARS were evaluated for lipid peroxidation levels.

The results showed that concentred parsnip fermented juice rich in bacteriocins encapsulated in lipid nanoparticles decreased the oxidative process and exhibit an antimicrobial effect compared with the products produced by producer recipes and untreated salad.

In conclusion, encapsulating the concentred parsnip fermented juice rich in bacteriocins into liposomes can be used to extend the shelf life of Romanian boeuf salad that uses mayonnaise in its composition.

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Natural Whey Starters for Grana Padano PDO Cheese: Quality Parameters, Fermentative Activity and Effects of Iodine-Based Disinfectants

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Research Hypothesis: Whey starter is an essential ingredient in cheesemaking technologies such as Grana Padano PDO and Parmigiano Reggiano PDO cheeses. Since it is composed of different bacterial cultures, its activity could be compromised by many factors, e.g. antibiotics or disinfectants. This study aims to evaluate the potential negative effects of iodine-based disinfectants on the quality of different whey starters.

Method: Whey starters were sampled from different dairies during the cheesemaking process of Grana Padano PDO cheese. The following quality parameters were investigated with certified tests: pH and Soxhlet-Henkel acidity (°SH), fat content (Gerber method), whey proteins, lactose and dry matter contents (infrared spectrometry). Moreover, authors set up a method to evaluate the fermentative activity of different whey starters. Briefly, whey starter was added to a specific quantity of standard milk and heated up to 52°C. Soxhlet-Henkel acidity and pH were determined at the beginning of the procedure and after 4 hours. Subsequently, the Δ °SH was determined and 4 categories of fermentative activity quality were established: excellent (Δ °SH > 3.1), good (Δ °SH 2.4-3.1), fair (Δ °SH 2-2.4) and poor (Δ °SH< 2).

Iodine, as a compound frequently used as disinfectant during teat dipping procedures, was investigated through an inductively coupled plasma-mass spectrometry. Lastly, statistical analyses were performed by the means of Analysis of Variance (ANOVA) and Spearman's rank correlation coefficient.

Results: A total of 43 whey starters were tested, resulting in the following means and standard deviations: 3.31 ± 0.06 for pH, 33.03 ± 1.48 for °SH/50 mL, 0.21 ± 0.20 g/100 mL for fat content, 0.60 ± 0.18 g/100 g for whey proteins content, 3.36 ± 0.15 g/100 g for lactose content, 6.08 ± 0.23 g/100 g for dry matter content and cheese's pH 24 hours after cheesemaking was 5.08 ± 0.08.

Fermentation activity test allowed to distribute the whey starters as follows: 34 were deemed as excellent, 6 as good, 2 as fair and only 1 as poor. All excellent whey starters were described by dairy owners as perfectly functioning, while those belonging to different categories displayed some deficiencies in cheesemaking process.

Iodine concentration was 0.19 ± 0.07 mg/Kg and ranged between 0.07 and 0.32 mg/Kg. These values are in accordance with physiological concentrations in bovine milk from industrialized countries, and are related to different features such as iodine feed intake, milk yield, goitrogens and of teat dipping procedures. No significant differences could be determined for iodine concentration compared to fermentative activity. Thus, iodine at physiological concentrations did not have any effect on whey starter quality.

ANOVA test highlighted a significant difference ($p < 0.05$) between pH, °SH or iodine concentration and different dairies. Soxhlet-Henkel acidity and pH diversity may be related to whey starter fermentation and sampling period: as a matter of fact, the more whey starter ripened, the lower pH was at sampling. Iodine concentration differences may be related to different farming procedures as described above. Other ANOVA test differences between quality parameters and whey starter fermentative activity did not stress significant results. Moreover, Spearman's rank correlation coefficient between fermentation activity tests and quality parameters did not highlight any statistically significant correlation.

Discussion: The novel method to assess the whey starter's fermentative activity can help dairies to estimate the future cheese wheels' quality. Concerning iodine concentration, despite no significant differences were determined, further studies on different disinfectants (e.g. chlorine derivatives) will help to identify other parameters that may affect whey starter activity.

Immunochemicall Determination of Structurally Similar Sulfonamide Compounds in Honey

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Research hypothesis : Interpretation of the results of immunoassays often requires taking into account the possible presence of structurally similar compounds in samples. Therefore, an important characteristic of an immunoassay is its cross-reactivity. It is traditionally believed that this characteristic is strictly determined by the selectivity of the antibodies used. However, our work has shown that the cross-reactivity of immunoassay depends on the conditions of its implementation and can be changed, in particular, by varying the ratio of immune reactants.

Method : Immunochemical determination was implemented for seven sulfonamides (SA), antibiotics that often contaminate food. Two variants of equilibrium competitive immunoassay have been implemented: enzyme-linked immunosorbent assay (ELISA) and polarization fluorescence immunoassay (PFIA). SA were conjugated with an amine-containing fluorescein derivative by carbodiimide technique and purified by thin layer chromatography as described in (Ermolenko et al., 2007). SA conjugates with proteins were prepared by carbodiimide technique with the following dialysis. Polyclonal anti-SA antibodies were obtained as previously described (Eremin et al., 2005). PFIA was performed using the obtained fluorescent derivatives as competitors of SA in samples. The FPIA conditions, providing the most sensitive detection, correspond to the antibody concentration of 0.2 nM and the SA-(fluorescein derivative) conjugate concentration of 0.16 nM. For competitive ELISA with immobilized SA-protein conjugate and indirect labeling of antibodies the chosen optimal conditions accord to effective concentration of immobilized SA estimated as 76 nM and the approximate concentration of specific antibodies of 0.3 nM. In the accordance with common practice, Cross-reactivities (CR) for various SA were calculated as the ratio of IC50 (standard compound) / IC50 (tested compound) * 100%.

Results : The regimes of both immunoassays were preliminarily optimized to provide the lowest detection limits for target analytes and an acceptable level of the recorded signal. The concentrations of antibodies used in both cases were close, whereas the concentrations of SA in the conjugates were several orders of magnitude higher for ELISA than for PPTA. Note that the true concentrations of the active SA bound with ELISA microplates are unknown. The SA content in the conjugate solution being used for immobilization is 475 times higher than the concentration of fluorescein-labeled SA in PFIA. Even taking into account the expected loss of activity for a significant part of the antigen during immobilization on the microplate, it can be argued that the concentration of conjugated CA in ELISA is much higher than in PFIA. According to our theoretical estimates, this means that the CR values for ELISA should be higher than for FPIA.

The obtained experimental results of SA determination in artificially contaminated honey samples demonstrated accordance with these theoretical predictions. For the SA studied, the CR in ELISA exceeded the CR in PFIA by up to 8.5 times.

Thus, it was confirmed that the cross-reactivity of competitive immunoassays depends not only on the properties of the antibodies used. The main contribution to this effect is made by the concentration ratio for antibodies and modified antigen.

Discussion : Cross-reactivity depends both on the absolute value of the concentrations of the reactants and on their ratio. For equal concentrations of antibodies and labeled/immobilized antigen, the higher their concentration, the higher the cross-reactivity. The proposed approach expands the toolbox that can meet different requirements in food and feed control when the content of several structurally similar low molecular weight compounds such as toxic contaminants should be estimated.

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Antimicrobial and Physical Characterization of Active Gelatin Biodegradable Films

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Research hypothesis: Currently, the use of environment-friendly materials, nano materials and also plant essential oils in food packaging instead of synthetic and non-degradable polymers is a growing necessity. The aim of this experiment was to evaluate some characteristics of whey-gelatin and nanochitosan biodegradable film incorporated with *Cuminum cyminum* essential oil.

Method: The solvent casting method was used to form the film. Each of the materials were added in specific concentrations (5% gelatin, 5% whey protein and 2% nanochitosan w/v). Then, the essential oil of the *Cuminum cyminum* plant was obtained by the hydro-distillation method, then it was added to the film-forming solution (0%, 0.5%, 1% and 1.5% w/w). The antimicrobial activity of the films was determined by disk diffusion method. The physical properties including moisture content, solubility, opacity, thickness and water vapor permeability of the films were measured. In this way, the moisture content of the films was measured by placing 2×2 cm^2 diameter piece of films in the 110ºC oven until completely dry and then weighing them, and the solubility of the films was measured by dissolving them in distilled water and obtaining the solubility level after filtering with filter paper. The opacity of each film was determined by a spectrophotometer (560 n.m) and the thickness of each film was measured by a digital micrometer at 5 random points. The water vapor permeability of the films was measured by creating a relative humidity of 75% in a desiccator and weighing the boiled cups with the films in 2-hour intervals. Then each of the mentioned parameters were calculated according to the respective formulas. The results were statistically analyzed by SPSS software (version 25).

Results: In measuring the diameter of the inhibition -growth hallow, it was observed that with increasing the amount of essential oil, the diameter of this hallow increased and the addition of essential oil increases the antimicrobial activity ($p< 0.05$). The highest amount of inhibition-growth hallow in the concentration of 1.5% *Cuminum cyminum* essential oil was observed in the case of *Staphylococcus aureus* (23.79 ± 0.78) and *Listeria monocytogenes* (22.28 ± 0.91), and the lowest hallow was observed in films without essential oil and lower concentrations (0.5%) of essential oil, especially in the case of Gram-negative bacteria (*Escherichia coli and Salmonella typhimurium*). In general, the effect of *Cuminum cyminum* essential oil on gram positive bacteria was more than gram negative bacteria. By increasing the amount of essential oil, the percentage of moisture and solubility of the films decreased ($p< 0.05$). The addition of essential oil increased the opacities of the films, so that the highest amount (1.92 ±0.01) was observed in the concentration of 1.5% essential oil ($p< 0.05$). Regarding the thickness of the films, no significant relationship was observed with the increase in essential oil percentage ($p> 0.05$). It was observed that increasing the concentration of essential oil in the films decreased the value of water vapor permeability rate ($p< 0.05$) so that the highest amount of this parameter was observed in films without essential oil (17.43 ± 1.11). Adding essential oil

improves the antimicrobial activity of the packaging, which also reduces the permeability to water vapor and increases the solubility and moisture resistance.

Discussion: The production of biodegradable nanocomposite films along with plant essential oils can improve antimicrobial properties (especially in the case of Gram-positive bacteria) and also improve the physical characteristics of the films, which in turn can delay food spoilage and increase the safety and shelf life of the product.

Antibacterial Activity of Whey-Carboxymethyl Cellulose Biodegradable Film Incorporated with *Zataria Multiflora* Boiss Essential Oil and Evaluation of the Physical Properties of the Produced Film

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Research hypothesis: Recently, with the expansion of the use of synthetic and artificial polymers, the concern of environmental contamination by these polymers is increasing. The purpose of this experiment was to design and evaluate of whey-carboxymethyl cellulose and nanochitosan incorporated with *Zataria multiflora* Boiss essential oil as a safe and environmentally friendly material for food packaging.

Method: The solving casting method was used to form the film. Each of the materials were added in specific concentrations (5% gelatin, 5% whey protein and 2% nanochitosan w/v). The essential oil of the *Zataria multiflora* was obtained by the hydro-distillation method using a glass Clevenger-type apparatus, then it was added to the film-forming solution in different concentrations (0%, 0.3%, 0.6% and 0.9% w/w). The antimicrobial activity of the films was determined by disk diffusion method, measuring the diameter of the growth inhibition hallow (Image J 1.46r) of Gram positive and Gram negative bacteria. The physical properties including moisture content, solubility, opacity, thickness and water vapor permeability of the films were measured. The moisture content of the films was measured by placing 2×2 cm^2 diameter piece of films in the 110ºC oven until completely dry and the moisture content was obtained from the difference between wet and dried films. The solubility of the films was obtained after dissolving them in distilled water and weighing their residues The opacity of each film was determined by a spectrophotometer (560 n.m) and the thickness of each film was measured by a digital micrometer at 5 random points. The water vapor permeability of the films was measured by creating a relative humidity of 75% in a desiccator and weighing the boiled cups with the films for 2 days. The results were statistically analyzed by SPSS software (version 25).

Results: In measuring the diameter of the inhibition -growth hallow, it was observed that with increasing the amount of essential oil, the diameter of this hallow increased and the addition of essential oil increases the antimicrobial activity ($p< 0.05$). The highest amount of inhibition-growth hallow in the concentration of 0.9% *Zataria multiflora* essential oil was observed in the case of *Listeria monocytogenes* (58.11 ± 1.11), and the lowest hallow was observed in *Salmonella typhimurium* (26.24 ± 0.39). Films without essential oil had no antimicrobial effect and at low concentration of essential oil (0.3%) the films were ineffective against gram negative bacteria (*Escherichia coli and Salmonella typhimurium*). In general, the effect of *Zataria multiflora* essential oil on gram positive bacteria was more than gram negative bacteria. By increasing the amount of essential oil, the percentage of moisture and solubility of the films decreased ($p< 0.05$). The addition of essential oil increased the opacities of the films, so that the highest amount (2.31 ±0.02) was observed in the concentration of 0.9% essential oil ($p< 0.05$). The highest amount of film thickness (0.31±0.02) was observed in the film that had the highest amount of essential oil, and in general, the thickness of the films increased with the increase of the amount of essential oil ($p< 0.05$). It was observed that

increasing the concentration of essential oil in the films decreased the value of water vapor permeability rate *(p< 0.05*) so that the lowest amount of this parameter was observed in films with 0.9% essential oil (12.57 ± 0.64). Adding *Zataria multiflora* essential oil improves the antimicrobial activity of the packaging. This effect was less in the case of Gram-negative bacteria due to having a thick lipopolysaccharide layer in their wall. However, the antimicrobial effect of the films was significant. Regarding the physical properties, although the transparency of the films is reduced in higher concentrations of essential oil, but the thickness, resistance to moisture, dissolution in water, and also the entry of water into the mentioned packaging increased, and overall, it increased the efficiency of the produced film.

Discussion: The production of biodegradable nanocomposite films based on whey carboxymethyl cellulose along with plant essential oils can improve antimicrobial properties (especially in the case of Gram-positive bacteria) and also improve the physical characteristics of the films. The set of these factors causes the production of an effective and active packaging that delays the spoilage of food, causes the health of the consumer and reduces environmental pollution.

Ultrasound-Assisted Extraction of Lacto-Fermented Olive Leaves for their Antioxidant and Antimicrobial Potential

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Research hypothesis: Lactic acid bacteria have an important potential as biopreservative in plant-based fermented products as they have the capacity to produce a wide variety of antimicrobial compounds such as organic acids, diacetyl, reuterin, antifungal peptides, bacteriocins and phenolic compounds having antioxidant, antiviral and anti-inflammatory activities. Among the fermented products, olive leaf which is one of the by-products in olive processing is a probiotic source for LAB.

Method: The objective of this study was to investigate the ultrasound assisted extraction of fermented olive leaves for its antioxidant capacity using DPPH• free radical scavenging activity analysis and also, lacto-fermented olive leaves were evaluated for antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Klebsiella pneumoniae*. In the study, the Gemlik variety of olive leaves which are grown in the Mediterranean region were used. Dried olive leaves at certain moisture content (6%) were fermented with *Lactobacillus plantarum (L. plantarum)* for 21 days. Then, ultrasound assisted extraction process of fermented olive leaves were performed using an ultrasonic device equipped with ultrasonic probe under different extraction conditions using parameters; solvent (ethanol/water) concentration (30-70% v/v), extraction time (5-15 min) and amplitude (30-50%). And also, sonication was conducted in pulsed mode. In addition, disc diffusion method was used to determine antimicrobial activity of lacto fermented olive leaves.

Results: Antioxidant capacity ranged between 86.62±0.51 and 117.0±0.98 µmol Trolox/g olive leaf. The leaves extracted at 50% amplitude, 70% ethanol for 10 min showed higher antioxidant capacity when compared with other ultrasound assisted extraction conditions. Moreover, the antioxidant capacity of fermented olive leaf extracts obtained by ultrasound assisted extraction with shorter extraction time was found to be higher than the conventional extraction methods. Ultrasound assisted extraction is an alternative to conventional methods as a green (environmental) technology due to its low energy consumption and low solvent usage. Fermented olive leaf extract and its main secoiridoid compound (oleuropein) can be used as natural antioxidants in foods due to their high antioxidant capacity. Since phenolic compounds in fermented olive leaves have both free radical scavenging and metal chelating activity, it can protect membranes from lipid oxidation initiated by metals. When examined in terms of antimicrobial activity, inhibition zone diameters for *Staphylococcus aureus (S. aureus)*, *Escherichia coli (E.coli)*, *Bacillus subtilis* (*B. subtilis*), *Klebsiella pneumoniae (K. pneumoniae)* varied between 16.48-24.03 mm, 8.46-10.27 mm, 14.66-20.84 and 14.1-17.59 mm, respectively. The lacto-fermented olive leaves which were extracted at 30% amplitude-50% ethanol-5 min, 40% amplitude-70% ethanol-15 min, 30% amplitude-70% ethanol-10 min and 40% amplitude-30% ethanol-15 min showed higher antimicrobial activity against *S. aureus*, *E. coli*, *B.subtilis*, *K. pneumoniae,* respectively. Fermented olive leaves with ultrasonic assisted extraction showed a stronger antimicrobial effect by forming a more inhibition zone

against *S. aureus* in terms of antimicrobial activity when compared with other test microorganisms. Fermentation of olive leaves with *L. plantarum* strain indicated to have an important potential in the control of pathogenic strains by improvement of microbiological stability in terms of food safety.

Discussion: Considering results totally, lacto fermented olive leaves represents a potential source of natural antioxidants and antimicrobial activity. It is important to evaluate the olive leaf, which is obtained as agricultural waste and by-product in the olive and olive oil industry, as a plant waste in food production and in terms of food safety.

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Enhancing Food Ethics In Afrıca

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Food ethics is a broad, interdisciplinary subject area that covers production, manufacturing, retailing, consumer choices, consumption and disposal. However, until a series of food safety incidents throughout the mid-1990's and early 21st century, the topic of food ethics wasn't given much prominence in the African continent. The increasing demand of food by the African population calls for a sustainable ethical practice. Food plays an important part in the lives of millions of Africans in relation to their conceptions of what a good life is, making it an intrinsic good in some cultures that has value beyond its monetary value. Thus, it gives us the opportunity to clarify the African beliefs and values of what they believe to be just and good. Using an ethical analysis approach and a descriptive method, this article explores the concept of food ethics in the African society base on three aspects: the producers, the consumers, and the government who are still very reluctant to embrace this notion. It equally examines how ethical food choices will shape a sustainable future if the producers, consumers, and the government, consider demands that balance all the relevant values of food when making decisions, reflect on possible outcomes, examine the big picture, and choose what is morally appropriate in the end. In this regard, the research affirms that, common African worries of food ethics include environmental harm, exploitative labor practices, food shortages and wastage for others, cruel treatment of animals used for food, and unforeseen consequences of food policy. As such, every sustainable food system must embrace ethics to bring improvement on choices base on power and accountability. Within this framework, to enhance food ethics in Africa (Cameroon), there should be a creation and execution of suitable national and regional food ethics regulatory frameworks (guidelines, standards, and legislation), as well as raising consumer and producers' awareness of food safety and quality standards. This can be realized by incorporating new methods of food production that include the diversification of foods, mechanized farming styles through various forms of morally acceptable coexistence. All these will go a long way solve the issue of food shortage and increase the social ethics of food choices if as well as sustainable food safety.

Evaluation of the Efficiency of the Training of Chefs Food Preparation, Cooking, Storage Techniques, Nutrition and Food Safety Working in International Gastronomy Enterprises

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It is aimed to determine the level of knowledge of chefs working in international gastronomy businesses, to obtain data for training programs to be prepared for chefs and to determine their needs for food safety trainings to be given.

In order to determine the distribution of food safety-related knowledge of chefs working in international food and beverage businesses, document analysis and quantitative analysis methods were used. The universe of the study consists of chefs working in international food and beverage businesses in Türkiye. Snowball sampling method was used as the sampling strategy of the research. With the snowball sampling strategy, a starting group of 21 participants was formed by the researcher and each participant was requested to be sent to possible participants in the research universe. Thus, 445 participants were reached. In order to determine the validity and reliability in the data set, Croncbach Alpha ($0.70<\alpha<1$) analysis was performed and its value was determined as 0.70. The study was carried out between 03/03/2021-19/04/2021. 445 questionnaires were examined and collected, and 21 questionnaires that were not suitable for inclusion in the study were excluded from the scope of the study. In this framework, the sample size of the study was created with 424 participants, chefs working in international food and beverage businesses. The applied questionnaire consists of three parts. In the first part, there are questions about the demographic characteristics of the chefs, in the second part, the educational background and professional knowledge of the chefs, and in the third part, the questions about measuring the nutrition and food safety knowledge levels of the chefs. The necessary ethics committee document was obtained for the study. Frequency analysis was applied to analyze the accuracy of the obtained data. Moreover; T-Test for two-group independent variables and Anova analyzes for dependent variables and more than two-group independent variables. Tukey test was applied in order to determine which binary groups formed the differences together with the Anova analysis.

411 men and 13 women participated in the study. Participants were found to be predominantly between the ages of 21-40 (76.4%). When evaluated in terms of seniority, he has been a cook for 20 years (12.9%). In terms of seniority, this situation is followed by chefs who performed the culinary profession for 14 years (10.1%) and 34 years (5.8%). It was found that the chefs were willing to do this profession (83.7%) and stated that they would continue to work in this profession in the future (85.4%). It is seen that the chefs gained their knowledge about healthy nutrition during meetings such as seminars and panels (32.3%) and during school education (26.6%).

Chefs had knowledge about the storage conditions of milk and this information was correct. It has been determined that 98.1% of the chefs have knowledge about foods that will gain toxic properties even if they are kept at room temperature, and they know how these foods should be stored. It was determined that 97.4% of the chefs received sufficient training in the storage and processing of meat products. It has been determined that 99.1% of the chefs have knowledge about storing cooked food in the refrigerator. Most of the chefs strongly agree with the statements "wrong cooking methods can create cancer-causing molecules" (59.0%) and "vegetables should be cooked in little water and for a short time" (68.9%). It is determined that he gained knowledge about food safety during school education (30.1%) and in-service training (25.2%). It was determined that 86.8% of the participant chefs had knowledge about balanced nutrition and used this information in menu planning studies. It shows a significant difference in favor of women at a significance level of 0.01 according to gender ($t=4.261$; $p<0.01$). A significant relationship was found between the ages of chefs working in food and beverage businesses and food safety information. In other words, it shows a significant difference at the 0.01 significance level between age and food safety knowledge ($F=12.289$; $p<0.01$). It was found that the group with a high level of knowledge was between the ages of 21-40.

It is seen that the chefs' knowledge on food safety mainly comes from their school education, but they have developed this knowledge through in-service training. According to the results of the research, it was determined that the participant chefs' knowledge about food safety was mostly good, but they had little knowledge in terms of healthy nutrition practices and it was found that it should be improved with in-service training.

Degradation Kinetic Modelling of Moisture, Colour and Textural Properties in Dabai Fruit (*Canarium odontophyllum* Miq) During Blanching Treatment

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Dabai (*Canarium odontophyllum* Miq.*)* are well-liked exotic (indigenous) fruits planted in Sarawak and have high demand among local consumer. Dabai blanching is a pre-treatment in hot water to soften the fruit flesh before consumption and to enhance the efficiency of flesh-nut separation for further processing. However, the effects of proper temperature and blanching time on the fruit quality are still limited in the literature. In this study, the effects of blanching treatment on moisture, colour and texture of dabai of variety Kapit were studied at five different time intervals (2, 4, 6, 8 and10 minutes) and temperatures (60, 70, 80, 90 and 100 ^{o}C). Degradation was expected for all the quality parameters studied. The results show that reduction at significant different $p<0.05$ in moisture of approximately 7.5% whereas 24.0–74.0% for both color and texture during blanching. In terms of kinetic model, moisture content is expected to fit the Fick's law, where calculation of effective moisture diffusivity can be performed via the utilization of slope. Fractional-conversion order well described the changes of a*, b*, L, chroma and hue angle parameter. Meanwhile, the kinetic model of firmness changes is expected to obey the Arrhenius's law. Gathering the quantitative information on the changes of the quality during blanching of dabai fruit is vital in designing a proper pre-processing condition. In addition, the established models could provide guidelines to line perators to manipulate blancher conditions.

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Removal of *Clostridium* (*Clostridioides*) difficile İnoculated İnto Lettuce with Washing Solutions

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Research Hypothesis: The fact that *C. difficile*, known as a nosocomial pathogen, causes infection in people who do not carry risk factors leads to the thought that it may also have non-hospital sources. Furthermore, the isolation of *C. difficile* from different food groups has led to the thought that there may be a possibility of transmission through food. In case of a possible *C. difficile* contamination of lettuce, consuming contaminated lettuce and threatening food safety and public health can be prevented with appropriate washing solutions.

Method: The checkerboard synergy test determined the synergistic activity between the cinnamon essential oil-acetic acid solution against *C. difficile* spores. The microdilution method determined the minimum inhibition concentration (MIC) of the solution. Lettuce was immersed for 10 minutes in *C. difficile* ATCC 1870 spore solution diluted to 6 log cfu/mL. Then, the lettuce was allowed to dry for 2 hours in a laminar safety cabinet. The effect of different concentrations of the solution (MIC, 2xMIC, 4xMIC) and sodium hypochlorite (NaOCl) (50, 100, 200 ppm) and different washing times (5, 15 minutes) on the removal of *C. difficile* ATCC 1870 inoculated into lettuce was investigated. Lettuce was washed by immersion method and then dried in a laminar safety cabinet for 30 minutes after each washing process. After that, serial dilutions were prepared and inoculated into Brain Heart Infusion Agar (BHI). Colonies in the petri dish were counted after 24 hours of incubation in the anaerobic workstation at 35-36^{o}C. Lettuce, which was not washed but inoculated, was evaluated as a control for the attachment of inoculated spores. In addition, the effect of washing solution on reducing the total mesophilic aerobic bacteria and Enterobacteriales load in lettuce were determined in Tryptone Soy Agar (TSA) and Violet Red Bile Glucose Agar (VRBG), respectively. At the same time, the effect of washing on pH, brix, color, texture and total phenolic content of lettuce was investigated. Lettuce washed with sodium hypochlorite, tap water and unwashed lettuce were evaluated as control groups.

Results: The relationship between cinnamon essential oil-acetic acid combination was evaluated as synergy, and the fractional inhibition concentration was determined as 0,31. The use of the solution at the MIC value did not provide an inhibition on *C. difficile* spores. However, the solution's 2xMIC value (0,76% cinnamon essential oil + 0,5% acetic acid) for 5 minutes and the application of 50 ppm NaOCl for 15 minutes reduced the number of *C. difficile* inoculated to lettuce 1,15 log cfu/g and 1,57 log cfu/g, respectively. These concentrations and times completely inhibited the Enterobacteriales. The cinnamon essential oil-acetic acid solution reduced the total mesophilic aerobic bacteria count by 1,68 log cfu/g, while NaOCl completely inhibited it. No statistically significant difference was found between washing at 4xMIC concentration and washing at 2xMIC concentration in microbial inactivation (P>0.05). However, 4xMIC concentration caused undesirable changes in the texture and color of the lettuce. In addition, no statistically significant difference was observed between washing with

the cinnamon essential oil-acetic acid solution and NaOCl in the removal of *C. difficile* inoculated into lettuce (P>0.05). Sterile drinking water was not effective in removing microorganisms. At the same time, the most effective parameters in microbial inactivation and preservation of the physical and chemical properties of lettuce were the application of 2xMIK concentration of cinnamon essential oil and acetic acid mixture for 5 minutes and 50 ppm NaOCl for 5 minutes.

Discussion: Cinnamon essential oil-acetic acid can be used as a household disinfectant in case of possible *C. difficile* contamination in lettuce. Thus, the risk of a possible *C. difficile*-related infection can be reduced. Furthermore, considering the toxic effects of NaOCl and the presence of strains resistant to NaOCl, the cinnamon essential oil-acetic acid combination may be an alternative natural disinfectant.

Determination of Thermal Resistance of *C. difficile* ATCC 1870 Spores in Milk with Log-linear and Weibull Models

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Hypothesis: Until now, *Clostridioides (Clostridium) difficile* infections are considered to be hospital-acquired. However, in recent studies, isolation from various foods has suggested that foods may be vectors in transmitting this bacterium. It is possible for *C. difficile* to be found in animal and milk and dairy products and pose a risk since it has also been identified in the intestines of animals.

Method: In order to control the possible *C. difficile* contamination in milk, the thermal resistance of *C. difficile* spores at different temperature values was investigated. For this purpose, a spore solution of the spores of *C. difficile* ATCC 1870 strain was prepared. The spore solution was added to the milk at a final concentration of 10^8 CFU/mL. To determine the spores' thermal resistance, heat treatments were carried out in a water bath at 75, 77.5, 80, 82.5, and 85°C ±0.1°C. During the temperature application, five different holding times were selected at each temperature, except the start time. Heat-treated tubes were rapidly cooled after heat treatment. Milk residues were removed by centrifugation twice at 4000xg for viable cell count. After this step, serial dilutions were prepared, and inoculations were made on BHIS agar using the spread plate method. Petri dishes were incubated in anaerobic conditions at 37°C for 48 hours, and then the colonies formed were counted. Results were calculated using the Log-linear model and Weibull models to calculate thermal resistance by plotting the survival curves of spores.

Results: D values calculated for five temperatures with the log-linear model were examined. The D value at 75 °C was determined for 44.85 minutes. When the applied temperature was increased to 85 °C, the D value decreased to 10.47 minutes. A weak negative correlation was determined between temperature and D values. As the temperature increased, the R^2 values of the equations belonging to the survival curves against the temperature obtained decreased and the lines drawn gradually became more and more non-linear. For this reason, the Weibull model was also used to explain the survival values obtained. The initial reduction time in the Weibull model was calculated as 47.99 minutes at 75 °C and 1.47 minutes at 85 °C for spores of the *C. difficile* ATCC 1870 strain, expressed as delta (δ). In the Weibull model, beta (β) values, which determine the shape of the graph of the microorganism, were examined and β values were generally determined as β>1. If these values are greater than 1, it means that the survival curves are shaped concave downwards, and the δ values decrease linearly with time. In other words, the remaining spores have a higher heat sensitivity indicating that cumulative damage causes more spore inactivation. When the mean square error (MSE) values used in the comparison of the models were compared, it was seen that the values of the Weibull model decreased at high temperatures compared to the Log-linear model and it was more suitable for revealing survival data. In addition, the experimental data at high temperatures and the results obtained with the Weibull model support each other in this sense. When

evaluated in this respect, it was determined that the Weibull model is more valuable than the Log-linear model in explaining the thermal resistance of *C. diffcile* ATCC 1870 strain.

Discussion: Published literature on the thermal resistance of *C. difficile* spores is limited. Studies on preventing *C. difficile* in food have focused only on meat. Compared to the studies in the literature, it was seen that the resistance of *C. difficile* spores differs depending on the strain, but they are resistant to classical cooking and pasteurization temperatures.

Determination of Microbiological Quality and *Salmonella* Risk in Kokorec

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Research Hypothesis: Products produced from food animals are accepted as one of the main causes of foodborne diseases. Kokoreç, which is made from sheep and lamb intestines, can become risky in terms of pathogenic microorganisms if the cleaning process is insufficient and the temperature during the cooking process is not sufficient. In this study, the microbial quality of kokoreç which is sold as raw and cooked, was investigated and the presence of *Salmonella* was determined.

Method: The presence of total aerobic mesophilic bacteria, *Staphylococcus aureus, Bacillus* spp., total coliform and *E.coli*, mold and yeast, *Clostridium perfringens* and *Salmonella* were investigated in the kokoreç samples obtained from Çanakkale province. 10 grams of kokoreç samples were homogenized in 90 ml of 0.1% sterile peptone water in a stomacher device for 1 minute. Serial dilutions were prepared from this prepared 10^{-1} dilution. Each dilution was inoculated onto Plate Count Agar for TAMB count, *Bacillus* ChromoSelect Agar for *Bacillus* count, Baird Parker Agar for *S. aureus,* and colonies in petri dishes were counted after 24-48 hours at 37°C. The total number of coliforms and *E. coli* in the samples were determined by counting in petri dishes at 37°C in Chromocult TBX Agar after 24 hours. Mold-yeast load was determined after 5-7 days of incubation at 25°C in DRBC medium. The presence of *C. perfringens* was determined in TSC medium after 24 hours of incubation at 37°C under anaerobic conditions.

In order to determine the presence of *Salmonella* in the samples, 25 grams of kokoreç were taken and pre-enriched in Buffered Peptone Water at 37°C for 18-20 hours. Then, 0.1 mL of the enrichment liquid was inoculated into Rappaport-Vassiliadis Broth medium and incubated at 42°C for 24 hours. 1 mL of enrichment broth was inoculated into Selenite Cystine Broth medium and left for selective enrichment at 37°C for 24 hours. From the tubes with growth observed, they were inoculated on Xylose Lysine Deoxycholate Agar (XLD) and Bismuth Sulfite Agar media. After 24 hours of incubation at 37°C, biochemical tests were applied to the isolates thought to be typical *Salmonella* colonies.

Results: The microbial quality of raw kokorec obtained from different markets and butchers were determined and the number of total aerobic mesophilic bacteria in the samples varied between 6.04-7.45 log cfu/g, while the number of *S. aureus* was 4.94-6.18 log cfu/g yeast and mold numbers were determined between 4.3-4.84 log cfu/g and 4.0-4.77 log cfu/g, respectively. While the possible number of *B. cereus* was found to be 6.8-7.42 log cfu/g in raw samples, suspicious *B. megaterium* colonies were detected at the level of 6.2-7.51 log cfu/g. The number of total coliforms in the samples was determined at the level of 5.31-5.55 log cfu/g, and the number of *E. coli* was determined at the level of 2.1 log cfu/g. *C. perfringens*

was found in 1 of the samples. Possible *C. perfringens* was detected at the level of 2.84 log cfu/g in the raw kokoreç sample. Suspicious *Salmonella* colonies were detected in 5 of the samples.

The number of total aerobic mesophilic bacteria in the cooked kokoreç samples were found to be between 4.85-5.49 log cfu/g. *S. aureus* was not detected in cooked kokoreç samples. The number of suspected *B. cereus* in cooked kokoreç was found to be in the range of 4.14-5.55 log cfu/g. Total coliform was determined between 3.14-3.23 log cfu/g. However, *E. coli*, *C. perfringens* and *Salmonella* were not detected in cooked samples. Mold and yeast were not isolated in cooked kokoreç samples.

Discussion: The microbial quality of raw and cooked kokoreç samples, which were analyzed according to the lower and upper limits determined for foods "limits of pathogenic microorganisms" in the Turkish Food Codex Communique on Microbiological Criteria, were evaluated. It was determined that the suspicious *B. cereus* level in raw and cooked samples was above the determined limits. The presence of *Salmonella* in raw kokoreç can also be detected in cooked samples as a result of insufficient heat treatment. This situation may pose a risk to food safety and public health.

Gas Content in Headspace as Indicator of Beef Meat Safety

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The raw meat microbial spoilage depends on metabolic potential of microorganisms to produce spoilage-associated compounds, among them gases which are the result of deamination, decarboxylation, and hydrolysis processes of meat components, mostly proteins. So, based on determination of gas content in headspace of the packages, it is possible to monitor the stage of meat spoilage.

The concentrations of CO_2, NH_3, H_2S and O_2 in the atmosphere above minced beef was determined by tunable diode laser absorption spectroscopy (TDLAS) device specially constructed for this purpose consisting of gas chamber and unit for data acquisition. The experiment was conducted at refrigerating temperature 4^oC in closed jars (total volume 500 ml) with minced beef (230 g). All the measurements were performed in triplicate and basic statistical analysis on data was done in Excel (Microsoft, USA). Microbial spoilage was tracked through determination of the presence of common spoilage bacteria during 15 days of meat storage. The number of total mesophylic bacteria (TMB), lactic acid bacteria (LAB), *Enterobacteriaceae*, *Pseudomonas* spp., *Listeria* spp., *Proteus* spp. and *Staphylococcus* spp., were determined by the use of standard microbiological methods. Additionally pH value was determined in each sampling point.

During the experiments, the content of O_2 continuously decreased to 0% after 10 days, while CO_2 increase to final cca 17% after 15 days of monitoring. H_2S presence was first detected at the 7th day, followed by increase to the final concentration of 30-45 ppm. NH_3 was detected at very low level 3-5 ppm only at the end of monitoring period.

TMB increased from initial 6.3±0.3 log CFU/g to cca 8 log CFU/g at the 10th day, followed by stagnation until the end of storage. Similarly, the number of LAB and *Enterobacteriaceae* continuously increased reaching maximum at the 12th d of incubation, 6.4 ±0.5 and 5.1 ±0.4 log CFU/g, respectively. Due to the anaerobic condition, the number of *Pseudomonas* spp. was detected on very low level < 40 CFU/g. Also, the level of common meat pathogen *Listeria* spp. and *Staphylococcus* spp. stagnate during process at a low, acceptable level of 2-3 log CFU/g. Additionally, the number of pathogen *Proteus* species reached the value of 2.6 log CFU/g. Value of pH of the beef slightly decreased from the initial 5.8 to 5.4 at the end of monitoring, probably due to the accumulation of organic acids produced mainly by LAB.

Since the experiments were conducted in closed jars, the O_2 consumption by aerobic microorganisms and CO_2 generation had established the anaerobic conditions. This condition favoured growth of anaerobic and facultative anaerobic bacteria, primary LAB, at the same

time reducing the presence of aerobic *Pseudomonas* spp. Since *Proteus* species have metabolic capability to produce H_2S, the presence and increase of the number of this bacteria explains the significant accumulation of this gas. The level of NH_3 was insignificant and on a detectable level. These results indicated that gas content in headspace determined by TDLAS can be correlated with microbial presence in meat and used for indirect determination of food quality. This creates the opportunity of the use of TDLAS technology in meat industry for early determination of food spoilage.

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Utilization of Eggshell Membrane as a Novel Protein Source

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Eggshells, formed by the shell and the membrane (ESM), are considered hazardous waste by European Union as their amount has increased tremendously in recent years. The shell and the membrane can be utilized after being processed by different processes. Due to its high protein content and essential amino acids like glutamic acid, proline, and glycine, egg shell membrane can be used as protein sources. Therefore, this study prompted the determination of appropriate protocol to separate ESM from the shell, solubilization of ESM proteins, identification of amino acids in soluble ESM and its use in food supplements. Different separation solutions were tested with water as a control, and the samples ESM were treated with 50mM EDTA (1:20), 100 mM EDTA (1:20 and 1:40), %1.25 acetic acid (1:30 ve 1:40), ve %0.185 HCl (1:30) revealed the highest protein content. Then, these samples were treated with the solutions involving 2-mercaptoethanol, Tris-HCL (lysis solution), Triton X-100, and SDS before the addition of acetone and centrifugation. The protein content of the samples was determined by the Lowry method, and the samples having the highest protein contents were used to produce soft gel capsules. Soft gels were formed with pectin, lactose, corn starch, Mg-stearate, gelatin, and glycerin. It was concluded that ESM could be used as an alternative protein source in soft gel capsules

Bioactive Compounds and Antioxidant Activity of Daikon *i.e.* Japanese and Chinese Red Radish Microgreens

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Microgreens are usually consumed raw, but are also are available in the forms of tablets, frozen juice or powders. They are immature plants produced from the seeds of vegetables, cereals or herbs. Their harvest takes place usually between 7 and 21 days after germination. It is known that microgreens possess a broad spectrum of bioactive compounds, such as polyphenolic compounds and pigments (chlorophylls, betalains, carotenoids, etc.), with a great potential for enhancing human diet.

In this study, the content of polyphenolics, chlorophylls, and antioxidant activity (DPPH•, ABTS+• and reducing power assay), as well as HPLC analysis of individual polyphenolic compounds were determined in Daikon i.e. Japanese and Chinese red radish microgreen samples. The total content of polyhenolics in sample extracts was determined spectrophotometrically by Folin-Ciocalteau method (Singleton & Rossi, 1965). HPLC analysis was used to identify and quantify individual polyhenolic compounds. The contents of chlorophyll a and chlorophyll b in microgreen extracts were analyzed spectrophotometrically by the method of Nagata & Yamashita (1992). Antioxidant activity on DPPH radicals (DPPH assay) was estimated spectrophotometrically following the method described by Girones-Vilaplana et al. (2014). Antioxidant activity on ABTS+• radicals (ABTS assay), i.e. the ability of samples to scavenge ABTS+• was evaluated employing method according to Tumbas Šaponjac et al. (2014). Reducing power (RP) was performed with the method of Oyaizu (1986).

The contents of bioactive compounds present in Daikon i.e. Japanese and Chinese red radish microgreens were: total polyhenolics 462.28 and 343.50 mg/100g DW, chlorophyll a 46.26 and 14.61 mg/100g DW, chlorophyll b 17.21 and 4.99 mg/100g DW, total chlorophylls 63.47 and 19.60 mg/100 g DW, chlorophyll a/b ratio 2.69 and 2.93, respectively. It could be observed that generally Daikon i.e. Japanese exhibited higher investigated bioactive compounds contents in this study. The total content of individual polyphenolic compounds obatained by HPLC analysis was higher in Daikon i.e. Japanese radish microgreens (258.40 mg/100 g DW), comparing to Chinese red radish microgreens (190.20 mg/100 g DW). The highest content of individual polyphenolic compound obtained by HPLC analysis was coumaric acid (42.60 mg/100 g DW) in Daikon i.e. Japanese radish microgreens. The highest individual content among flavonoids was rutin determined in Daikon i.e. Japanese radish microgreens (32.9 mg/100 g DW). Two antioxidant methods (ABTS and DPPH assays) that involving both hydrogen atom transfer (HAT) and single-electron transfer (SET) mechanisms and one method (RP assay) that is based on SET mechanism were used for assessment of antioxidant activity of microgreens extracts. Applied antioxidant assays have shown the scavenging activity against DPPH• to be 194.24 and 135.55 mmol TE/g DW, against ABTS+• 82.37 and 47.24 mmol TE/g DW, while reducing power was 196.88 and 150.06 mmol TE/g DW, respectively. As it could be seen Daikon i.e. Japanese radish microgreens also exhibited better results in used antioxidant tests.

In conclusion, it could be proposed that, due to the presence of bioactive compounds, microgreens could express great antioxidant and health beneficial properties. This study has

shown that Daikon i.e. Japanese red radish microgreens present good source for health beneficial and safe food, owing to their high content of polyhenolics, chlorophylls, and strong antioxidant capacity.

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Development of Fibrous Casings with Natural Antioxidant Using Rosemary and Thyme Extract in Dried Sausages

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In this research, an active packaging system with antioxidant properties has been designed for the shelf life extension of sausage. Cotton linter based fibrous casing has been coated with thyme and rosemary extract with different percentages (0, 2, 4, and 6%). The water vapor permeabilty rate, extract loading on the casing, total phenolic content, DPPH radical scavenging activity and migration of phenolic compounds were determined in developed casings. lipid oxidation (TBARS), film color and sensory properties of packed sausage were assessed during 2 months in cold storage (4 ±1 °C). Casings containing 0 and 2% of thyme and rosemary extract showed the most hydrophobic and the lowest water vapor permeability. Phenolic compounds migration was different from 60 to 191 (mg gallic acid /g) and the result showed that releasing extent and rate of both extracts were significant ($p < 0.05$). Fibrous casing loaded with 6% thyme extract showed the highest antioxidant activity (1.01 mg malondialdehyde/ kg). Sausage packaged in fibrous casing loaded with 6% thyme extract was preferred by the panelists in terms of overall acceptability. Regarding Sausage color, there was no significant difference between active and control packaged sausage samples ($p > 0.05$). There was significant difference in color between extract loaded and control casings ($p < 0.05$).

It was concluded that loading fibrous casing with natural antioxidant extract could be introduced an antioxidant active packaging which effectively can reduce fat oxidation in meat products.

Novel Infrared Popping of Popcorn (*Zea Mays* L. var. Everta)

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Popcorn (*Zea mays* L. var. Everta) as one of the most popular snack foods in the world is predesigned particularly for the consumption of humans. Popcorn after the expansion has functional and excellent nutritional properties. Expansion properties are related to the acceptance of consumer and sensory attributes. Change in functional characteristics and desirable sensory at foods by processing, leading to increased demand of consumers. For popcorn, these properties are the most important characteristics. Infrared (IR) radiation is environment-friendly, and highly energy-efficient compared to conventional heating. In addition, IR efficiency is characterized by heating homogeneity, food safety, high heat transfer rate, improved product quality, low processing (heating) time and low total energy consumption. in our study, the effect of IR popping process, different IR power (350, 450 and, 550 watts (W)) in the different distances (10, 20 and, 30 cm) on some physicochemical characteristics of popcorn (antioxidant activity, total phenolic content, color, morphology (SEM), FTIR and energy consumption) was investigated. By increasing the power of IR and reducing the distance, bulk density, popping commencement, and expansion residue were significantly decreased, and expansion volume popping yield, and popping percentage were significantly increased ($P < 0.05$). The total phenolic content, color, and antioxidant activity were significantly changed ($P < 0.05$). In SEM analysis, an increase in the size of popcorns cavities means an increase in the volume of samples. IR expansion effect significantly on food compounds were in FTIR spectra. The IR expansion method has a high efficiency in the popcorn popping process.

Preparation Steps/Techniques/Procedures of Growth Mediums that are Used in Detection of Biohazards in Food Safety

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Food is the most basic need for people to survive. However, factors such as increasing world population, economic and environmental conditions make access to food way more difficult. Also, the aim is not only to reach food, but to safe food; is to obtain what is healthy, has not lost its nutritive value, is free from physical/chemical and biological hazards and is intact. In the Regulation on the Inspection and Control of Food Safety and Quality, published in the Official Gazette No. 27009 in Türkiye, food safety is the whole of the procedures and measures taken to eliminate physical, chemical, biological and all kinds of damages that may occur in foods. Food safety is also defined by TGDF as "following the necessary rules and taking precautions during the production, processing, preservation and distribution of foods in order to ensure healthy and perfect food production" (Koç & Uzmay, 2015).

Many countries including Türkiye, especially the USA and EU countries, have developed and implemented food safety standards and management systems for the safe presentation of food to consumers. However, despite the implementation of food safety systems and legal obligations, foodborne diseases and epidemics continue to affect millions of people and cause thousands of deaths. Food safety is endangered through the contamination of food by various pathogenic and spoilage-causing microorganisms in the production environment (Onbaşı & Umay, 2021). Microbiological analyzes are of great importance for the control of food safety and public health of food-borne microorganisms.

Microbiological examination of foods relies heavily on culturing techniques to detect and enumerate live microorganisms. Given the great variety and multiplicity of groups, genera and species that may be present, a large number of tests are used that can be classified. The first is the tests in which the presence or absence of the target microorganism is detected without quantification, the other is the quantitative tests that determine the amount of the target microorganism in the sample, usually per unit of weight or volume. Each of these tests follow different procedures, which in turn depend on the target microorganism(s), but most use the same basic microbiological culturing techniques. These techniques are present/absent detection, Most Likely counts, and standard license plate counts. Standard plate counts are used for the quantification of both large microbial groups such as aerobic mesophilic microorganisms, mold/yeast, sulfide-reducing Clostridia, enterococci and lactic bacteria, as well as certain genera and species such as Staphylococcus aureus, Bacillus cereus. The basic procedure consists of inoculating the homogenized sample (and dilutions) onto a solid culture medium (with agar) in a petri dish followed by incubation of the plates for the desired time and temperature (Silva et al., 2019).

However, the preparation of the materials used in these analyzes is more important. Incorrect preparation of the medium used affects the results negatively. For this reason, there are points to be considered in the growth medium prepared and used. In the medium prepared in the laboratory, it should be carefully prepared with reference to TS EN ISO 11133: 2014 Food, feed and water microbiology-Cultural medium preparation, production, preservation and performance test standard. For example, one of the first steps in the preparation of the medium is weighing the granular medium and mixing it with distilled water with the hardness appropriate to the standard. Before weighing, a balance of sufficient sensitivity is used; The maximum allowable error should be 1% or less, as given in ISO 7218 and ISO 8199. Unless

otherwise specified, ingredients are added to the specified volume of water rather than being made up to the specified volume. In the next step, mixing is done by heating to realize the dissolution process. The purpose of this process is to solubilize the granular medium. Then comes the sterilization step with the autoclaving process. The sterilized growth medium is poured into molten agar culture medium to a thickness of at least 3 mm (for example, 90 mm diameter dishes typically require 18 mL to 20 mL of agar) or as specified in the appropriate International Standard. One of the most important points to be considered in the amount of spillage is if the containers are to be kept or if the incubation will exceed 72 hours or if the incubation temperature is above 40 °C, more culture medium may be required. By placing the plates with their lids on a cool, horizontal surface, the agar is allowed to cool and solidify (ISO, 2014).

In this review, details about the preparation of growth medium used in microbiological controls, which are important for food safety at every stage, are given.

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Toxic Metals in Tissues of Fish from the Bulgarian Black Sea Coast and Assessment of Consumer Exposure

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Marine organisms are often used as bioindicators of pollutants in marine environment due to their higher capability of bioaccumulation. The aim of this study was to determine the levels of Cd, Pb, As, Hg, Zn, Al, Ni and Cr in edible part of four most consumed Bulgarian fish species and to evaluate the risk to human health.

Fish samples were collected from different sites of the Bulgarian Black Sea coast in the period winter 2021 – spring 2022. Toxic elements Cd, Pb, As, Hg, Zn, Al, Ni and Cr were determined in muscle tissue of four local fish species: goby (*Neogobius melanostomus*), horse mackerel (*Trachurus Mediterraneus ponticus*), anchovy (*Engraulis encrasicholus ponticus*), grey mullet (*Mugil cephalus*). Concentrations of toxic metals were determined by inductively coupled plasma - masspectrometry (ICP-MS) after sample mineralization. The samples were digested with concentrated nitric acid under pressure in a microwave system.

The decreasing order of the mean levels of elements in fish tissues was established as follows: Zn > Al > As > Ni > Hg > Pb > Cr > Cd. The content of mercury (Hg) and lead (Pb) in fish was found significantly higher in goby (benthic fish species). Nickel and chromium were found at highest level in horse mackerel and ranged from not detected to 0.322 and 0.042 mg/kg, respectively. Arsenic (As) was found in all fish samples in the range from 0,30 mg/kg (in grey mullet) to 2,63 mg/kg (in anchovy). Concentrations of toxic elements Cd and Pb in all fish species from Bulgarian Black Sea coast were found in the range from not detected to 0.073 and 0.564 mg/kg (maximum in goby from Chernomorec – south part of Bulgarian coast), respectively and mean levels were below the permissible EU and WHO limits.

The levels of toxic elements in marine fish from Bulgarian Black Sea were found lower than those reported from the other regions. Health risk assessment of consumers from the intake of fish was evaluated by using the target hazard quotient (THQ). Estimated dietary intake of polychlorinated biphenyls through the analyzed marine species does not seem to pose a human health risk.

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Genetic Diversity and the Population Structure of *Penicillium roqueforti* Isolates from Turkish Mold-ripened Cheeses

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Background: Türkiye has a variety of traditional mold-ripened cheeses produced by spontaneous fermentation such as Konya Kuflu Tulum, Erzurum Kuflu Civil, and Divle Cave Tulum. In this study, it was aimed to identify the mycobiota of Turkish mold-ripened cheeses and determine the genetic diversity and the population structure of the isolates of *Penicillium roqueforti*, the principal mold giving the characteristic blue-green color to these cheeses.

Methods: Using 61 cheese samples including Divle Cave Tulum, Erzurum Kuflu Civil, Karaman Kuflu Tulum, Kars Kuflu Chechil, Konya Kuflu Tulum, Sivas-Zara Tulum and Rize-Ardesen Golot148 molds and 16 yeasts were isolated . The isolates were molecularly identified using internal transcribed spacer (ITS) region or beta-tubulin (*benA*) gene. The interspecies diversity were investigated using rep-PCR with GTG5 primer and RAPD-PCR with M13 primer. The horizontal transfer regions that might be observed in cheese molds, *Wallaby* and *CheesyTer,* were PCR-screened in mold isolates. The mating genotype of *P. roqueforti* isolates were determined using *MAT* locus PCR. The morphological characteristics of *P. roqueforti* isolates were explored using potato dextrose agar (PDA), yeast extract sucrose agar (YES), malt extract agar (MEA) and oatmeal agar (OA). The population structure of *P. roqueforti* isolates was determined using the Bayesian method in Structure (version 2.3.4) software and Neighbor-Net Method in Splitstree (version 4.18.3) software using three microsatellite loci (Proq01_3, Proq02_2 and Proq16). The isolates representing the population were selected based on the information obtained from microsatellite loci, and five polymorphic loci (*cmd, benA*, *proq235*, *proq631* and *proq845*) from these isolates were PCR-amplified and sequenced. A phylogenetic analysis was conducted with these sequences using Mega 11 (version 11.0.10) software.

Results: The majority of the mold isolates (n=120) obtained from Turkish cheeses were identified as mostly *Penicillium roqueforti* along with the species *P. biforme*, *P. crustosum*, *P. paneum*, *P.) nordicum*, *P. brevicompactum*, *P. roseomaculatum*, and *P. solitum*, *Alternaria alternata*, *Albifimbria verrucaria*, *Cladosporium cladosporioides*, *C. macrocarpum*, *C. sphaerospermum* and *Talaromyces kabodanensis.* The yeast isolates consisted of *Debaryomyces hansenii, Geotrichum candidum*, *Kluyveromyces lactis, Pichia membrafaciens* and *Candida zeylanoides*. GTG5 and M13 primers were discriminative at the species level; however, they showed limited information on intraspecies diversity. *Wallaby* and *CheesyTer* regions were detected in all *P. roqueforti* isolates. The mating genotype distribution of *P. roqueforti* isolates was skewed in favor of MAT1-2 (95%). The media with the highest morphological diversity among *P. roqueforti* isolates was observed on PDA and 7 morphotypes were determined. Microsatellite analysis resulted in 36 sequence types. The most and the second most commonly observed sequence types included 31% and 10% of the isolates, respectively. The isolates with more than one sequence types were identified in some cheese samples. This showed that different strains from the cellar or cave environment can grow on cheeses during the ripening process. The isolates with opposite mating types were detected together in some cheese samples, which indicated possible sexual reproduction on cheese. Population structure analysis resulted in two groups among *P. roqueforti* population of Turkish mold-ripened cheeses. The phylogenetic analysis performed showed that Turkish *P. roqueforti* isolates were closely related to *P. roqueforti* isolates of European blue cheeses.

Discussion: The determination of genetic characteristics and the diversity of the Turkish isolates of *P. roqueforti*, will enable extending the scientific information about Turkish cheeses, selecting the strain best representing Turkish cheeses and development of starter

cultures in future studies and production of these cheeses under controlled conditions in terms of food safety.

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Food Safety Culture in Türkiye: an Insight Through Systematic Review and Meta-synthesis

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Background: The positive impact and rapid up take of food safety culture (FSC) in the food sector internationally, opens promising research areas to better understand and improve food safety management practices also in Turkish food businesses. Therefore, this systematic review and meta-synthesis aims to obtain an in depth insight into food safety and hygiene related research to obtain an initial understanding of the FSC context in Türkiye.

Method: Inclusion criteria of the systematic review covered research papers, Master´s and PhD thesis in both English and Turkish languages on foodborne outbreaks and disease occurrences, on food safety management systems´ (FSMS) implementation, on the evaluation of both FSMS and hygiene and finally, on knowledge, awareness and practice (KAP) studies in food manufacturing companies in Türkiye. With respect to foodborne outbreaks and disease occurrences, grey literature, namely newspaper articles, were also included to complete existing research data on foodborne outbreaks in recent years. To be sure that the data included in the review would give insight into the current situation, studies conducted and published after 2011 were taken into consideration, because major Turkish food safety legislation changes took place before that, possibly affecting companies´ food safety practices. Next, the qualitative meta-synthesis was conducted by aggregating the data into thematic findings based on the Global Food Safety Initiative´s (GFSI) proposed FSC dimensions. Finally, the data under each dimension was analysed to draw conclusions on FSC aspects.

Results: Findings show that Türkiye lacks a coordinated foodborne disease surveillance system. Thus, it is difficult the estimate the number of foodborne illness cases or the number of outbreaks. However, foodborne outbreak data from Turkish news reports and research papers, foodborne disease occurrence data from hospital and forensics medicine directorate databases, reflect deficiencies in food safety measures taken by food businesses. This is backed up by research on pathogen presence in different types of food, especially despite some of these companies having food safety certification. Furthermore, FSMS research both focuses and emphasizes the importance of the ISO 22000 food safety standard for Turkish food businesses, resulting in research gaps regarding other, especially GFSI recognized food safety standards and thus gaps around FSC criteria. Results of the meta-synthesis revealed FSC aspects on setting direction, leadership commitment, responsibilities, employee empowerment, food safety stakeholders and hazard and risk awareness. Findings highlight the lack of technical and food safety knowledge, in addition to relationships, like how the size of food businesses might influence companies´ FSC, e.g., SME owners or managers, especially with a lower education level tend to be less actively involved in production´s food safety compliance. However, leadership commitment is one of the key elements of a mature FSC.

Discussion: FSC research has demonstrated its significant impact on food safety performance and business success, which might also be a valuable approach regarding both food businesses and governmental food policy in Türkiye. Especially, since research in other countries has indicated that national values and food safety governance approaches might affect food businesses´ FSC. The results of this study will help to shape both the food safety and FSC research in Türkiye, in addition to allowing food manufacturing companies to take into

consideration important aspects when evaluating and developing improvement strategies for their FSC.

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Fully Automatic Production of Traditional Kashkaval Cheese

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Research Hypothesis: The manual execution of all the processes in the current Kashkaval cheese process brings with it physical (impurity substance contamination) and biological (microbial contamination) hazards and poses a food safety risk. With this project, the full automatic realisation of all the manual process steps without zero touch will provide benefits in many ways such as food safety, labour and cost advantages.

Method: In the production of traditional Kashkaval cheese, each portion is molded one by one and manually dried and packaged. With this project, it is planned to produce a single block with the dimensions that are the common multiple of all weights and to cut small weights from this block with the help of ultrasonic knives. In this context, the main mold size has been designed in which the existing products can be cut in all their weights (200-250-400-600-700-2000g). According to this measure, the Kashkaval cheese doughs (65° C) taken from the blanching stage in the current process were weighed and placed in the molds. In the fully automatic method, it is aimed that the structure of the Kashkaval cheese remains stable while the product is going to the cutting unit during the cooling stage and the dough reaches standard temperature degrees. For this reason, experiments were carried out on the in-mold temperatures and the residence times of the samples. The samples placed in stainless and teflon molds were subjected to cooling tests in the cooling room (4°C), at the control temperature of 15°C, 20°C, 25°C and 30°C.

Results: According to the test results, it was observed that the dough placed in the stainless mold adhered to the surface after cooling. On the other hand, in stainless molds coated with Teflon, it was observed that the samples with a control temperature of 15°C did not stick to the surface and their shape remained intact. It has been seen that this project eliminates the risk of food safety due to the fact that many points are manually intervened in the traditional method, from the production of Kashkaval cheese to the packaging stage, and the product quality and food safety are at risk. In addition, in this project, it was ensured that the labour cost was reduced, the production capacity was increased and the production wastage was minimized with a more standard production model. As a matter of fact, the utility model application made to the Turkish Patent Institute with this project was evaluated positively and registered on 23.11.2020.

Discussion: Biological hazards (microorganisms, etc.), physical hazards (foreign substances etc.) and sabotage risk (mixing physical and chemical substances into the product from outside), which pose a food safety problem, do not occur during the fully automatic production of Kashkaval cheese, the final product is physical and confirmed by microbiological analysis results.

Investigation of Thermal Process Parameters on Microbiological Safety and Sensory Quality of Soup and Broths

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Shelf stable liquid soups that can be presented with different packaging formats give the modern world people easy access to quick and healthy soups and convenience with an easy heat and drink application. However, the challenge lies in getting the industrially produced soup to consumers in an optimum condition, i.e. safe, stable during shelf life; natural, fresh and flavorful. In the present study, the overall efficiency of new processing time and temperature combinations was investigated. The targets for commercial sterilization processes are primarily the heat resistant spores of the pathogen *Clostridium botulinum*. However, to avoid potential spore outgrowth of *C. botulinum*, in this study *Geobacillus stearothermophilus* is selected for inoculation in commercially-prepared tripe soup, chicken broth and bone marrow broth stored in glass jars to observe the inactivation performance and the impact on the product attributes. Spore suspensions of *G. stearothermophilus* (106 cfu/ml) were inoculated into all soup and broth samples. Thermal inactivation of *G. stearothermophilus* spores was achieved through sterilization process. Heat process lethality (F0 values) designed to inactivate all microorganism including thermophilic spores at ambient temperature even under tropical conditions. Three different time and temperature combinations were chosen and applied to all samples at 120 ºC for 20 min, 122 ºC for 13 min, and at 125 ºC for 7 min, respectively. The effect of heat treatment on microbiological and sensorial attributes of samples were examined by using traditional cultural techniques and descriptive qualitative method, respectively. While the targeted F0 value was achieved when the temperatures were hold at 120 ºC for 20 min and at 122 ºC for 13 min during sterilization, adjustment of temperature to 125 ºC for 7 min was not enough to reach the targeted value. Thermal inactivation of *G. stearothermophilus* spores was quicker in chicken broth compare to bone marrow broth and tribe soup. The highest process lethality for all samples was observed when temperature was applied at 120ºC for 20 min. Although the odor of all heat-treated samples was in acceptable levels with no significant differences, taste, color, and mouthfeel values varied for each sample at different time and temperatures. The sensorial attributes (i.e. taste, and mouthfeel) of bone marrow broth, evaluated in lentil soup, and chicken broth, evaluated in rice, were better when they treated at 122ºC for 13 min. On the other hand, there were no noticeable differences in the colors of the lentil soups and rice at different time and temperatures. Tripe soup treated at 120ºC for 20 min had better taste in roasted meat direction, more solid particles in appearance and a better mouthfeel. Tripe soups treated at 120 ºC for 20 min and 125ºC for 7 min had darker color, yet, color of the other samples was also acceptable. Among the three sterilization process parameters, the optimum time and temperature value was considered as at 122ºC for 13 min, by considering microbiological safety, sensorial attributes and efficiency of the sterilization process.

The Effect of Fermentation By-Products of *Lactobacillus plantarum* on the Growth of *E. coli*

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Hypothesis: The traditional approach to probiotics is that the applied live microorganism will balance the intestinal microbiota and reduce undesirable bacteria. This balance may be disturbed, for example, by the excessive proliferation of Escherichia coli species, a genus of the Enterobacteriaceae family. In addition, specific strains of Escherichia coli (E. coli) can be invasive, enterotoxin producing and carriers of multiple antibiotic resistance genes. Plantaricin 35d, a bacteriocin secreted by Lactobacillus plantarum (Lb. plantarum), bacteriocin ST28MS and ST26MS have been reported to inhibit certain Gram-positive bacteria in addition to Aeromonas hydrophila, E. coli and Acinetobacter baumannii. Lb. Plantarum and E. coli are bacteria that can be found competitively, especially in intestinal flora. In this study, it is aimed to observe the in-vitro antimicrobial effect of bacteriocin derivative metabolites of Lb. Plantarum, which could be spread to close environment.

Method: In this study, live cells are separated from the medium by centrifugation and filtration methods after the bioreactor processes of Lb. plantarum. The bioreactor product containing the metabolites of plantarum was obtained. The inhibitory effect of the obtained bioreactor product against E. coli, in particular bacteria from the intestinal microbiota, was tested in vitro. In the first step, 4 L. MRS Broth broth inoculated with Lb. plantarum culture was fermented until stationary phase stage under microaerophilic bioreactor conditions. The reactor product obtained after the fermentation via centrifugation by 2 times at 2,500 rpm for 20 minutes and the supernatant was separated and passed through 0.45 microbiological filter. After filtration, the separated product was adjusted to pH 6.5. The effect of this bioreactor product, on which is separated by the fact that Lb. plantarumu carries bacteriosin-like metabolites, on the inhibition of E. coli, by means of in-vitro by agar well method within the framework of the methodology reported by the European Committee for Antimicrobial Susceptibility Testing (EUCAST) is investigated. At this stage, 0.1 ml of E. coli suspension adjusted to 0.5 McF was inoculated on Nutrient Agar petri plates and spread to the surface with sterile swab. 6 mm. 50 µl and 100 µl of the undiluted bioreactor product, 1/10, 1/100 and 1/1000 dilutions, were added to the wells. Petri plates were incubated at 37 ° C for 24-36 hours under aerobic conditions and each study was carried out in 2 replicates. After incubation, the inhibition sites around the wells were measured in mm. The study was also planned to be carried out by pour plate method.

Results: When the inhibition zones are examined in the cultivated petri dishes, the inhibition diameters around the wells, in which 100 µl of undiluted and 1/10 diluted bioreactor products are added to the wells, differ significantly compared to other dilution rates. It was observed that the inhibition diameter around the well in which 50 µl undiluted bioreactor product was added differs from other wells in which the diluted bioreactor product was added at the rate of 1/10, 1/100 and 1/1000.

Discussion: According to the findings obtained in the study, Lb. plantarum may suppress Gr-negative enteric bacteria, such as E. coli, when it reaches a predominant population (105 - 106 cfu /ml/gr). Accordingly, It was concluded that fermented products that can carry Lb. plantarum to the effective values may have positive effects on the intestinal microbiota and

may provide protective effect against intestinal pathogens especially through nutrition. In addition to detecting the presence of lactic bacteria in fermented products, further research studies on the effects of metabolites of these bacteria will help to clarify the nutritional values of these products as well as the protective and supporting properties of the microbiological activities in the intestine.

How Can We Analyze Egg Allergen with Mass Spectrometry in Different Food Matrices?

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Food allergies are a growing global concern because even low exposure to a given food can have significant consequences to allergic people. The introduction of labelling the main food allergens when used as ingredients can be not sufficient to avoid health risk in consumers, due to unintended contamination introduced during the production of food (Korte et al., 2019).

Alongside antibody-based methods (ELISA) and DNA-based methods (PCR), targeted liquid chromatography-tandem mass spectrometry (LC-MS/MS) represents a useful technique to detect and quantify simultaneously multiple food allergens in complex matrices with high specificity (Xiong et al., 2021). Talking about constraints and limitations, in some situations results obtained with immunochemical food allergen detection methods may vary between kits from different suppliers, due to differences in protein extraction, reference materials and antibody selectivity (Parker et al., 2015). However, also LC-MS approach presents some critical issues such as the choice of an optimal extraction procedure, the lack of officially approved reference standard materials and the choice of specific peptides, obtained from the enzymatic digestion of allergenic proteins, suitable for allergens detection and quantification.

During the development of Mérieux NutriSciences multi-allergen LC-MS/MS method for bakery products, resistance to thermal treatment, presence of interfering signals deriving from allergen matrices and appropriate reference materials were considered in order to optimize the selection of allergen peptide markers. The choice of LoQ (Limit of Quantification) level for each allergen was based on VITAL 3.0 references doses (BfR, 2020) and referred to realistic serving sizes.

In this study, coordinated by WFSR (Wageningen Food Safety Research) inside a public-private partnership consortium [Top Sector Alliance for Knwoledge and Innovation (TKI, LWV19252, Dutch initiative for evaluation and quality assurance of fast methods in food safety testing)], the Mérieux NutriSciences LC-MS/MS method was applied to detect egg allergen in various food matrices, also different from bakery products, in order to verify the specificity, accuracy, precision and robustness of the method and consequently, the real capabilities which today make mass spectrometry a complementary technique to the more traditional and recognized ELISA and PCR approaches.

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Determination of Food Safety Concept Consciousness Level

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This research was conducted as a field survey survey by face to face with the consumers by the researcher himself in order to determine the consciousness level of the concept of food safety. The study was carried out on individuals living in Konya province in 2016 - 2017 and selected by simple random sampling method over the age of 18 who are doing food shopping. The data collection tool of this research is a questionnaire composed of 33 questions, 2 chapters. 01-09. Questions to determine consumer demographics, 10-33. The questions aimed to measure the level of food safety information.

Consumers have found that 73.4% of them have heard the concept of food safety and 26.6% of them have not heard the concept of food safety. Consumers who have heard the concept of food safety and have defined this concept as "the production of healthy, healthy food products" is required as conscious consumers at every stage from the production to the consumption of food. 73.9% of the consumers were conscious about food safety and 26.1% were unconscious. The definition rate of 174 Food Lines "All kinds of complaints and requests of consumers regarding food" is defined as 67,4%. It has been determined that consumers are most informed about TSE and HACCP food safety systems. Consumers are informed about food safety mostly from internet, then radio and television programs. It was determined that more than half of the consumers who participated in the survey thought that human health was not paid attention to where food production was made and sold. A significant number of consumer groups (65.3%) were found to be willing to pay extra for food they believed to be reliable. This benefited from the Chi square analysis in determining the factors that caused the overpayment requests. These factors are; sex, place of birth, marital status, income. Binary logit analysis was used to determine the variables affecting the profiles of those who heard the concept of food safety. According to this, gender, age group, educational status, monthly income status, food safety have been determined as important variables in the perception of the concept.

In order to increase awareness, information programs on food safety should be organized for consumers and contribution should be made to increase their awareness. Companies producing or selling food products should organize programs such as panels and educational television programs in order to ensure that consumers are conscious and careful in this subject. The awareness of auditing and control organizations should be increased. In order to gain the trust of the consumers who think that the inspection is not sufficient in the places where food production is made, legislation should be amended, laws should be enacted to deter those who act to deceive the consumer. Consumers should be informed about the ways in which they come into contact with defective and defective products.

Evaluation of Divle Obruğu Tulum Cheese Production

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Research Hypothesis: Türkiye has a rich diversity of traditional cheeses. Divle Obruğu tulum cheese is the cheese formed by the ripening of the tulum which is placed in the cave called obruk which has its own settled mold flora. In this study, it is aimed to determine and record the components and production stage of traditional Divle Obruğu tulum cheese.

Method: The research was conducted in the form of a qualitative study and the data were obtained using a semi-structured interview form from housewives (n=2), producer men(n=2), producer and auditor men(n=1) who are the source persons residing in Karaman. In addition to the demographics of the source persons, the interview form included questions about the materials used in making Divle Obruğu tulum cheese, the production process, the production conditions and the mode of consumption. In case of insufficient answers during the interviews, additional questions were asked. Each of the interviews lasted approximately 20 to 30 minutes. Short notes were taken during the interview to support the data. The raw data obtained from the interviews were evaluated using descriptive analysis technique. While evaluating the research data, production of Divle Obruğu tulum cheese in houses and production in enterprises was evaluated separately.

Results: Production in houses: In the making of cheese, sheep, cow and goat's milk is used alone or mixed in different proportions. Raw milk is added to the ready-made yeast for fermentation. Weight is placed on the curd separated from water and waited. The curd in the form of molds is pressed and crushed. Then, certain amounts of rock salt are added to the curd whose weight is measured. The overalls are swollen to release water. The swollen coveralls are allowed to rest for 1 week at a temperature of 15-16°C they dry well. At the end of this period, the coveralls are left to the pothole to ripen cheese. Coveralls left to the puddle first turn blue, then white and then red. The outer surface of the overalls is considered to be the red color of the tile and is considered to be the full ripening of the cheese. The ripening period of cheese takes about 3-5 months depending on the size of the bag. Production in enterprises: In the making of cheese, milk obtained by milking goats and sheep Fed in the Highlands and pastures within the borders of Ayrancı district of Karaman is filtered with clean cloths and 100 kg milk is added to 10 ml cheese yeast and left to ferment for 80 minutes. The yeast used can be Shirden yeast or any cheese yeast. When the clot is fully formed, it is taken into clean cloth bags and left to filter in print for 24 hours. Then the thoroughly crumbled cheeses are salted and mixed with 3%. The resulting cheese is cleaned and stuffed tightly into prepared goat jumpsuits so that there is no air in between. After waiting for 8-10 days in a cool area, the coveralls are placed in a suitable place and kept for about 5-6 months. Products removed from Obruk cave are offered for sale without opening overalls.

Discussion: Lack of a certain standard in the production of homes produced by local people in the region may pose a health risk. The fact that the cheeses produced in the enterprises are produced and inspected in accordance with the standards in the geographical sign registration document prevents nutrition and economic losses. With the support of the enterprises, it should be ensured that this local flavor is more recognized both in our country and in other countries.

Changes in Biogenic Amines Content During Processing of Traditional Sausage *Sjenički sudžuk*

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Sjenički sudžuk is traditional dry-fermented beef sausage from south-western region of Serbia. During fermentation and ripening, high amount of free amino acids is generated and precondition for biogenic amines (BAs) formation is settled. Accumulation of BAs is a consequence of microflora activity. Hence it could be seen as good hygienic practice indicator.

Sample sausages were produced in small processing facility within town of Sjenica. It was done according to traditional procedure, using fresh boneless beef and spices (sea salt, raw garlic paste, black pepper and red sweet paprika powder). Further, raw sausages stuffed into natural casings, underwent process of smoking/drying/ripening during 23 days. For BAs analysis raw sausage mixture and three sausage samples were taken after 3, 7, 15 and 23 days of processing.
Putrescine, cadaverine, histamine and tyramine were determined as dansyl derivatives, using liquid chromatography (Agilent 1200 series), equipped with a diode array detector on an Agilent, Eclipse XDB-C18, 1.8 µm, 4.6 x 50 mm column. As solvents, acetonitrile (solvent A) and water (solvent B) were used. Gradient elution program was established: initial 50% B; linear gradient to 10% B in 7.6 min, 10% B to 10 min; linear gradient to 50% B in 2 min. Flow rate was 1.5 mL/min, column temperature was 40°C and injection volume was 5 mL.

In the raw sausage mixture, BAs were not detected, indicating good hygienic quality of raw materials. After three days of processing, only tyramine was quantified (48.5 ± 2.91 mg/kg), confirming previous data of its highest abundance and prevalence in dry-fermented sausages, with usual content ranging from 50 to 300 mg/kg. Following logarithmic growth pattern, on the 23rd day of production tyramine content reached 147 ± 8.30 mg/kg. After 7 days of production putrescine and cadaverine were found in low concentration. Subsequently, cadaverine showed slow linear increase ($p<0.05$) from 20.4 ± 2.12 to 30.8 ± 3.76 on 23rd day. On the other hand, putrescine concentration significantly increased ($p<0.05$) during ripening period, becoming the most abundant amine in *Sjenički sudžuk* (212 ± 10.1). Histamine was only detected on 23rd day of production. It is the most important BA because of its toxic effects and the single one with stipulated maximal amount, by European Council: 100 mg/kg in some fish species and 200 mg/kg in fishery products. Its content in *Sjenički sudžuk* was only 9.69 ± 0.70 mg/kg. Moreover, sum of tyramine and histamine was 156.69 mg/kg at the end of production, what was lower than limit of 200 mg/kg suggested as criteria for good hygienic conditions. Furthermore, according to European Food Safety Authority (EFSA) prescribed thresholds for these two amines consumption (healthy person) are: for tyramine – 600 mg/meal and for histamine - 25 mg/meal. Hence, these tolerable limits would hardly be reached by consuming *Sjenički sudžuk*. Considering good manufacture practice, content of cadaverine and histamine are proposed as indicators, since their accumulation is closely connected with bacterial spoilage, and in this research their contents remained at low values.

In conclusion, four analysed biogenic amines were detected at the end of processing, on 23rd day. However, the obtained concentrations remained lower then recommended and stipulated thresholds, proving that production of *Sjenički sudžuk* was in accordance with good hygienic and manufacturing practice.

Fabrication of Carbon Quantum Dots From *Lactobacillus acidophilus* and Evaluation Of their Antibacterial Activity Against Gram-Positive and Negative Bacteria

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A vast number of severe diseases develop as a result of foodborne bacterial pathogen infection which poses challenging global threats to human health and needs to prevent their transfer from food and water supplies. With the remarkable advances of nanotechnology in recent years, nanomaterial with unique physical and chemical properties have gained increasing attention in biological and biomedical fields. Owing to their great specific surface area and high bioactivity, nanomaterials are considered as appropriate candidates to use rather than traditional organic antimicrobial agents that are extremely irritant and toxic. Various nanomaterials with antimicrobial performance have been recently reported. Carbon quantum dots (CQDs) with less than 10 nm in size, are novel approaches in this field with a special application as antimicrobial and UV barrier materials. These CQDs have unique physicochemical attributes including high sustainability, photostability, non-toxicity, antibacterial and antioxidant features. These features make CQDs applicable in a broad range of fields such as chemical sensors, fluorescent ink, antimicrobial, cell imaging, UV-barrier, medical diagnosis, biosensors, and energy sources. Moreover, surface functional groups and the ultra-small size of CQDs are very efficient for their inhibition properties against bacterial cells. Hydrothermal, chemical oxidation, ultrasonic microwave, and electrochemical are a variety of ways employed to synthesize these nanoparticles. Among them, the hydrothermal procedure is eco-friendly, simple, cost-effective, safe and efficient. Generally, CQDs can be derived from various precursors like chemicals, waste, by-products, and biomass. In this study, CQDs were synthesized through a one-step hydrothermal method as a green and economical approach, from Lactobacillus acidophilus at 200 °C for 24 hours in a stainless-steel chamber, and then characterized. The size, morphology and surface functionality of as-prepared CQDs were assessed using particle size analyzer, TEM and FTIR technique, respectively. The results illustrated that the synthesized CQDs were water-soluble with an average size of 2.8 nm and spherical which had a great number of hydroxyl groups on their surface. The obtained CQDs have shown antibacterial activity at only 50 mg/mL concentration against both gram-positive and gram-negative bacteria which were determined by agar well diffusion on tryptic soy agar, previously inoculated with ~6 log10 CFU/ mL, and incubated at 37±1 °C for 18 hours. The zones of inhibition were 20.16, 18.42, 14.37, 15.38, 16.69, 14.14 and 14.69 mm for *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella enteritidis* (as gram-positive bacteria) *Escherichia coli*, *Enterococcus faecalis*, *Salmonella Typhimurium*, and *Klebsiella pneumonia* (as gram-negative bacteria), respectively. According to the results, CQDs had more effect on gram-positive bacteria than gram-negative one which is related to the cell wall. Besides, ultra-small size and high surface/volume ratio of CQDs giving CQDs the ability to produce free radical and oxidizing as well as disrupt the membrane which leads to the leakage of bacterial cell contents. The results show that the preparation of CQDs via the hydrothermal method and using them as an antimicrobial agent in food packaging toward both gram-positive and gram-negative bacteria can be developed as an effective technique.

Synthesis of Carbon Quantum Dots from *Saccharomyces cerevisiae* and Evaluation of their Antibacterial Performances on Food-borne Pathogens

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Food-borne pathogens are one of the major public health threats. Novel and innovative packaging material could help to overcome the risk of those microorganisms to a certain extent. In this sense, antimicrobial packaging has gained more attention for consumers and industry. This is a type of active packaging getting involved in the control and growth/survival of foodborne pathogens in food commodities. Several types of antimicrobial substances have been proposed for fabrication an antimicrobial coating and film including animal, microbial and plant originated agents. Nowadays, the use of nanomaterials, particularly carbon quantum dots (CQDs) have been considered as advanced emerging biomaterials and as a suitable replacement for the chemical antimicrobials in the development of edible films. CQDs with the size of less than 10 nm have attracted a lot of attention due to several unique physicochemical properties such as simple synthesis procedures, environmentally friendly, significant solubility in water, suitable permeability in cells, high resistance against salt, revealing fluorescent characteristics, low toxicity, low costs, and being economical. These particles are formed by hydrogen, oxygen, carbon, and nitrogen. Due to those diverse specifications, CQDs have multiple applications in areas such as optoelectronics, cell imaging, fluorescent ink, medical diagnoses, chemical sensors, biosensors, and food. Their antimicrobial characteristics depend on the structure of the material. In addition, they pass easily through cell membranes because of their small size, so CQDs are considered as new potent antimicrobials for different applications. They are being synthesized through various methods such as hydrothermal, ultrasonic microwave, and chemical and electrochemical oxidation from different resources. In this study, a green method has been applied, for the first time, for synthesizing CQDs from byproducts of Saccharomyces cerevisiae. CQDs were synthesized via a one-step hydrothermal method. The obtained CQDs were characterized by particle size analyzer, a transmission electron microscopy (TEM) and a double beam spectrophotometer. The antimicrobial characteristics of CQDs were assessed against *Listeria monocytogenes* and *Staphylococcus aureus* via a well-diffusion method on tryptic soy agar initially inoculated by ~6 log10 CFU/ mL of bacteria under aseptic conditions. Through analyzing particle size, the size of CQDs were found to be less than 10 nm. Based on the results of morphology and surface features, it was found that CQDs are spherical in shape and have high hydroxylation groups at the surface. In *L. monocytogenes*, 13.40 and 10 mm zone of inhibition were found for CQDs at 25 and 12.5%, respectively, while the zone of inhibition around 18.5 and 15.2 mm were reported for CQDs at mentioned concentrations on S. aureus. Consequently, CQDs represented good antimicrobial performance on S. aureus followed by *L. monocytogenes*. The obtained results showed that synthesized CQDs through green methodology with low costs are an antimicrobial biomaterial revealing their role as a suitable material for fabrication of antimicrobial packaging to combat with familiar foodborne pathogen including *L. monocytogenes* and *S. aureus*.

Molecular Identification Methods of *Staphylococcus aureus* Strains Isolated from Food

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Foodborne diseases caused by consumption of food contaminated with Staphylococcus aureus adversely affect food safety and public health. S.aureus is a food-borne pathogen that produces enterotoxins that are resistant to many applications, particularly heat treatment, and 35-50% of its strains are capable of producing enterotoxins. Enterotoxins produced by the microorganism are known to be responsible for disease production. S.aureus is naturally present in environments such as oral and nasal mucosa, human and animal skin, dust and soil. However, they can also be isolated from food sources such as red meat, seafood, salads, milk and dairy products. The ingestion of S.aureus through food causes serious diseases such as meningitis, septicemia, endocarditis, arthritis and bacteremia. For this reason, fast, reliable, practical and economical determination of S.aureus in foodstuffs is very important for food safety and human health. In recent years, molecular identification methods such as PCR (polymerase chain reaction), MLST (multilocus sequence typing), 16S rDNA sequence analysis and MALDI TOF (Matrix Assisted Laser Desorption / Ionization) have made important contributions in the field of microbiology. Among these methods, MALDI-TOF MS, which has been used in the identification of microorganisms in recent years, is based on the passing of molecules of microorganisms through electromagnetic flight tube after ionization with laser pulses. Signals recorded as ions passing through the flight tube and hitting the detector at different times form the mass spectra of the proteins. These spectra are compared with the spectra in the device database and by matching, microorganisms can be identified at the genus and species level. Studies with staphylococci indicate that MALDI-TOF is successful in isolating S. aureus on a species basis. In addition to the latest technological molecular methods, DNA based methods are among the most widely used methods in microbiology laboratories. The PCR method is frequently used to detect S. aureus strains. Classical PCR, real-time PCR and multiplex PCR are the PCR methods used for this purpose. Real-time PCR can be used to determine the strain-specific responsible mRNA gene sequence so that gene activity is instantaneous. In multiplex PCR, more than one strain-specific gene can be investigated simultaneously. In the identification of S. aureus, the presence of species-specific genes is being investigated. The nuc gene responsible for the extracellular thermostable nuclease enzyme, the coa gene responsible for coagulase activity, the femB gene responsible for transferase activity, and the spa gene encoding Protein A located at the outermost part of the peptidolicane layer are the genes frequently investigated by PCR. However, sea, seb, sec, sed and see genes responsible for the production of SEA, SEB, SEC, SED and SEE type enterotoxins are also frequently investigated by PCR in the identification of S. aureus. MLST (Multilocus sequence typing) is a widely preferred DNA sequencing method based on the analysis of conserved genes. In this technique, specific portions of the 7 essential genes are used. Fragments of about 450-500 base pairs in the interior of each gene are sequenced by the automated DNA sequencer. For this purpose, for S. aureus, the data obtained by MLST is quite successful for species separation. The use of molecular techniques in the field of microbiology is becoming more and more common.

Molecular identification methods are very important in terms of public health and food safety because they provide results in a short time, virulence and resistance profiles of microorganisms in a short time and even at the same time and as a result enable rapid and accurate measures for eradication of microorganisms.

Biocontamination Risk of Glass by *Staphylococcus aureus* in Presence of UHT Milk

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The biofilm produced on the surface of the processed milk equipment may be a cause of contamination of dairy products. This work aims to study the biocontamination risk of materials by *S. aureus*.

The adhesion of *S. aureus* on glass coated by tree kinds of UHT milk (whole milk, semi skimmed and skimmed milk) was investigated. The physicochemical properties of the glass treated with both types of UHT milk were estimated by contact angle measurements. The hydrophobic quantitative and electron acceptor characteristics of the glass appear to increase with the presence of fat in milk, while its property as an electron donor decreases with this component. The ability of *S. aureus* to adhere to treated and untreated glass using milk was also tested. The percentage of occupied surface in the case of untreated surface is more important than in treated surfaces. The percentage of occupied surface by bacterial strains in the case of untreated glass by skimmed milk is more important. Therefore, the risk of biocontamination is more favorable for skimmed milk than semi skimmed and whole milk.

Antimicrobial Resistance of *Salmonella* spp. in Broiler Farms in Malaysia

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Antimicrobial resistance (AMR) is a major threat and public health risk issue worldwide when antimicrobials used to treat infectious diseases are no longer effective. Meanwhile, *Salmonella* spp. are among the most common food borne pathogens. The increasing of incidence in antimicrobial resistant on "*Salmonella*" poses a severe risk to public health. The main objective of this study was to determine the prevalence and the AMR of *Salmonella* spp. in broiler farms in Malaysia. A total of 2429 pool samples of cloacal swabs were collected from 258 farms were examined for the presence of *Salmonella* spp. Subsequently, "Salmonella" isolates were serotyped and antimicrobial resistance was determined by a disk diffusion method. *Salmonella* spp. prevalence was 15.1%. A total of 140 were confirmed to be "Salmonella" spp., consisting of 10 serotypes: *Salmonella albany*, *Salmonella brancaster*, *Salmonella brijbhumi*, *Salmonella* Enteritidis, *Salmonella molade*, *Salmonella havana*, *Salmonella hindmarsh*, *Salmonella javiana*, *Salmonella magherafeit* and *Salmonella* Typimurium. Higher AMR was observed for tetracycline (84%), ampicillin (70.0%), chloramphenicol (58.0%), trimethoprim (42%) and gentamicin (30%). Based on the prevalence of *Salmonella* spp. and AMR findings, it can be concluded that, an aggressive approach needs to be taken by industry at the farm level by strengthening the farm's biosecurity practices. In addition, investigation into the causes of Salmonella infections and factors that contributing to the AMR need to be conducted. Resistance to Veterinary Critically Important Antimicrobial Agents (VCIA) and Veterinary Highly Important Antimicrobial Agents (VHIA) used to treat salmonellosis is a concern to public health. However, both the industry and government need to proactively monitor AMR and antimicrobial stewardship practices to ensure the long-term protection of animal and human health.

Geographical Indication as a Food Safety and Food Quality Instrument

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Protected Designation of Origin (PDO) and Protected Geographical Indication (PGI) is one of the essential issues in agriculture and food industry in terms of sustainable production, food quality and authenticity, and regional distribution of added value/income due to regional reputation of agriculture and food products with local producers. PDO mark identifies a product originating in a specific place, region or country. PGI mark designates a product originating in a specific place, region or country whose given quality. Objectives of geographical indication, support local production and rural development, preserving traditional knowledge and cultural values, contribute to tourism and it is a struggle against product imitation.

According to the data of Turkish Patent and Trademark Agency, 464 products have been registered and the total number of applications in progress is 448 while 37.5% of geographically indicated products in Türkiye was registered as PDO and 62,5% of those were registered as PGI.

All geographically indication products are grouped under 17 titles. These are; carpets & rugs, Beers and other spirits, Other products, Processed and unprocessed fruit and vegetables and mushrooms, Chocolate, confectionery and other products, Cheeses, Processed raw meat products, Handicraft products, except carpets and rugs, Dishes and soups, Honey, Fats and oils, including butter, Bakery and confectionery products, pastries desserts weaving, Cheese and dairy products other than butter, Soft drinks, Condiments, flavorings, sauces and salt for food and Ice creams and edible ice. When the total amounts considered, food products cover 77,9% of all geographically indicated products. The dossiers of registered food products contain the information about the region where the food product belongs, the special characteristics of the product and control policy and methodology in general. Among these food products while most of them were characterized in the Turkish Food codex, some of them does not covered within a legislation. This study, discusses the current PDO and PGI registered products using their against the quality aspects determined in Codex and evaluates the relation of these properties with food safety and food quality.

Aflatoxin B1 and Salmonella, Process and Critical Control Points in Compound Feed Production

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The most important parameter for production and quality determination in feed factory is traceability. In order to ensure full traceability, written registration systems must be in place. In case of recalling a product due to a problem, traceability is very important to find the source of problem quickly and effectively. The word 'process' that entered into our everyday language recently has become more meaningful in the food chain from field to table. This word had a broad repercussion in full sense together with Good Manufacturing Practices and Feed Hygiene Guide for the Feed Sector released in 2014. Food should come to mind when feed is mentioned. That's why there are series of process chains from the production of feed to its delivery. The aim of feed production process is to produce the compound feed under controlled conditions. Numerous pathogenic bacteria may be present in animal feed, but keeping the amount of Salmonella in the feed under control has been a priority for feed producers for years. The reason for this is that *Salmonella* is the most common pathogen that causes safety problems in feed and dry food. Inadequate storage conditions of feed raw materials, both in pre-harvest and post-harvest periods in hot and humid climatic conditions, can reproduce some common fungal molds, such as mycotoxins, to produce dangerous levels. The only mycotoxin that has been the most studied and has legal limits to its occurrence in food as well as animal feed is currently aflatoxin. Aflatoxin, which is considered to be carcinogenic, can also pass from human milk to cows fed with contaminated feed. Other mycotoxins have also started to play a key role in feed safety. For example, DON, Zeralenone or Ochratoxin may have negative effects on animals and it is found to be in serious amounts in feed raw materials. Therefore, feed in the food chain from farm to fork is the essence of food.

Waste Compost Quality Assessment for Efficient Use in Agriculture: Case of the Khenifra Region - Morocco

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Composting is an aerobic process for biodegradable materials by biological transformation to form, after maturation, compost stable and rich in humus. This study aims to evaluate the solid waste composts quality in Khenifra region in order to use them as an organic amendment.
Two composts types were characterized: waste solid (C1) and waste solid with plant debris (C2). The evaluation criteria's are based on maturity, particle size, organic matter, heavy metals and pathogenic microorganisms.

The results showed that the C / N ratios varied in between 13% -15% and showed that the composts obtained were mature. The pH is slightly basic and varies between 7.9 and 8.1. Fine particles represented 61% while particles > 2 mm in size have a proportion of about 40% confirming this result. The average of organic matter content in composts is approximately 19-20%, carbon 12%, nitrogen 0.77%, perfectly complying with international standards. The results for heavy metals also showed relatively high values but remain within the standards. Microbiological analyses revealed the presence of fecal coliform bacteria (Escherichia and streptococci) and fungi of genus *Aspergillus*.

In general, the composts produced by solid waste in Khenifra are of good quality and can be used as organic fertilizer for the soil. A simple pre-treatment of the compost and a germination test are then necessary.

Investigation of *Campylobacter* sp. in Chicken Meat Samples Sold in Istanbul Market

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Research Hypothesis: *Campylobacter* spp. is an important foodborne pathogen that is often found in chicken meat and products. It is found in chicken meat and in its products, which are widely consumed in our country. In the scope of the study, different chicken meats sold in the market were analysed by the presence of *Campylobacter* spp. and the frequency of contamination was determined by comparing the products.

Method: A total of 100 samples, whole chicken (n=25), thigh (n=25), breast (n=25) and lung (n=25), which are sold as packaged or unpacked in markets and butchers, are collected in the cold chain and transported to laboratory. Samples were analyzed for microbiological analysis immediately. In the analysis method to promote detection of Campylobacter sp., 25 g of chicken sample was homogenized in 225 ml Bolton Broth in a sterile stomacher bag and incubated under microaerobic condition for 4 h at 37°C and then for 4 h at 42°C (ISO 10272-1: 2006 (E)). After pre-enrichment, the samples were streaked with a 10 µl volume loop on m-CCDA plate and incubated at 42°C for 48 h under microaerobic condition. Metallic grayish colored Campylobacter sp. suspected colonies were examined by gram staining. Suspected colonies were taken to catalase and oxidase tests and positive response to tests were verified as Campylobacter sp.. The results were analyzed statistically with SPSS version 11.5 statistical program and 95% confidence interval and significance level was evaluated as $p < 0.05$.

Results: As a result of the research, 27 out of 100 samples (27%) were determined as contaminated with *Campylobacter* sp. The most frequent contamination was observed in lung samples (n=10), followed by breast (n=9) and chicken thigh (n=7). The least contamination was obtained in whole chicken (n=1) sample. According to these results, when the risk of contamination was compared between the chicken products examined, it was found that nearly half of the chicken lungs were contaminated (40%), thus the chicken breast and lung meat were contaminated significantly more frequently than other sample types ($p<0.05$). In terms of food safety, *Campylobacter* can be seen more frequently in edible offal (lungs, etc.) than other parts and also processes applied to meat may affect *Campylobacter* spread. This result was obtained due to the low incidence of Campylobacter (1%) especially in whole chicken. When this situation is compared with the existing literature, no other research has been found that draws attention to the lack of contamination in whole chicken meats. The obtained isolates are stored in -80°C with 20% glycerol broth for further studies.

Discussion: As a result of this study carried out by microbiological examination of different chicken products, it was determined that parts of chicken lung, breast and thigh were frequently contaminated with *Campylobacter*, but whole chicken showed less contamination compared to these products. Considering this significant difference, which is thought to be caused by processing technology during and after production and cutting, it is foreseen that there is still a need for innovative applications in poultry production, cutting and processing technology.

Evaluation of Menus in Food Services Provided with Centralized and Decentralized System in Terms of Food Variety, Cost and Consumer Satisfaction

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This study was conducted in order to evaluate the menus in terms of food variety, cost and consumer satisfaction in centralized and decentralized system. The study was carried out with 202 workers (170 (84.2%) males and 32 (15.8%) females) who were between 19-82 years of age and also the average age of the workers was 36.2±10.41 years and receiving service from a catering company in Yenimahalle district in Ankara. The menus offered in the centralized and decentralized system catering services were evaluated in terms of food variety and cost, and satisfaction levels of the menus offered to the workers were determined by satisfaction survey. The frequency of green leafy vegetables and buttermilk, milk, sugar, honey, jams etc. in the menus of decentalized system was higher than the menus centralized system. The energy value of the menus is determined 2598.35 kcal for centralized system and 3465.65 kcal for decentralized system. While Carbohydrate amount was 228.05 g in the centralized and 316.45 g in the decentralized system, The ratios from energy were found %35.6 and %37.29, respectively. The protein amounts of the menus were 86.95 g (%13.83) for the centralized and 104.89 g (%12.43) for the decentralized system. The fat amounts was found 146.72 g (50.6% of the energy) in the centralized and 195.4 g (50.3% of the energy) in the decentralized system. Cholesterol levels of the menus; while it was 355.70 g in the centralized and 501.45 g in the decentralized system. The amount of pomace was 16.4 g in the centralized system and 32.14 g in the decentralized system. Vitamin A was 1003.65µg in the centralized, while it was 2018.16µg in the decentralized system. The amount of vitamin C was 117.31 g in the centralized and 281.29 g in the decentralized system ($p<0.05$). While the amount of calcium is 858.69 mg in the centralized and 1176.77 mg in the decentralized system, the amount of iron are 13.24 mg and 17.72 mg respectively. The difference between the two systems was significant for all macro and micro nutrients ($p<0.05$). When the costs of the menus are evaluated, the breakfast offered in the centralized is 2.12 TL and 3.75 TL in the decentralized system. 113 of the workers benefit from centralized system and 89 of them decentralized system. In the study, 65.5% of the beneficiaries of centralized system were bluecollars and 34.5% were whitecollars, while 49.4% of those using decentralized system were bluecollars and 50.6% were whitecollars. Accorging to 70.8% of the workers benefiting from centralized system considered that menus are good, while 31.5% of workers benefiting from decentralized system considered that menus are good, and 50.6% were considered that the menus are average quality. There was no significant difference between BKI (25.6±3.18) of workers using centralized system and BKI (26.0±4.02) of workers using decentralized system. In general, the ratio of satisfaction on menus were different between the two groups. Among the workers who benefit from centralized system, The ratio of satisfaction for the variety of food, soup taste, thickness, content, meat temperature, taste, fat ratio; presentation, the temperature, the taste, the oil and content of rice pasta and pastries; presentation, warmth, taste, fat, content of vegetable and legume dishes; presentation and content of cold and olive oil dishes; salads and desserts presentation, taste, freshness, satisfaction for service flow in the cafeteria, cleaning of service containers and trays is significantly higher ($p<0.05$). It should be applied to the companies considering the advantages and disadvantages of centralized and decentralized system catering services, menu planning should be made considering food variety, cost control and customer satisfaction.

Processing of Ultrasonically Brew White Tea: Changes on Quality Parameters and Microbial İnactivation

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Depending on the variations in harvesting, processing, and associated degree of oxidation of fresh tea leaves; white, green, oolong, and black teas are produced from the leaves and buds of the *Camellia sinensis* (L.) (family *Theaceae*). White tea extracts (WTE) have shown as an antioxidant, antibacterial, and antifungal activities. Tea, served as hot or ice cold, is an extremely popular beverage around the world. The potential of ultrasonication (US) to replace the traditional brewing process to make cold tea in terms of the extraction yield of bioactive compounds and inactivation of endogenous microflora has not been explored. Among different nonthermal technologies such as high pressure processing (HPP), pulsed electric fields (PEF) and ultrasonication come forward due to their minimized adverse effect on product quality. For this reason processing of white tea by US by different processing time, temperature and amptitude with the measurement of physicochemical and inactivation of endogenous microflora was prompted.

One gram of grounded tea leaves mixed with 100 mL of water under the different design conditions. Then, samples centrifuged at 10000 rpm at 10 min. Supernatant was collected and stored at 4 °C under refrigeration for further analyses. Explanatory variables for US such as amplitude (70-90%), processing time (5-15 min) and temperature (30-50 °C) were investigated using Box-Behnken Design (BBD) wtih respect to pH, color (L, a, b values), total antioxidant capacity (TAC), total phenolic content (TPC), total mold and yeast (TMY) and total aerobic mesophilic bacteria (TAMB). With change treatment time from 5 to 15 min, amplitude from 70 to 90% and processing temperature of 30 to 50 °C, minor changes were observed in pH, L value, TAC, TPC with no significant difference ($p>0.05$). Increased treatment time, amplitude and temperature provided significant amount of inactivation on both total mold and yeast and total aerobic mesophilic bacteria. Among the variables studied, only amplitude showed significant effects ($p<0.05$) on total aerobic mesophilic bacteria, whereas significant quadratic terms were found amplitude and temperature ($p<0.05$) for total mold and yeast. Antioxidant activity of the control white tea sample was measured as 66.78±0.12 % and this value was not significantly affected by ultrasonication. TPC of the control sample was found as 31.94±0.36 mg gallic acid equivalence/L. The TPC of white tea samples is ranged from 4.39-77.55 mg/L. Control white tea samples had the initial total aerobic mesophilic bacteria (TAMB) and total

mold and yeast (TMY) count of 3.73±0.03 and 3.60±0.03 log cfu/mL, respectively. Ultrasound process with different amplitude, time and temperature was effective to reduce both TAMB and TMY. Reduction of initial number of total mold and yeast was determined as 2.30±0.00 log cfu/mL at 80% amplitude, 40 °C for 10 min, whereas TMY were found as 2.00±0.00 log cfu/mL at 90% amplitude, 30 °C for 10 min. It is concluded that US is a viable option to process white tea without adversely affecting its physicochemical properties.

Molecular Diagnosis of Rotavirus in Raw and Ready-to-Eat Food Samples

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Research Hypothesis: Low hygiene conditions in the food sector lead to important cases such as gastroenteritis in humans. These cases of gastroenteritis are of bacterial and viral origin. Norovirus, adenovirus, astrovirus, rotavirus, sapovirus, hepatitis A and E viruses have been reported as foodborne viruses. Rotaviruses are transmitted by fecal-oral route in humans and can contaminate food at any point in the food chain. The food handlers who shed the virus have been responsible for cases of foodborne viral illness. In this study, we aimed to isolate rotavirus in susceptible cell cultures from the food samples detected positive by RT-PCR.

Method: In this study, raw or ready-to-eat meat, chicken and seafood samples were collected and RNA of samples isolated. Spesific primers (Con3 & Con2 ve S-Beg & End9) for VP4 and VP7 genes were used to detect rotavirus by one-step RT-PCR. In order to determine the genogroups of rotaviruses in samples which were detected positive by RT-PC, DNA sequencing was performed as service procurement from PCR products. Sequence results were analyzed and genogroups of rotavirus has been determined. In addition, rotavirus isolation studies were performed by inoculating filtered rotavirus positive sample homogenates onto MA-104 cell cultures. Following the inoculation the cell cultures observed for occurence cytopathic effect. The cultivation was carried out for 4 passages.

Results: In this study, a total of 105 raw and ready-to-eat meat, chicken, seafood were collected. 20 samples (19%) were detected rotavirus positive by detection of VP4 gene by RT-PCR. Two of the 10 mussel samples were positive for both VP4 and VP7 gene regions of rotavirus; 15 of 20 chicken salami, sausage, schnitzel and ham products; 3 of 5 Türkiye products were found to be positive on VP4 gene region of rotavirus. While rotavirus was not detected in raw chicken products, rotavirus positivity was high (72%) in processed chicken products. The origin of the high positivity of processed poultry products will be determined by the classification of rotavirus in the ongoing gene analysis, whether it is a human-transmitted or avian rotavirus specific rotavirus. The DNA sequencing results of the positive mussel samples analysed and revealed as G1P[8] type Human Rotavirus A. DNA sequencing studies on chicken and Türkiye origined products are in progress. After observation of the samples which have been inoculated on MA-104 cells, no significant cytopathic effect was demonstrated in any of the inoculated cells, therefore, there is no data on whether the identified virus is infective or not. In the light of the results obtained, it was revealed that the mussels collected from the points where the sewers were poured into the sea could be the

source of rotavirus. Consumption these products as undercooked food will pose a risk for gastroenteritis.

Discussion: Rotaviruses are the most important viral agents in the etiology of acute gastroenteritis in children under five years of age and they also cause infection in adults. In many studies, rotaviruses that cause infections in humans have been found to be of bovine and porcine origin, but avian rotaviruses have not been observed to cause infections in humans. A, B and C group rotaviruses causes infection in humans, cattle, pigs; A, D, F and G group rotaviruses in poultry; Group E rotaviruses cause infection in pigs. In Türkiye, studies have been conducted for norovirus and hepatitis A viruses among food-borne viruses, but in our knowledge, there is no study has been conducted on food-borne rotaviruses. This study is the first study in Türkiye on detecting the presence of rotavirus in foods.

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Process Validation of Aseptic Beverage Production Lines

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Hypothesis: According to the FDA, process validation is defined as the collection and evaluation of data, from the process design stage through commercial production, which establishes scientific evidence that a process is capable of consistently delivering quality product. For this purpose, microbiological validation studies are carried out in the aseptic beverage production lines of Uludağ İçecek Türk A.Ş.

Method : In this study, after periodic maintenance, CIP-Sterilization process was performed in order to check the efficiency of cleaning before aseptic production. For this purpose, microbiological samples were taken from the aseptic production line. The clear lemon juice (3,3-3,5 pH), was produced by filling 750 mL each in 1 liter PET bottles. Capacity of the production was 10.000 bottles. Microbiological sampling points during production are as follows; raw material, primary packaging, process water, syrup, mixer product, sterile product before filling, water used for sterilization, final product and swab samples taken from all production steps and air sampling points. Microbiological analysis were performed from these samples taken during the production. The final products were passed through the labeling, shrinking, palletizing steps and stored in a container with a temperature of 27 ± 2 °C for 14 days. After 14 days, turbidity, sediment and color change properties were examined and visual control was completed.

Visual control and results of microbiological analysis were evaluated according to Uludağ Beverage Quality Plan. After aseptic filling tests, the number of inappropriate bottles should be zero.

Results : After 14 days of storage/incubation, inappropriate bottles were not detected in terms of turbidity, sediment, color change in the products that were fed from the container to the line for visual control. In this study, the effectiveness of the CIP-Sterilization process was checked after the maintenance. Microbiological analysis results of raw material, primary packaging, process water, syrup, mixer product, sterile product before filling, water used for sterilization, final product and swab samples taken from all production steps and air sampling points were found appropriate. Based on these results, the conformity assessment of the aseptic production was approved.

Discussion: Process validation is done periodically to verify significant change in raw material, equipment, tools, environment, material or process steps that may affect the product; the

results in the process that do not meet product and process specifications; the change of production method of final product; the process parameters and critical equipment are under control. In this study, it is significant that repeat the process validation periodically in terms of maintaining the microbiological quality of the final product thus maintaining food safety.

Changes in the Sensory Responses of Individuals Depending on Age, Sex, Smoking, and Alcohol Use

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Research Hypothesis: In this study, sensory analysis training and panelist evaluation tastes were conducted with volunteers in cities selected as pilot regions. Panelist assessment was carried out considering the region age gender smoking and alcohol use factors.

Method: Firstly, the factors that may negatively affect the environment are eliminated so that panelists can objectively evaluate sensory evaluation. For this, the distractions in the environment are removed, and as quiet as possible, and on the order in which the panelists can not influence each other. The assessment consists of three parts; odor test, taste test, and color test, in addition to filling in the personal questionnaire. In order filling in the panelists, a personal questionnaire including factors such as region age, gender, smoking, and alcohol use was asked to be completed.

After completing the personal questionnaire, panelists were subjected to odor testing. Any aroma in nature found in the fragrance test was given to the panelist to guess what it was reminiscent of.

After the smell test, the tasting senses of the panelists were measured. In this test carried out in two stages, five basic flavors, bittersweet, salty, sour, and umami flavors, were given, and these flavors were graded as mild, medium, and more. Caffeine was used fort he bitter taste in the basic waist flavors given to the panelists. User sugar for sweet taste. Salt used for salty taste. Citric acid was used for sour taste. It is given to the panelists to taste it by using vitamin mix in different dosages for umami taste. A coding system was also used for panelists to write their responses after tasting.

Finally, by using the senses of sensory analysis from the panelists, it was asked to order the colors prepared form different concentrations (0,1 – 1,0 g) from light to dark.

The panelists were evaluated in 3 stages;

1.) The panelist who achieved %100 success in determining the 5 basic tastes received 49 points.
2.) The panelist achieved %100 success in the scent test and scored 27 points.

3.)The panelist achieved %100 success in color tasting and scored 27 points. Panelists evaluated a total of 100 points.

Results: In the sensory analysis tests which were performed with the participation of 99 people in the Bursa region, the factors of the Minitab statistical data program were evaluated by considering factors such as age, gender, smoking, alcohol use and employees type of the panelists.
Among female panelists;

-A total of 28 women panelists participated in 26 people between 20-40 years and two people between 40-60 people.

-26 female panelists participated in the White-collar two female panelists participated in the blues collar.

-9 female panelists smoke, 19 female panelists do not smoke.

-9 female panelists drink alcohol, 5 panelists do not drink alcohol.

Among male panelists

-46 male panelists aged 20-40 and 25 male panelists aged 40-60 participated.

-43 male panelists participated as a White collar, 27 male panelists participated as blue-collar.

-32 male panelists smoke, and 39 male panelists do not smoke.

-18 male panelists drink alcohol, 53 male panelists do not drink alcohol.

Discussion: When we consider gender in the tests conducted in the Bursa region, female panelists were more successful, 20-40 age group was more successful in panelists, non-smoking panelists are more successful when we consider smoking that negatively affects our health when we consider the use of alcohol that negatively affects our health, panelists who do not use alcohol are more successful.

Molecular Characterization and Determination of Antibiotic Susceptibility of *Listeria monocytogenes* Isolated from Wastewater of Cattle Slaughterhouses

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Listeria monocytogenes is an important pathogen cause of serious, sporadic infections in humans and various animal species. The mortality rate of up to 30% in individuals in the risk group is indicated the severity of the disease. The widespread presence of the pathogen in nature, especially in the soil and environment, increases the contamination of food and consequently the frequency of food-borne listeriosis. Listeria species commonly found in nature are mostly found in sewers, swamps, river water and vegetables. Epidemiologically, the environmental distribution of *L. monocytogenes* as a ubiquitous microorganism is of great importance. Various environmental contamination shows that end products foods are also pose a risk. It is thought that various foods create public health danger in terms of L. monocytogenes, especially as irrigation waters are contaminated with slaughterhouse waste waters. This study was aimed to determination of molecular characterization and antibiotic susceptibility profiles of 17 different *L. monocytogenes* isolated from cattle slaughterhouse wastewater and to evaluate the public health risks.

Genetic diversity of Polymerase Chain Reaction (PCR) verified 17 *L. monocytogenes* isolates obtained from ten different cattle slaughterhouses at different periods were evaluated by Pulsed Field Gel Electrophoresis (PFGE) with the restriction digest pattern with AscI and ApaI. For this purpose, gel images obtained after electrophoresis were analyzed in BioNumerics v.4.0. Cluster analysis was performed using Dice coefficient with 1.5% position tolerance. mPCR assay developed to separate the four major *L. monocytogenes* serovars isolated from food and patients (1/2a, 1/2b, 1/2c, and 4b) into distinct groups were used. Allele-specific oligonucleotide PCR (ASO-PCR) were used for lineage group identification based on the prfA virulence gene cluster of *L. monocytogenes*. Antibiotic susceptibility profiles of the isolates were determined according to the protocol published in 2019 by the European Committee on Antimicrobial Susceptibility Testing (EUCAST). For this purpose, ampicillin (2 µg), meropenem (10 µg), erythromycin (15 µg) and Trimetoprim/Sulfometaxazole (25-23.75 µg) discs and E-test strips for MIC (Minimum Inhibitory Concentration) values were used. PFGE analysis revealed that all isolates were of different pulsotype. The mPCR analyses were showed that the isolates were distributed in two different serotypes and two different lineage groups. As a result of

antibiotic susceptibility tests, all isolates were susceptible to ampicillin, while two were resistant to meropenem, two were erythromycin and three were resistant to Trimethoprim/sulfamethoxazole. Besides, one isolate was found to be resistant to meroponem, erythromycin, and trimethoprim/sulfometaxazole and had multiple resistance. In the study, it was determined that *L. monocytogenes* which pose serious risks to public health and resist to antibiotics used in treatments effectively can environmentally spread via wastewater of cattle slaughterhouse. The presence of the pathogen in nature, especially in the soil and environment, increases the contamination of food and consequently the frequency of food-borne listeriosis. It is considered that the food industry wastewater which has rich microbiota should be treated carefully and possible environmental contamination should be prevented. The study is important in terms of the showing importance of food safety management systems such as HACCP (Hazard Analysis and Critical Control Points) for slaughterhouse safety regarding L. monocytogenes. Therefore, other various epidemiological pathways should be examined in further studies. It should be considered to monitor other food processing plants where animal originated production is carried out besides slaughterhouses. The outcomes of the study also would contribute for new approaches to be planned projects on antibiotic resistance pathways.

Method Validation of Multi Residue Analysis of Antibiotics in Milk Powder and Whey Powder

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In modern animal husbandry applications, the use of antibiotics is extremely important for efficient and safe food production. These antibiotics can cause residues in animal origin foods consumed by humans. Consumption of foods containing these residues poses many risks to human health, particularly antibiotic resistance. These risks emerges the importance of monitoring animal origin foods in terms of antibiotic residues. In the national inspection activities, mostly the primary products are monitored. However, processed foods derived from products containing antibiotic residues are outside the control activities, thus posing a risk to food safety.

Whey and milk powder, which have high nutritional value, are used in the production of many foods from floury foods to meat products, from dairy foods to chocolate and confectionery in order to improve the textural properties of foods. In this study, an analysis method optimization and validation was performed for the detection of antibiotic residues in whey powder and milk powder which are used as raw material in many products. Within the scope of the optimized method, 6 parameters from macrolide group (Erytromycin, Sarafloxacin Hydrochloride, Spiramycin, Neospiramycin, Tilmicosin, Tylosin, Tylvalosin) 11 parameters from Sülfanamid group (Sulfachloropyridazine, Sulfadiazine, Sulfadimethoxine, Sulfadoxine, Sulfamerazine, Sulfamethazine, Sulfamethoxazole, Sulfapyridine, Sulfaquinoxaline, Sulfathiazole, Trimethoprim), 9 parameters from quinolone group (Ciprofloxacin Hydrochloride, Danofloxacin Mesylate, Difloxacin Hydrochloride, Enrofloxacin, Erytromycin, Flumequine, Marbofloxacin, Nalidixic Acid, Oxolinic Acid), 1 from Lincosamid group (Lincomycin Hydrochloride), totally 27 antibiotics were analyzed in whey powder and milk powder. The method is based on the extraction of samples with methanol, the determination and calculation of the residue in the extract by LC MS/MS. The analysis of antibiotics by LC MS/MS used at least two product ions obtained from the fragmentation of the molecular ion determined for each antibiotic. The ratios and retention times of the selected ions were also taken into account in the identification of the analytes. Validation of the method for detection and quantitative analysis of analytes was carried out according to the Commission Decision 2002/657/EC applicable to all analyzes (veterinary medicines, pesticides, minerals, etc.) of animal products. In this validation study, ILPL (In Laboratory Performance Limit), Linearity, Trueness / Recovery, Precision (Repeatability, Reproducibility), CCα and CCβ, specificity / selectivity and ruggedness parameters were performed.

Since milk powder and whey powder do not have the maximum residual limits defined in the food legislation, firstly the ILPL values which determine the detection limit of the method were

calculated for each antibiotic. As a result of the validation study, ILPL values were between 0.8 µg/kg and 8 µg/kg; CCα values were between 0.89 µg/kg and 9.16 µg/kg. Recovery, reproducibility and reproducibility studies were performed at three levels, ILPL, 1.5 ILPL and 2 ILPL. Statistical evaluation of all parameters studied was carried out in accordance with the requirements of the Commission Decision 2002/657/EC of the European Union and the results were found within the appropriate value ranges. The results of this study showed that this method is suitable for the determination of antibiotic residues in milk powder and whey powder in order to contribute to food safety. Methods that enable the monitoring for antibiotics in processed food products are also important in guiding the determination of maximum residue limits for food products in the food legislation.

The validated method allows the analysis of antibiotic residues in the milk powder and whey powder products commonly used in the food industry, allowing these products to be included in the scope of control activities. This will help to avoid consumption of food products containing antibiotic residues and thus contribute to the preservation of food safety.

Investigation of the Effects of Geographical and Climatic Changes on the Structure of Lollipop Candies

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Introduction : The awareness of consumers has led businesses operating in the food industry to pursue new searches to ensure and improve the safety of food based on international food safety management standards in order to maintain customer satisfaction. In the confectionery sector, it is necessary to process the sugar components correctly so that hard candy products can maintain structure stability throughout the shelf life and remain sensually stable. Optimizing the storage conditions of products exported especially to foreign countries and conducting the logistics process correctly; is critical in terms of end product quality and food safety. Lollipop candies are exposed to different humidity and temperatures due to logistics, storage and storage conditions; products cause significant quality losses and shorten their shelf life. In this study, it was aimed to eliminate the risk of inversion caused by high temperature and humidity values on lollipop sugars without any change in shelf life of lollipop sugars, and to increase the durability of high temperature and humidity values to which sugar can be exposed.

Method : Hard candy - lollipop group products are exposed to inversion - cold melting problem after spending a certain period of time at high humidity and temperatures due to the chemistry of the sugar components in its content. The main reason for this is that the stability of the sugar structure could not be achieved through the formulation and firing parameters. Within the scope of this study, the lollipop production process has been revised by forecasting the climatic changes that may occur from the exportation period of the hard candy / lollipop group products to the end of its shelf life, and the formulation studies have been carried out to protect the original structure from the factory outlet. A list of average temperature and humidity values was created by examining the different climatic conditions and geographical structures of more than 60 countries that were exported. By selecting a pilot country from this list, the products were shipped and the variable temperature and humidity values that they were exposed to during the shipment were recorded by the data logger.

Results and Discussion : In the light of all data, during the formulation studies, different recipes were studied with different raw materials and final products were subjected to shelf life tests at certain humidity and temperatures. The products which are produced with high fructose corn syrup, maltose syrup, maltodextrin and glucose syrup, which are expected to be added to granular sugar forming the base structure of the confectionery products, are subjected to accelerated shelf life tests after being kept in controlled cabinets at 40^{o}C temperature and 70% relative humidity. inversion was observed in combinations other than formulation. In the test analysis studies carried out in lollipop sugar, mg moisture /g product

ratios were determined by Karl Fisher moisture analyzer. Accordingly, by using sugar glucose in different combinations and comparative shelf-life tests in the air conditioning cabinet, the rates of use of the agents in the recipes suitable for the climates of the countries were determined (25:75, 50% 50 and 75:25 proportional use for glucose syrup). The usage rates in the recipes were optimized by RSM method and the recipe-based ratios of the two raw materials sugar and glucose syrup forming the base structure were determined, then the countries to be exported were determined and the existing sugar recipes were mapped by country-based diversification. When the annual temperature and humidity averages of the countries are evaluated, risk of inversion of lollipop was examined as %40 of total countries.

Optimization of CIP Systems and Cost Reduction of CIP

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Clean-in-place (CIP) is a method of cleaning the interior surfaces of pipes, vessels, process equipment, filters and associated fittings, without disassembly.

Up to the 1950s, closed systems were disassembled and cleaned manually. The advent of CIP was a boon to industries that needed frequent internal cleaning of their processes. Industries that rely heavily on CIP are those requiring high levels of hygiene, and include: dairy, beverage, brewing, processed foods, pharmaceutical, and cosmetics.

The benefit to industries that use CIP is that the cleaning is faster, less labor-intensive and more repeatable, and poses less of a chemical exposure risk. CIP started as a manual practice involving a balance tank, centrifugal pump, and connection to the system being cleaned. Since the 1950s, CIP has evolved to include fully automated systems with programmable logic controllers, multiple balance tanks, sensors, valves, heat exchangers, data acquisition and specially designed spray nozzle systems. Simple, manually operated CIP systems can still be found in use today. The interior surfaces of pipes, vessels, process equipment and filters affected from cleaning factors.

Factors affecting the effectiveness of the cleaning agents

Temperature of the cleaning solution. Elevating the temperature of a cleaning solution increases its dirt removal efficiency. Molecules with high kinetic energy dislodge dirt faster than the slow moving molecules of a cold solution.

Concentration of the cleaning agent. A concentrated cleaning solution will clean a dirty surface much better than a dilute one due to the increased surface binding capacity. Contact time of the cleaning solution. The longer the detergent contact period, the higher the cleaning efficiency. After some time, the detergent eventually dissolves the hard stains/soil from the dirty surface.

Pressure exerted by the cleaning solution (or turbulence). The turbulence creates an abrasive force that dislodges stubborn soil from the dirty surface.

When these factors are considered, the chemical use as a part of the effectiveness of the CIP system is remarkable. The chemicals used in the CIP system are generally separated into alkali and acidic. When we focus on alkaline cleaning agent, we see that caustic is used in many industries.
In the world, the caustic production process has changed as the caustic production technology

has changed over a certain procedure. Changing processes have created additional costs. These costs cause significant increases in caustic prices. There has been a need for an alternative cleaning chemical to reduce chemical costs, chemical utilization rates and chemical residue risks.

Alternative alkaline CIP chemicals were used in the laboratory. Conductivity, cleaning efficiency and costs were evaluated after these studies. Summary of the application; Purpose; It is used to reduce chemical consumption and reduce chemical costs by using chemical containing> 30% NaOH + 15% KOH instead of 48% NaOH based caustic chemical used during sanitation.

Current situation; 48% NaOH based caustic chemical is used for alkaline cleaning before the project.

Study: Preliminary experiments were performed by using chemical containing> 30% NaOH + 15% KOH instead of 48% NaOH based caustic chemical in syrup and production lines. With the positive results of microbiological tests, chemical containing> 30% NaOH + 15% KOH was put into use.

Result: According to the studies, the amount of chemical used was calculated against 1L product volume. Approximately 61% chemical saving was achieved. In addition, the cost of consuming chemicals was reduced by approximately 56%.

Fermented Coffee Production Techniques

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Coffee is a widely consumed beverage that has dark brown color and pungent taste, in all over the world because of its stimulating properties and bioactive components. Coffee is one of the world's most valuable agricultural products, and the leading production region is in Brazil, and it is among the largest import entry of all regions as South and Central America, Carribeans, Africa. Today there are more than 100 coffee types belonging to the Coffea family, Arabica (Coffea arabica) and Robusta coffees (Coffea canephora) have the largest commercial share. However, these coffees are endangered plant species due to the recent droughts and/or excessive rainfall in the world. It is predicted that the quality of coffee will decrease before it's completely exhausted due to climate change. While coffee producers are trying to find alternatives to increase their production, the World Coffee Research Center is trying to produce new types of coffee by crossing non-traditional coffee trees in Ethiopia. The techniques developed to improve coffee type and quality can be used at different stages of production. Fermentation and drying of coffee beans are among the techniques used for this purpose. It is stated that different microorganisms during fermentation affect some quality characteristics of coffee beans. Coffee fermentation can be carried out by the use of a starters or by natural microflora of coffee beans. In natural fermentation, the variety of microorganisms, type of coffee beans and the amount of water in the environment can affect the process. The fermentation can be carried out by wet or semi-dry methods, which ends with drying. It has been sensorially determined that fermentation changes the taste and aroma of the coffee significantly. It has been found that fermented coffees have an acidic taste and some flavor components such as hazelnut, some fruits, caramel and cocoa aromas as well as almond essences and floral flavors. Additionally, World's renowned Kopi Luwak (Civet Coffee) and Black Ivory coffees are the leading products of fermented coffee. In Indonesia, Kopi Luwak coffee is produced by acidic and enzymatic fermentation of coffee beans in the gastrointestinal tract of a musk cat (Paradoxurus hermaphroditus) while Black Ivory coffee is obtained from the feces of elephants specially raised in Thailand. The coffee beans are subjected to a kind of fermentation in the gastrointestinal tract of those animals by their gut flora and the other digestive instruments. In such coffees, fermentation conditions cannot be controlled in the gastrointestinal tract of these animals, and some undesirable by-products may also be formed. It is determined that to protect the coffee taste and quality, controlled fermentation techniques can be better for those negative effects. Again, the coffee obtained

from the feces of these animals may give a disgusting feelings to consumers in addition to hygienic concerns. Therefore, it is extremely important to use alternative fermentation techniques in view of the fact that consumers may not prefer a food obtained from the animal feces. The aim of this study is to investigate different coffee production techniques and fermentation, which can be an alternative to popular coffee beans that are in danger of extinction and decreasing quality due to recent climate changes and the increasing demand.

Pesticide Analysis in Milk and Milk Products with QuEChERS Method

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It is a known fact that pesticide use is intense in our country and the presence of high pesticide in many plants. This danger is not limited to herbal products, and high amounts of animal feeds cause significant risks in milk and dairy products by passing to the milk of animals fed with these feeds. In this study, the suitability of Quechers method used in herbal foods for dairy products was investigated.

In our study, the performance characteristics of the method were determined using International validation parameters to determine the suitability of the method for use in milk and dairy products. For this, milk and butter samples were selected and studies were carried out to detect 434 pesticides with the AOAC 2007.01 method. Preparation of the samples was made in accordance with the same method. For these studies, in accordance with internationally accepted validation standards, experimental patterns were created to calculate linearity, detection limit, determination limit, repeatability and reproducibility, recovery values, and results and performance characteristics were calculated. Following the validation studies, screening studies were carried out with commercial milk and dairy products collected from the market.

In the studies carried out with LC-MS / MS, the limit of detection for Carbofuran, Carbofuran-3-Hydroxy, Difenoconazole, Epoxiconazole, Fenamiphos, Fenamiphos-sulphone, Fenamiphos-sulfoxide, Spirodiclofen and Spirotetramate pesticides was determined as 0.0008 mg / kg. The limit of detection for these pesticides was found to be 0.001 mg / kg. The maximum residual limit is 10 mg / kg for Carbofuran and Carbofuran-3-Hydroxy according to the Turkish Food Codex Regulation on the Maximum Residue Limits.

The detection limit for all other pesticides was determined as 0.003 mg / kg and the detection limit was determined as 0.005 mg / kg. The maximum residue limit for these pesticides was determined as 0.01 mg / kg according to the Turkish Food Codex Regulation on Maximum Residue Limits. 292 parameters were analyzed in total. The mass spectrometer was operated by switching between the positive and negative ion modes suitable for each pesticide to obtain optimum sensitivity. 6-point matrix-matched calibration was used. 70-120% recovery and ≤20% Residual Standard Deviation (RSD) were calculated in the enriched samples.As a result of the studies carried out, considering the 52 commercial products analyzed, no results were found on the detection limit or maximum residue limit, which posed a threat to food safety. The tests were performed using appropriate protocols and analytical quality assurance practices were applied to ensure the validity of the data obtained. The accuracy of the method

was demonstrated by participation in the BIPEA proficiency test, where valid Z-scores for both accurate identification and quantification of detected residues were obtained. As a result, it has been found that the use of QUECHERS method for 292 pesticides in milk and dairy products yields successful results. In addition, according to the results of the pesticide screening study on commercial milk and butter samples, the products examined were found to be in compliance with the regulations. However, with subsequent studies, the study should be expanded with more samples from a larger sampling area.

Investigation of the Effect of Continuous Flow in Process Water on Microbiological Results

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Research Hypothesis : Cleaning and disinfection processes in process components, CIP-Sterilization processes, thermal applications prevent microorganism colony formation. In the systems where water is always present, growing and spreading of microorganisms more than usual can be prevented by continuous flow. For this purpose, ensuring continuous flow of process water was monitored the at two different points.

Method : While the production water usage is 3600 tons per day during the peak production periods, the daily usage amount of process water decreases up to 1680 tons when production is less. In shortly, the pipe flow decreases and thus water stops can occur in the process water pipes.10cfu/100 ml total mesophilic aerophilic bacteria were detected in the samples taken from the process waters during peak production periods. When the production is less, 100-300cfu/100 ml colony were detected. When the production is less, process water flow rate used during the shift was monitored and tracked by water treatment operators to maintain the water flow. 4 tons of water was discharged in 20 minutes at 08:00 and 16:00 for 10 days, and samples were collected from each point in accordance with 1000 ml microbiological sampling criteria.In these samples, analyzes were carried out with the membrane filtration method by taking the Human Consumption Water Regulation as a reference. Total mesophilic aerophilic bacteria 22°C 1ml, total mesophilic aerophilic bacteria 22°C 100 ml, total mesophilic aerophilic bacteria 37°C 1 ml and total mesophilic aerophilic bacteria 37°C 100ml, E.coli/coliform 37°C 250 ml and Pseudomonas aeruginosa 37°C 250 ml analyzes were performed. Since E.coli/coliform and Pseudomonas aeruginosa growths were not observed, evaluations were made according to total mesophilic aerophilic bacteria growths.

Results : Before the discharging of water, >100 kob/100ml total mesophilic bacterial growths were seen. Samples were taken after each discharging. While there were no significant differences in the first samples, decreases started to appear from the 3rd day. At the end of the 10th day, the flow mobility of the water passing through the pipes has been fully ensured and bacterial growth has been reduced by up to 70%. Microorganisms show good growth in their environment, under optimal conditions, according to the genetic character of their genus and species. One of the factors affecting the growth of microorganisms is stagnant water environment. In stagnant water, colonies, even biofilm layers, can form for several hours. Biofilms are very important in the food industry due to their effects on industry and health. The first step in preventing the formation of biofilms is to prevent microorganisms to be present in the environment and form colonies. It has been determined that any minimal

microorganism in water poses a risk when production is reduced or stopped. The results of the work carried out are the Regulation on Waters for Human Consumption and Uludağ İçecek Türk A.Ş.The quality control microbiology plan was evaluated with reference. No reproduction was observed above the standards, but it was seen that reproduction increased in the calm period and approached the standard values. Possible microbiological effects of the stability of water should be taken into account not only in process water but also in all areas of production. Due to the high microbiological quality of the process water, countable data were handled. Stability of waters with high microbiological load causes serious problems from energy loss to rust.

Discussion: Microorganism reproduction, which occurs as a result of these postures, may negatively affect the production lines and the food safety of end product. Considering that the water, which we think complies with the standards, may become inappropriate with stagnation, preventions will increase the product quality while eliminating the risks that may occur.

Determination of Imitation and Adulteration in Food by Infrared Spectroscopy

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In order to gain more economic profit through food products, imitation and adulteration events that cause loss of nutritional value in foods and threaten food safety are increasingly encountered. Classical analysis methods requires long time and more chemicals. Methods based on Infrared spectroscopy (IR) are more commonly being used in the rapid identification of imitations and adulterations in food. In IR spectroscopy, vibrational frequencies of various bindings in the structure of molecules are measured. In Infrared spectrum, it is defined as 400-10 cm-1 far infrared (FIR), 4000-400 cm-1 mid infrared (MIR) and 12500-4000 cm-1 near infrared (NIR). IR based methods do not require much use of chemicals and samples, they are known as environmentally, fast, low-cost methods. Methods based on IR spectroscopy: Fourier transform infrared (FT-IR), near infrared (NIR), nuclear magnetic resonance (NMR) and Raman spectroscopic methods.

In spectroscopic methods, since the data sets obtained from the spectra are very large, the data must be processed and interpreted mathematically and statistically. The structure of these data was found to be conducive to using techniques such as Principal Component Analysis (PCA) and Partial Least Squares (PLS).

FTIR spectroscopy is the method used to determine the number of wave against the infrared intensity of light. FTIR methods are commonly used especially in studies to determine the adulteration in milk and dairy products. There are many tricks are encountered mixing vegetable oil into butter or mixing different types of milk with each other. FT-NIR (Fourier transform-near infrared) spectroscopy method is used for fat and protein analysis in raw milk. ATR-FTIR spectroscopy was used to determine the adulteration with different oil mixtures of olive oil and the data obtained were interpreted with the PLS method. In addition, this method is used to determine the mixture of different oils in bakery products. FTIR spectroscopy is applied to determine the adulterations in honey and molasses added starch based sugar syrup.

NIR spectroscopy is a method based on absorption in the wavelength range of 780-2500 nm. VIS-NIR (visible and near infrared) spectroscopy is a high power method when applied together and by preparing very few samples, measurements are made quickly. VIS-NIR method is used to distinguish vegetable oils added to olive oil and to verify the identity of olive oil. VIS-NIR method has been modeled according to the PLS method and successful results have been obtained in the adulteration studies conducted by mixing different fruits to strawberry and raspberry pulp and mixing two different crab meat. With this technique,

adulteration can be established by determining acidity, brix, sugar, soluble solids and organic acids in fruit juices.

Raman spectroscopy is based on measuring the intensity of a strong laser beam sent to the sample in the infrared region. The use of Raman spectroscopy with the Fourier transform technique increases spectral resolution and provides better wavelength sensitivity. FT-Raman spectroscopy was used for adulteration by mixing horse meat to the beef and the data obtained were interpreted using the PCA method. Raman spectroscopy is widely used to detect adulterated vegetable oils by cheaper oils.

NMR spectroscopy is based on the principle that some atomic nucleus rotate around their axes. It is possible to determine adulterations made by adding sunflower and hazelnut oil in olive oil and adding sugar to wine using by NMR.

Analysis of the data obtained by various spectroscopy methods by using classification and clustering with chemometric applications allows for easy estimation of imitation and adulteration in foods and these rapid methods are also of great importance in terms of food safety.

Evaluation of The Use of Non-Thermal Technologies in Production of Meat and Meat Products in terms of Food Safety

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Meat and meat products that have a special position in our diet due to their rich nutritional contents and desired sensory properties can cause diseases and even death by becoming a potential cause of disease due to natural resources such as air, water, soil, and potential contaminants of mycotoxins and industrial contaminants such as dioxins and metals. So, they become unsafe for human consumption with such physical, chemical or biological hazards. Meat and meat products do not contain any components that harm human health or do not harm the consumer during processing, distribution, storage and marketing are defined as "safe". To this end, every stage in the production chain should be guaranteed with management measures covering appropriate and effective supervision and monitoring procedures that meat and meat products are not adversely affected at any stage. In the meat and meat products production chain, it is possible to examine safety problems in three stages: pre-harvest, harvest and post harvest. Especially due to its rapidly deteriorating structure, after slaughtering meat must be processed and preserved with a suitable method. In this context, due to the increasing awareness of consumers about food safety and concerns about this issue, providing healthy, hygienic and nutritionally high-quality meat and meat products to consumers without compromising food safety has become an important problem for the industry in both developed and developing countries. The fact that the food-health relationship has become more prominent today has led producers to new approaches to increase food safety, and this trend has brought important developments in food production. In particular, academic studies focused on non-thermal technologies in the preservation of meat and meat products, and some of these technologies have found industrial application. Among these technologies, which are alternative to traditional methods, high pressure application, pulsed light technique, ultrasound application, pulsed electric field, high pressure carbon dioxide application and plasma technology are classified among the technologies that have the potential to be applied in the meat industry. The disadvantages of traditional heat treatment methods are their high cost, limited effect on product durability and shelf life, and especially causing the food to lose its freshness and natural quality by causing changes in the smell, color, flavor, texture and nutritional value. On the other hand, non-thermal technologies show superiority over traditional methods due to their advantages such as low temperatures, inactivation of pathogens and degrading microorganisms, saving energy, being environmentally friendly, enabling minimum processed safe food production while preserving the natural appearance, nutritional value and taste of the product. There are studies that these technologies can be used effectively, alone or in combination, instead of heat treatment applications in ensuring microbial safety of meat and meat products. However, the need to

use non-thermal technologies at high intensity, especially for microbial inactivation, may negatively affect the sensory properties of some foods. For example, high pressure application can disrupt the structure of proteins and polysaccharides, causing changes in the texture, appearance and functionality of foods. In addition, energy and processing costs are limited in use due to the consumers' negative approach to these technologies. Therefore, these technologies need to be developed and implemented to meet the demand for high quality and safe meat and meat products in the developing meat industry. In this study, non-thermal technologies, which are used in ensuring the safety of meat and meat products and which attract attention both academically and industrially, have been reviewed.

Food Security of The Future: Insect Proteins

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The rapid increase of the population in the world makes natural resources inadequate and many factors such as changing living standards lead to exceeding the carrying capacity of the world. According to FAO, one in 8 people suffer from hunger. Millions of people who struggle with hunger are suffering from the lack of vital protein. The global population is predicted to be more than 9 billion in 2050 and since traditional protein sources cannot meet current needs, edible insects can be considered as alternative protein sources.

Some edible insects are currently consumed by two billion people worldwide. In the literature, more than 2100 insect species have been recorded as edible. The most consumed insect species globally are caterpillars, bees, wasps and ants, grasshoppers, crickets, cicadas. The nutritional values of edible insects may vary depending on the origin of the insect, the metamorphosis, diet of insect and processing techniques. The main reason for high the nutritional value of insects is that they have a protein content. The protein content of edible insects vary in a wide range (13%-77%).

As the consumption of edible insects has gained momentum worldwide, food safety problems have also increased. The lack of knowledge of edible insects on food safety is an obstacle to insect consumption and farming of insect in many countries. According to EFSA, the prevalence and concentration of contaminants in insects and insect-derived foods are largely affected by from insect production method, insect species, harvest stage and feed used in growing. Potential food safety risks of edible insects can be microbiological, parasitological and allergenic.

High microbial content was detected in some insect species which stated to be mainly from Micrococcus spp, Lactobacillus spp and Staphylococcus spp about microbial risks. Edible insect food safety in terms of pathogenic microorganisms seem to be a major concern, especially as those in Africa and Asia where the consumers mainly rely on wild harvesting. The most common types of pathogenic bacteria isolated from edible insects belong to the genus Staphylococcus, Micrococuss, Bacillus, Salmonella, Shigella and Clostridium. Bacteria and mycotoxins in exoskeleton are also a problem. Providing appropriate heat treatment and storage conditions will minimize microbiological hazards. It is known that moths contain cyanogenic glycosides, while caterpillars' hair is toxic. The mineral levels of some insects can also be at a toxic level. Therefore, it is necessary to apply by knowing the toxic properties of the insect species well.

Some insect proteins are specifically described as arginine kinase allergens; Beetles such as Tenebrio molitor and some crustaceans also cause allergic problems in humans such as eczema, dermatitis, rhinitis, conjunctivitis, congestion, bronchial asthma and edema.

Glycoproteins are the main allergenic structures in insects. Other extensive allergens due to edible insects include α-amylase and tropomyosin (cockroaches, shrimp).

Parasitic disease of wild harvested insects are more likely to be transmitted to humans than farm insects because their diets are not controlled unlike insects raised on the farm. Dicrocoelium dendriticum is a zoonotic parasite that is easily transmitted to humans through the consumption of insects such as ants. Foodborne and waterborne parasites such as Entamoeba histolytica, Giardia lamblia and Toxoplasma spp. are isolated from insects such as cockroaches. It is of large significant to research the development potential of foodborne parasitic diseases especially in humans.

As a result, various research evidence shows that edible insects can play an important role in overcoming starvation. In order for insects to be used as potential protein sources, it is necessary to develop safe and appropriate sources, as well as processing techniques that reduce these risks.

Food Safety in Honey

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Honey is one of the nutrients that should be emphasized in terms of purity, cleanliness and quality since it is not washable, cleanable and extractable. The acceptable limits of residue levels are quite low due to this property. It should be pure from organic and/or inorganic substances that are not found in the natural composition of honey.

Honey products can be contaminated from antibiotics, drug residue sources and heavy metals, radioactive substances, pesticides, organic pollutants, pathogenic bacteria and genetically modified microorganisms during maintenance.

Naphthalene is one of the most important problems encountered in honey and its safety limit is 10 ppb in the EU Directives and the Turkish Food Codex. Naphthalene is a very dangerous carcinogenic substances, it is absorbed by the wax and preserved for a long time and forms a residue in the wax. The use of waxes containing this residue in reproduction causes naphthalene to pass to honey and consequently unwanted health problems. It is in the 2B group in the IRAC (International Agency for Research on Cancer) classification. In a study investigating the residue of naphthalene in honeys, 20 of the 209 honey samples collected from the Black Sea region, over 10 ppb, which is the legal limit, were found to be naphthalene. Naphthalene was detected in only a sample of 30 honey sample collected from the Eastern Mediterranean region, besides two of 25 samples is found contaminated in another study. Different veterinary drugs used by beekeepers to prevent various diseases in honey bees cause residue in honey samples. There are two most important causes of drug residues found in honey. The first reason is the application of drugs to the hives in the fight against bee diseases, and the second reason is the agricultural drugs. In Poland, 178 honey samples were analysed for pesticide active substance (HCH, DDT, aldrin, endrin and methoxychlor). Amitraz and flumetrin pesticide active substances used against Varroa jacobsoni pests were determined in the Black Sea region honeys. 36 honey samples from Cyprus, the active ingredient of kumafos encountered, while only one sample has exceeded the MRL value. Honey samples from Israel, the most common pesticides were found as kumafos and dimethylphenyl.

Antibiotics applied to bees commonly found as residues in honey are sulfonamides, aminoglycosides, phenicols, macrolides, betalactams. In a study where antibiotic residues were analyzed, sulfamethazine was detected in all samples, while tetracycline was found positive in half of the samples. In another study, half of the honey samples were found to have streptomycin, while it was found to contain sulfonamide residue in all samples. Besides honey products can be contaminated by air and soil, it causes heavy metals

accumulation. Heavy metals found in honey are lead, cadmium, mercury and nickel, but a specific MRL level for heavy metals has not been established.

Microbial contamination in honey is caused by pollen, honeybee digestive tract, dirt, dust, air and flowers. Microorganisms in honey are bacteria, yeast and fungus. Due to the high sugar content and antimicrobial activity of honey, microorganisms are inactive. For example, although the spores of the Clostridium botulinum bacteria are found in honey, they cannot produce toxins.

Chemical substances unconsciously applied by bees and honey producers at the wrong time and dose cause residual problem in honey. These ruins both endanger human health and cause economic losses. Bee keepers should be trained on bee diseases combating and importance in human and community health. In terms of food safety, residue analysis should be performed and evaluated frequently in honey samples.

Investigation of the Relationship Between University Students' Emotional Eating Behavior and Anthropometric Measurements

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Research Hypothesis: There is a relationship between emotional eating behaviors and anthropometric measurements of university students in positive or negative emotional states such as stress, anxiety, sadness, anger, boredom, joy, excitement and happiness.

Method: This study was carried out in Hasan Kalyoncu University Faculty of Health Sciences, Gaziantep, between October 2016 and May 2017, in order to investigate the relationship between emotional eating behavior and anthropometric measurements of the volunteer university students (n:325) in the 3rd and 4th grades of Nutrition and Dietetics (ND), Nursing and Physical Therapy and Rehabilitation programs (PTR). In this cross-sectional and descriptive study, general characteristics, dietary habits, daily food consumptions, were determined using Three-Factor Nutrition (TFEQ) Questionnaire and Eating in Emotional Situations (EESQ) Questionnaires. Students' anthropometric measurements (height, body weight, waist circumference and hip circumference) were measured and Bioelectric Impedance Analysis (BIA) were done. A daily energy and nutrient intaken were analyzed using Nutrition Information System (BEBIS) and the results were compared to Türkiye Nutrition Guidelines (TÖBR). SPSS 21.0 package program was used for statistical analysis of the data obtained in the study. The results were evaluated at 95% confidence interval and $p < 0.05$ significance level.

Results: 77.2% of the students participating in the study are girls and 22.8% are boys. Mean age (x ±S) is 22,2±1,9 in women, and 23,2±1,9 in men. In terms of Body Mass Index (BMI), 68.3% of the students are normal and 21.5% are slightly fat. According to TÖBR, it has been understood that the rate of students coming from protein and fat is higher than recommended and carbohydrate ratios are lower than recommended. It was determined that the majority of all students ate more, when they were anxious, when they were worried, when their friends tried to persuade themselves, when they were sad, when they felt lonely, this situation was mostly in girls. A positive ($p<0.05$) significant relationship between TFEQ score and body weight, waist circumference, hip circumference, BMI, body fat rate, body fat amount; It was found that there was a negative ($p<0.05$) significant relationship between body water ratio and lean body ratio. A positive ($p <0.05$) significant relationship between EESQ score and hip circumference, BMI, body fat rate, body fat amount; there was a negative ($p <0.05$) significant correlation between height, body water ratio, body water amount, lean body ratio, lean body amount, Basal Metabolic Rate (BMR) (Table 1).

Table 1. Comparison of Students' Emotional Eating Behavior and Anthropometric Measurements

Anthropometric Measurements	Three-Factor Nutrition (TFEQ) Questionnaire		Eating in Emotional Situations (EESQ) Questionnaire	
	r	p	r	p
Height (cm)	-0,024	0,668	-0,163	0,003
Body Weight (kg)	0,241	0,000	0,027	0,623
Waist Circumference (cm)	0,248	0,000	0,041	0,458
Hip Circumference (cm)	0,292	0,000	0,160	0,004
BMI (kg/m2)	0,344	0,000	0,169	0,002
Body Fat Rate (%)	0,261	0,000	0,337	0,000
Body Fat Amount (kg)	0,321	0,000	0,274	0,000
Body Water Ratio (%)	-0,272	0,000	-0,327	0,000
Body Water Amount (kg)	0,103	0,063	-0,132	0,017
Lean Body Ratio (%)	-0,242	0,000	-0,312	0,000
Lean Body Amount (kg)	0,103	0,063	-0,143	0,010
Basal Metabolic Rate (BMR)	0,103	0,063	-0,119	0,032

* Pearson correlation analysis

Dıscussion: In conclusion, emotinal eating habits and antropometric measurements have a strong relationship, it would be useful to embrace a multidisciplinary approach focused on emotion and stress management to reduce the risk of weight gain as a result of emotional eating in university students.

Oleogel Added Functional Ice Cream Production

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Trans and saturated fat substitutes are among the active research areas for the food industry. Edible oleogel applications are used to structure processed foods by replacing the need for trans saturated and unsaturated fatty acids. The effect of oleogel production with hazelnut oil on the color and sensory properties of ice cream was investigated in order to replace the oils used in ice cream production with alternative products in terms of health and to produce acceptable products. For this purpose, hazelnut oil oleogel was obtained by mixing different amounts of carrageenan, beeswax, monoglyceride, Tween 80 and hazelnut oil with ultra turrax. The production of ice cream was prepared by adding hazelnut oil oleogel in different fat ratios (5%, 10% and 14%), stabilizer, sugar and vanilla. Control samples produced with milk fat were prepared. Physical, chemical, functional and sensory properties of samples were investigated. According to the results obtained, general acceptability values decreased and hardness values increased due to wax increase. Ice cream produced with the addition of 14% hazelnut oil oleogel was found brighter and whiter than the control samples. 10% fat and 5% fat oleogel ice creams were found to be less white and shiny than the control samples with the same fat ratios.

Determination of the Encapsulation Effectiveness of *L. paracasei* Probiotic Bacteria

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The quality of commercial probiotic products marketed as functional food, dietary supplements and medicines is an important consideration. Although there are many scientific studies about the specific clinical benefits of probiotic microorganisms, legal regulations are needed at the stage of production. Within the scope of the study, it is aimed to provide composition optimization of encapsulation coating agents (peeling alginate, inulin and chitosan) of *Lactobacillus paracasei* bacteria using a lyophilizer. The experiments in the study were designed according to the response surface method (RSM), sodium alginate (1-5%), inulin (1-7%), chitosan (0.5-2%) and calcium carbonate (0.5-1.5). four-factor central unified design model was created by selecting the quantities as independent variables. After determining the effect of bacteria with applied encapsulation technique on heat tolerance, pH tolerance, color, variance analyzes were made by modeling the data. According to the results obtained, the encapsulated bacteria produced by using formulations obtained as a result of the optimization performed in the heat tolerance test values have been found to maintain their vitality level compared to the non-encapsulated bacteria after 2 minutes of heat treatment at 70° C.

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Determination of Antilisterial and Antibiofilm Properties of Probiotic *Bacillus coagulans*

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Probiotics are defined as live microorganisms that, when consumed in adequate amount, have a positive effect on the health and physiology of the consumer. *Bacillus coagulans* has recently attracted researchers and food manufacturers with its probiotic and spore-forming properties. *Bacillus* genus bacteria secrete antimicrobial agents such as antibiotics and bacteriocin. *Listeria monocytogenes* is known as an important pathogen. The ability of *Listeria* species to form biofilm is very important for the food industry. Especially in food establishments, there are studies in which *L. monocytogenes* species develop in biofilm containing different microbiota and this is the main reason of food contamination. *L. innocua* is preferred for laboratory studies in terms of laboratory safety because of the high similarity between *L. innocua* and *L. monocytogenes* species, and although they could be isolated from the same environment, *L. innocua* is not pathogenic to human. In this study, the antilisterial and antibiofilm effects of probiotic *Bacillus coagulans*, against *Listeria innocua* were investigated. In order to statistically evaluate the results obtained from this study, "Windows SPSS 20.0 software" program was used.

Bacillus coagulans GBI-30, 6086 and *L. innocua* ATCC 33090 were used in our study. 12-well plate method was used in biofilm formation. 4% crystal violet was used and biofilm formation was evaluated by absorbance measurements at 620 nm. It was confirmed that *L. innocua* strain produced biofilm. Especially after 24 hours, biofilm formation is an expected result considering the reproductive cycle and generation time of the organism. According to the results obtained by adding *B. coagulans* to the medium, the effect of *L. innocua* on biofilm production was measured. It was determined that the absorbance value decreased from 0.285 to 0.073. Since the absorbance value> 0.1 indicates biofilm formation, probiotic *B. coagulans* has been found to be effective on *L. innocua* biofilms. After biofilm was obtained in 12-well plates by *L. innocua*, the number of cells attached to the biofilms after 48 hours of incubation was determined. For this purpose, Oxford Listeria Selective Agar medium was used and the number of *L. innocua* live cells was determined as 5.08 log CFU/mL. In antimicrobial trials, agar well diffusion method was used. The inhibition effect of *B. coagulans* on *L. innocua* was examined at 48 hours of incubation using both supernatant and direct cell suspension, but no zone formation was observed. Since resistance mechanism is a complex phenomenon shaped by microorganism species, antibiotic type, interaction of human and environment, natural or acquired resistance should be taken into consideration in some bacteria. When *L. innocua* produces biofilm, it gains resistance against environment. For this reason, the inhibition effect of *B. coagulans* on *L. innocua* could not be observed. A direct

probiotic *B. coagulans* inoculation on *L. innocua* reduced the number of cells at 6.64 log cfu / mL. This decrease indicates that there is an inhibitory effect of probiotic *B. coagulans* bacteria on *L. innocua* development.

The result obtained from this study will be a solution to the biofilm problem, which has become the main concern in food establishments, and can enable production under more hygienic conditions. The study should be expanded using different probiotic bacteria and different pathogens, and is expected to contribute as a natural preservative for food safety by using biofilms directly or indirectly.

Frehness Indicator Applications in Food Packaging and Importance on Food Safety

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Nowadays there are new packaging technologies developed to maintain or improve food quality and safety. Changes in consumer preferences, technological innovations and difficulties to reach safe food are the most important drivers for the development of new packaging technologies. These drivers could provide to reach higher quality and safer food by smart/intelligent packaging. Thanks to the smart packaging technology, the producer, retailer and consumer can monitor the quality/safety changes in the food during transportation, storage and retail. Freshness indicators as one of smart packaging applications work on the principle of color change in the presence of metabolites formed as a result of microbial spoilage or chemical changes in the product, thereby enabling the communication between the package and the consumer by visual indicator. Freshness indicators ensure food safety by detecting the products that are spoiled before the last consumption date or continue to be sold even after the consumption date. Freshness indicators usually change color to provide information about the quality and spoilage of food in the presence of a single metabolite, so the reliability of the indicators should be high. However, incorrect results may occur if the indicator reacts in the presence of a different metabolite or is not sensitive enough to detect the spoilage. There are scientific researches continuing on the freshness indicators and also commercial applications are available at the market. However, the scientific studies about the topic are more limited in Türkiye. There are different freshness indicators sensitive for different spoilage metabolites like volatile nitrogen compounds, carbon dioxide and sulfur compounds. Freshness indicators were generally tested for foods such as chicken, fish and red meat with high nutrient content which rapidly deteriorate by microorganisms. Also, there are other foods such as fresh fruit and vegetables, milk and dessert that freshness indicators were validated. The dyes such as bromothymol blue, methyl red, bromocresol green and bromocresol purple as well as also natural color pigments like turmeric, carotene and chlorophyll have been used for the indicators to determine the visual color changes on the packages. There are different studies in the literature where these dyes were used individually or as in combination. The sensitivity of the dyes to the metabolites and the rate of color change correlated with the food spoilage were successfully observed with the different concentrations of dyes tested. There should be high correlation observed between metabolite concentration and color change mechanisms of the dyes which should not migrate into the food. In general, multilayer systems are used to prevent possible chemical or dye migration into the food. To better observe the color transition, a filter paper is used for the main layer of most of the produced freshness indicators. The dye compounds are first transferred to a

surface which can absorb the compounds and then covered with a gas permeable breathable polymer film. The indicator is then transferred to a food package. In literature, there is no study about the direct application of the freshness indicator dye to a package by printing process. The freshness indicators were also successfully produced with natural polymers like cellulose, chitosan, starch or with biodegradable polyesters like polylactic acid and polyhydroxybutyrate. In this review, freshness indicators systems and working principles developed for different foods and commercial applications, techniques in the design and production of freshness indicators and recent developments in the literature relating with the food safety will be discussed.

Production of Plant Protein Powder From Mung Beans

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Research hypothesis: Nowadays, with the increasing population, it is difficult to sustain the protein demand from animal sources. With the fact that individuals turn to vegan and vegetarian nutrition, plant proteins gained more importance. Legumes containing high amounts of protein are among the most important plant protein sources. Soybean has the highest production and consumption among plant protein sources and is mostly used as a raw material for production of plant protein powder. However, there is a need for alternative plant protein sources because soybean contains 16 allergen proteins and soybean protein isolates (SPI) do not exhibit desirable functional properties in food processes requiring high pH values or temperatures due to reduced solubility and emulsifying properties resulting from protein denaturation. Mung bean (Vigna radiata L. Wilczek) has a high protein content (19.5-33%) which can be considered as an alternative source to soybean. Therefore, mung bean was selected as raw material in this study and it was aimed to obtain protein powder from mung beans by determining the effects of the extraction parameters.

Method: Mung beans were obtained from a local market and were ground to a powder form which contains 26.84 g protein/100 g. In order to obtain protein powder, distilled water was added to the ground mung bean in 1/25 solution/solid ratio and the mixture was homogenized by stirring. The sample pH was then adjusted to 8.5 by addition of 1 M NaOH, and the samples were allowed to stand at 50 °C for 10, 65 and 120 min by mixing. After the proteins has extracted into the aqueous phase, the samples were centrifuged at 4000 rpm for 15 min. The liquid fraction was filtered. The filtrate was adjusted to pH 4.5, the isoelectric point of the proteins, with 1 M HCl, to allow the proteins to precipitate. The protein was separated by centrifugation (4000 rpm, 15 min). Finally, the samples were dried in a lyophilizer (Armfield, HA-308/3) for 9 hrs under vacuum at -48 °C to obtain protein powder.

Results: Total protein content of ground mung beans with a total dry matter content of 88.17±0.29 g/ 100 g was determined as 26.84 g/100 g of dry matter after Kjeldahl protein determination. The protein content of mung bean protein isolates obtained was determined by Bradford method. When protein extraction was performed at 50 °C, the extraction yield was 43% for 10 min., 58% for 65 min. and 23.14% for 120 min. extraction times. After the decrease was found in yield values due to the increase in time at constant temperature, the pH and solution/solid ratio were kept constant. Protein extraction was carried out at 40 °C for 40 min. and the yield was increased to 72%.

Discussion: Nowadays, changes in people's lifestyle have influenced eating habits and consumer behaviors. As a result of this study, the increase in the protein deficit is ensured

from alternative sustainable plant protein sources. It is aimed to develop plant based protein powder product to be used in high protein functional foods and to obtain high quality powder product by minimizing the nutritional value losses by freeze drying process applied to the raw material. Obtaining the dried powder product is also important in terms of ensuring food safety and public health. According to the results of this study, it is thought that the need to plant more mung beans and production of value added product such as plant protein powders will contribute to the economy of our country. The extraction parameters effects will be optimized and functional properties of proteins will be determined in further studies.

Evaluation of Rapid Alert System for Food and Feed (RASFF) Data on Mycotoxin Hazard in Dried Figs Originating from Türkiye

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Fig *Ficus Carica* L. is a high nutritional value fruit, which is generally consumed in dried form, growing in the regions where the average annual temperature is 18-20°C. Türkiye has an important position in the World as the largest dried fig (Sarılop) producer and exporter country. Mycotoxins are fungal toxins and important dietary risk factors that can be consumed chronically due to their presence in a wide range of food products. According to the International Agency of Research on Cancer, aflatoxins (B1, B2, G1, G2), the main mycotoxins that can be found in dried figs, are highly toxic and carcinogenic compounds for humans. Mycotoxin contamination in dried figs can occur depending on harvest, processing, storage and transportation conditions. Also, climatic conditions (rainfall, temperature, relative humidity) can affect mycotoxin contamination of dried figs. The Rapid Alert System for Food and Feed (RASFF) portal was established by the members of the EU in order to protect consumer health and produce an emergency response and solution for all kinds of risks related to food safety. It includes data on food safety hazards including classification of the notification (alert, border rejection or information), date of case (day, month and year), sampling date, hazard category (e.g., mycotoxin), notifying country, subject (e.g., type and concentration of mycotoxin), product category, risk decision and action taken. While RASFF data have been analyzed for a number of product groups (such as seafood products, herbs and spices, fish products, meat samples, fruits and vegetables) and hazard categories (such as biogenic amines, foreign bodies, heavy metals, food allergens, food additives), an in-depth investigation of mycotoxin hazard in dried figs has not been carried out. In this study, the RASFF data was systematically analyzed for Turkish dried figs to establish the extent of the problem (mycotoxin hazard) and to identify the factors that affect mycotoxin contamination. Mycotoxin hazard data for dried figs exported from Türkiye to EU in the RASFF portal were collected by selecting the origin of product as “Türkiye” and hazard category as “mycotoxin” while the subject of notification was restricted using the keyword “fig” between 01/01/2002-31/12/2018. The RASFF mycotoxin hazard data of dried figs was exported to Excel spreadsheets and analyzed using descriptive statistics. The trends of total number of notifications and aflatoxin concentration (µg/kg) of the notified samples were analyzed over time. 929 notifications were reported between 01/01/ 2002-31/12/2018 for mycotoxin hazard in dried figs (aflatoxin (93%) and OTA (7%)) with the majority of classifications being border rejections (66%). The countries with the highest number of notifications were France (27%) and Germany (26%) as 247 and 239 notifications, respectively among the 26 notifying countries (2002-2018). While the concentration of AFB1 (max. level: 6 µg/kg, EU Regulation

No: 1058/2012) was in the range of 0.8-257.6 µg/kg, the concentrations of Total AF (max. level: 10 µg/kg, EU Regulation No: 1058/2012) and OTA were found as 3.3-360 µg/kg and 10.7-659 µg/kg, respectively. No maximum limit has been specified in the EU Regulation for ochratoxin A in dried figs. The number of notifications increased between 2003 and 2008 reaching 80 in 2008, a decrease was observed in 2009 (56) and 2010 (53). After 2010, the number of notifications started to increase again and reached a maximum (131) in 2012. Then, the number of notifications decreased to 50 in 2013 and was in the range of 33-67 between 2014-2018 with no clear trend. The yearly trends were evaluated considering the changes in regulations and climatic conditions. This study provides a comprehensive framework for further study of mycotoxin hazard of Turkish dried figs with particular focus on the factors affecting mycotoxin contamination.

Determination of Ultraviolet Light Penetration in Pear Tissue

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Pear fruit is a suitable medium for various microorganisms including Listeria species, *Salmonella spp*, *Aeromonas hydrophila*, *Yersinia enterocolitica*, *Escherichia coli*, molds and yeasts due to its composition. Industrial processes applied to the fruit make microorganisms easier to benefit from nutrients and cause them to grow and spread. It is important to develop new technologies to minimize microbial risk while preserving the fresh properties of fruits. UV-C light is an innovative non-thermal process for inactivation of microorganisms because of its broad-spectrum microbicidal activity. However, the limited penetration depth of UV-C light causes this application to be applied to food product surfaces. In this study, it is aimed to determine the level of penetration depending on the intensity of UV-C light in the energy scope in order to estimate how deep UV-C light can penetrate into pear tissue. UV-C light penetration depth was determined photometrically using a portable radiometer equipped with UV-C light probe. Fresh-cut pear tissues of increasing thickness (0.3 mm, 0.4 mm, 0.5 mm, 0.75 mm, 1 mm, 2 mm, 3 mm, 4 mm, 5 mm) were obtained. The obtained slices were kept in isotonic water adjusted according to the brix value of the fruit in order to avoid water loss and color changes during the waiting period. The slices were placed on the radiometer sensor and irradiation was performed with 8 UV-C lamps having a lamp power of 21 W and emitting 254 nm wavelength. Light intensity penetrating from pear tissues was measured. The ratio between incident light (I0) and transmitted light (I) is shown as a function of the thickness of pear tissue. Transmittance (T) was obtained using Beer - Lambert law. As a result of the analyses, it was found that the light transmittance of pear tissue decreased with increasing slicing thickness. The lowest transmittance was obtained in pear slices with a thickness of 5 mm and this value was 0.03 ± 0.016%. The transmittance was determined as 0.05 ± 0.022%, 0.16 ± 0.117, 0.43 ± 0.228, 4.36 ± 2.152, 8.69 ± 3.390, 15.92 ± 4,418, 19.43 ± 4,235% in slices having thicknesses of 4, 3, 2, 1, 0.75, 0.5 and 0.4 mm, respectively. The transmittance of slices 2 mm and thicker is almost negligible. The transmittance of slices with a thickness of 0.3 mm was 34.06 ± 3.949%. Since the slicing process was performed manually, it was difficult to obtain thinner slices more homogenously, resulting in more deviations in the measurement results. When the literature is investigated, there are not many studies examining the penetration of UV-C light on foods. Effectiveness of UV-C application is affected by various factors including UV-C dose (J/m²), UV-C dose rate (W/m²), UV light source, distance between UV lamp and food sample, UV light exposure time, type of food, composition of food, physical and optical properties of the food surface, the type of microorganism, even different strains of the same species and the initial microorganism load. For this reason, it is important to know the depth of penetration of UV-C foods, to select the UV-C dose to be applied and to predict the direct effect of microorganisms on the surface and other parameters. As a result of this study, it was determined that the effect of UV-C light on pear tissue was limited to a very thin surface layer of the product. These results show that UV-C light can affect both

microbial decontamination and functional activity of food cells in different ways depending on the thickness.

Organochlorine Pesticides and PCB Levels in Soil and Vegetable Samples of Lushnja Region, Albania

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The aim of this study was to determine concentrations of organochlorine pesticides and polychlorinated biphenyls (PCB's) in soil and vegetable samples of Lushnja region. Study area is part of Myzeqeja field, the main agricultural area of Albania when organochlorinated pesticides were used continuously until 90'. Soil and vegetables (different types) were sampled in 15 stations (farms) in April 2019. Both samples type was taken in an area of 1 m^2.

Vegetable samples were homogenized with anhydrous sodium sulphate and after that were extracted by using ultrasonic bath assisted with mixture of Hexane/Dichloromethane (3/1). The extract was purified with Silicagel impregnated previously with sulfuric acid. A further clean-up step was performed in an Alumina glass column. Also, ultrasonic extraction was used for dry soil samples. The extract was purified in an open glass column packed with Sodium sulphate (upper layer) and Florisil. Both extracts were concentrated up to 1 ml using Kuderna-Danish. The qualitative and quantitative analysis of organochlorine pesticides and PCB in all samples was performed by using HP 6890 Series Plus gas chromatograph (GC) equipped with micro-electron capture detector (μECD). Organochlorine compounds were analyzed simultaneously using capillary column (Rtx-5, 30m x 0.25mm x 0.25 μm). The organochlorine pesticides detected were: Lindane and its isomers, DDT and its degradation products, Heptachlor's, Chlordane's, Aldrin and its related compounds, Endosulfan's, Methoxychlor and Mirex. Analysis of PCBs was based on the determination of the seven PCB markers (IUPAC Nr. 28, 52, 101, 118, 138, 153 and 180).

In this study were analyzed soil and vegetable samples at 15 different stations of Lushnja area, Central Albania. In all analyzed samples were found organochlorine pesticides. Higher levels of pesticides were found frequently in soil samples. Their concentration was from 2 to 100 times higher than in vegetable samples. Chlorinated pesticide levels ranged from 29.7 to 1137.3 ug/kg dry soil sample and from 11.9 to 115.2 ug/kg fresh vegetable samples. Presence of pesticide could be mainly because of their previous use for agricultural purposes because degradation products of pesticides were found in higher concentration. Some other factors that can influence soil and vegetable samples are geographical position, slope, soil geology, water used for irrigation, vegetation type and atmospheric deposition. The profile of organochlorine pesticides was almost the same in soil and vegetable samples. Their profile was: Aldrin's > DDT's > Endosulfanes > Chlordane's > Heptachlor's > HCH's. This was related to the fact that contamination of soil with pesticides can cause contamination of vegetable products that grow in it. The passage of pesticides was not the same in all analyzed samples because passage of pollutants from the soil to the plant depended by vegetable type. Also, PCBs were found in all analyzed samples. Their levels were from 5.6 to 227.8 ug/kg dry soil

samples and from 2.7 to 43.5 ug/kg fresh vegetable samples. Their presence may be mainly due to atmospheric deposition. Terrestrial point sources are not excluded especially for some stations where heavy PCBs were detected. PCB 153 and PCB 52 were found in high level for both types of samples. Levels of organochlorine pesticides and PCBs were found below EU and Albanian norms for all analyzed samples but their presence should encourage institutions for frequently and rigorous control in this area.

Pesticides have been used widely in this area to fight malaria vectors (a part of study area has been wetland) and for agricultural purposes. The presence of organochlorine pollutants in soil and vegetable samples is due to their previous uses, degradation processes, irrigation, atmospheric deposition, etc. Continuous control of organic pollutants in soil and vegetable samples of Lushnja area is required for consumer safety.

The Influence of Extrusion Processing on the Anti-nutrients in Flaxseed and Camelina Seed

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Flaxseed and camelina seed have emerged as a potential functional food because they are a good source of alpha-linolenic acid (ALA, C18:3 ω-3), high-quality protein and soluble fiber. ALA is the most important ω-3 PUFA in human nutrition and precursor for the synthesis of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which cannot be synthesized in the human body and the only way is to enter through food. Modern nutrition has led to increased intake of ω-6 fatty acids while, at the same time, decreased the ω-3 fatty acid intake, which has adversely affected the health of modern humans. Sources of ALA in human consumption are most commonly seeds and vegetable oils, while EPA and DHA are most commonly found in fish and oils of marine organisms. However, these seeds usually contain anti-nutritional factors which affect digestibility and nutrient utilization, and may have adverse influence on the health and well-being of human population. Cyanogenic glycosides, erucic acid and other anti-nutritional factors can be easily destroyed by heat treatment with or without addition of water, such as autoclaving, microwave roasting, pelleting and extrusion. The aim of this study was to decrease anti-nutritional factors in flaxseed and camelina seed with extrusion processing and provide functional food which is safe for consumption. Flaxseed and camelina seeds were ground using a hammer mill equipped with 4 and 2 mm sieve, respectively. Extrusion of seed rich in oil is very difficult to perform alone, therefore in this study ground seeds were mixed with corn meal (ratio 1:1) in double-shaft pedal mixer for 90 s. Obtained mixture of flax and corn meal, as well as camelina and corn meal, was then extruded using co-rotating twin-screw extruder (7 sections, extruder barrel length 880 mm, length/diameter ratio = 28:1). The extruder was equipped with two tempering tools for heating/cooling of sections of jacketed extruder barrel using water as a medium. A die plate that had one 4 mm diameter opening with cone inlet (total die open area 12.56 mm2) was used. Based on obtained results it can be concluded that extrusion processing did not adversely affect preferred omega-3 fatty acids while, on the other hand, significantly reduced the content of the anti-nutritional factors. Content of PUFAs in oilseeds before extrusion processing was 68.34% in flaxseed and 54.33% in camelina seed. After the thermal treatment content of PUFAs was 70.32% in co-extrudates of flaxseed and 56.51% in co-extrudates of camelina seed. Determined differences were not statistically significant ($p>0.05$). The obtained results have shown that content of cyanogenic glycosides after extrusion processing significantly decreased from 177.28 to 23.87 mg/kg for flaxseed and from 28.51 to 3.21 mg/kg for camelina seed, respectively. Likewise, the content of erucic acids also significantly decreased from 3.38 to 2.69% for camelina seed. Extrusion processing of flaxseed and camelina seed with corn meal applied in this study successfully provides a new functional

product with added value due to its high PUFAs level, as well as low content of anti-nutritional factors.

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Antibiotic Risk In Food Industry

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Antibiotics, inhibit or stop bacterial growth, are substances that can be produced naturally, semi-synthetic and synthetically. Antibiotics, the most frequently used drug group all over the world, can be classified according to their various features such as their degree of action, mechanism of action, and chemical structure on microorganisms. Antibiotic resistance resulting from the unnecessary and misuse of antibiotics, considered one of the most important discoveries of the 20th century, is an important public health problem in the international arena today. The most important risk factors for animal and human health in the formation of resistance depend on antibiotic applications are; the application of antibiotics unconsciously, at low doses and for a long time, formed by the use of broad-spectrum drugs.

Antibiotics cannot be completely removed from the body as a result of giving more than the prescribed doses to the animals and especially when the animals applied to the drug are sent to the slaughter without using the legal waiting period or using the milk. Accordingly, antibiotic residues which are important in terms of food safety can be found in the tissues and organs of animals and animal foods obtained from them. Multiple antibiotic resistant bacteria types that have not been associated with foods and the spread of resistance genes can be seen with excessive and unconscious antimicrobial use in farm animals and, antibiotics resistant food-borne infections in humans.

The use of antibiotics for growth-promoting purposes in animals causes the formation of multiple resistant bacteria populations. Due to the increasing resistance, the use of antibiotics as feed additives is completely prohibited in our country, except for the purposes of disease, treatment or protection of animals, in accordance with the European Union (EU) legislation.

Increasing antibacterial resistance in microorganisms is a health crisis that leads to treatment failures, increased frequency of side effects, and an increase in treatment costs. According to the antibiogram test results report published by the EU Food Safety Authority in 2011, antimicrobial resistance was highest in Salmonella, Campylobacter and Escherichia coli species. In addition, the 3 different classes listed below stand out as important threat sources. First, methicillin-resistant Staphylococcus aureus strains (MRSA) are estimated to cause an additional $ 3-4 billion in health care costs in the United States, with ~ 19,000 deaths per year. The second group is less common than MRSA and contains multiple drug resistant Gram (-) bacteria, a serious threat to untreatable infections. The third group includes Mycobacterium tuberculosis strains, which are also multi-drug resistant, difficult to treat and mostly fatal.

The rise of resistant pathogens as well as lower antibiotic diversity rates put humanity at risk of returning to the "pre-antibiotic era". To deal with this condition, antibiotics should be used only for therapeutic purposes. When it is necessary to use antibiotics in treatment, the first

choice should be narrow spectrum antibiotics. In order to ensure food safety and protect public health, attention should be paid to the necessary expulsion and waiting time after application in antibiotic treatments.

The solution proposal of the scientific world to the developing resistance problem was primarily the development of new antibiotics. However, due to the diverse antibiotic nowadays, the trend towards alternative antimicrobials such as bacteriocins and bacteriophages has begun.

In order not to return to the pre-antibiotic period, the most important solution is to use antibiotics only when necessary, at the appropriate dosage and at the appropriate time. Reducing the use of antibiotics for both animals and humans should be ensured with vaccination, prebiotic and probiotic practices, and unnecessary antibiotic use should be prevented with Good Hygiene Practices, Good Management Practices and HACCP principles.

Some Changes in Lipid and Meat Fraction of Chicken Doner During Cooking

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In this study, some changes during cooking of chicken doner which are consumed frequently were investigated and their health risks were evaluated. For this purpose, samples were taken from four chicken doners prepared at different times before and during cooking. The polar material and polymer triglyceride contents, free and ester bound 3-MCPD contents and the acrylamide contents of samples were investigated by using column chromatography, HPLC, GC-MS and UPLC-MS, respectively. Furthermore, the fatty acid composition of the extracted oil from the samples was analyzed by gas chromatography apparatus. According to the results of the study, the polar material content of oil extracted from the doner samples were found in the average of 7.30±1.26 -9.77±0.55% in cooked doner and 8.12±1.68% in raw doner. The change in the polar material content of doner samples was found to be significant both between doner kebabs and at different cooking times of the same doner kebabs ($p<0.05$). It is thought that irregular change in the amount of polar substance during the cooking process may be due to the heterogeneous structure of the cutting meat layers. The change in the amount of polymer triglycerides of the doner samples was found to be statistically insignificant ($p>0.05$). The average polymer triglyceride content of the doner samples was found to be 0.027±0.008 g/100g g fat in raw samples and 0.024 ± 0.006 -0.031±0.007 g/100g oil in cooked samples.

The ester 3-MCPD content of the oil extracted from raw samples was 49.28±33.98 µg/kg, whereas it was 86.41±63.57 - 205.74±82.11 µg/kg in cooked samples ($p<0.05$). Free 3-MCPD contents of fat free meat samples were found to be 26.00±13.14 µg/kg in raw samples and 15.77±4.33 -20.78±4.83 µg/kg in cooked samples. In general, it was observed that the amount of ester 3-MCPD content increased and the mean free 3-MCPD contents decreased during cooking ($p<0.05$). The drop of free 3-MCPD was thought to the result from the conversion of 3-MCPD compounds to other MCPD or glycidyl isomers. Although 3-MCPD is a compound formed during heat treatment of foods, ester and free 3-MCPD were detected in raw samples. It was estimated that this might be caused by oily sauce, tomato paste, and spices used in the preparation of doner. On the other hand, the acrylamide level of the doner samples was found to be below the detection limit (3 ng/g).

In doner samples, palmitic acid (C16:0), oleic acid (C18:1c) and linoleic acid (C18:2) contents were found to be 19.90±0.59%, 32.32±0.98% and 34.89±2.17% in raw samples, respectively, and 19.07±0.07%, 31.86±0.14% and 36.43±0.17% in cooked samples, respectively. In addition, raw and cooked doner samples were found to contain average 0.05% trans fatty acid. Saturated fatty acid (SFA), monounsaturated fatty acid (MUFA) and polyunsaturated fatty acid (PUFA), MUFA/SFA, PUFA/SFA ratios were 25.83±0.77%, 35.80±1.22%, 38.37±1.99%, 1.39±0.01 and 1.49±0.12, respectively in raw doner and they were 25.40±0.12%, 34.84±0.18%, 39.76±0.17%, 1.37±0.01 and 1.57±0.01, respectively in cooked samples. The change in trans fatty acid content during cooking was found insignificant ($p>0.05$). Because, the surface of doner wasn't exposed to high temperatures for a long-time during cooking.
In the absence of detectable levels of acrylamide during the heat treatment, low polymer triglyceride content, low polar content and trans fatty acid were evaluated as positive in terms of food safety. However, due to the presence of ester and free 3-MCPD, it is recommended to be careful and not to consume excessive amounts. It is also necessary to determine the microbiological quality of chicken doner kebabs and to investigate possible pathogenic microorganisms.

Effects of Thymol and Carvacrol on the Oxidative Stability of Refined Sunflower Oil

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The aim of this study is to determine the effects of various phenolic compounds (thymol and carvacrol) on the oxidative stability of the sunflower oil by adding at certain concentrations. The potential of thymol and carvacrol to prevent oil oxidation has been investigated. In this study, refined sunflower oils containing different concentrations of carvacrol and thymol were subjected to accelerated oxidation test for 21 days at 60 °C. In oxidation tests, carvacrol and thymol were added to refined oils at concentrations of 250 and 500 ppm. Oxidation tests were applied in two replicates. In the oven test, 50 g of oil was used for each trial. Oils were put in colored glass bottles. The bottles were kept open. Oxidation was monitored by determination of specific absorption values (K232 and K268), peroxide value, p-anisidine value and total tocopherol content. For comparison, oil containing BHT (100 ppm) was used in the oxidation test. Results of the analysis were given as mean±standard deviation. The results statistically evaluated using the Minitab 17 Statistical Software (v17.3.1) package program. The difference between the means of the groups was determined by variance analysis (ANNOVA) test ($p<0.05$). Tukey test was used in the difference tests.

K232 values of oil samples taken during the storage of refined sunflower oils containing thymol and carvacrol at 60 °C showed a regular increase and this increase was found significant ($p<0.05$). At the end of the 21st storage period, carvacrol was the most effective component against oxidation. Generally, all additives provided lower K232 values than control. K268 values of oil samples taken during the storage of refined sunflower oils containing thymol and carvacrol at 60 °C did not change regularly. Considering each trial during the oxidation, the difference between days was found statistically significant ($p<0.05$). As a result of 21 days of storage, thymol was as effective as BHT which prevented the increase of secondary oxidation products. As a result of 21 days of storage, the phenolic compound that was as effective as BHT, which prevented the increase of secondary oxidation products, was thymol. The peroxide values of the oil samples taken during the storage of refined sunflower oil containing thymol and carvacrol at 60 °C increased and this increase was found significant ($p<0.05$). Except for the 18th day, thymol added oils caused less hydroperoxide formation than

those with carvacrol additives (250 and 500 ppm). Phenolic compounds had a concentration-dependent effect in the change of peroxide values.

The p-anisidine values of the oil samples taken during the storage of refined sunflower oil containing thymol and carvacrol at 60 °C increased regularly between the 3rd and 9th days and between 12th and 21st days. The change of the p-anisidine values from day to day was found significant ($p < 0.05$). At the end of the oxidation period, p-anisidine values of sunflower oils with additives were lower than the control. Additives reduced the formation of aldehydes, secondary products of oxidation.

The decrease in the amount of tocopherol of the oil samples taken during the storage of refined sunflower oil containing thymol and carvacrol at 60 °C was found significant ($p < 0.05$). BHT was the most effective one in the prevention of tocopherol degradation. Overall, all additives slowed the drop in the amount of tocopherol at 60 °C storage compared to control. It has been observed that thymol and carvacrol have low potential to prevent oxidation of refined sunflower oil at studied concentrations. Their effectiveness at higher concentrations needs to be investigated. Certain concentrations of tocopherol isomers can be added to purified sunflower oils with carvacrol and thymol to examine possible synergistic or proxidant activity.

Nanotechnology, Electronic Nose – Artificial Detection Systems and Food Safety Applications

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Recently, new methods and application areas in food industry are increasingly used due to technological advances. Artificial intelligence (AI) based applications is also finding place in food industry in parallel to other industries. Early works about AI started in 1960s and continues to develop until today. Some examples of AI applications in food industry are artificial neural networks, fuzzy logic, genetical algorithms that can be used as problem solving and analysis purposes. These applications are based on nanotechnology.

Nanotechnology has developed dramatically in recent years, and it seems to continue to develop in the future. Data from computer image, electronic nose and tongue analysis methods are used for improving quality control capacity in food industry. In this study, information will be given about how artificial intelligence applications on food engineering can benefit product grading and classification, process modelling and optimization, quality control monitoring, conversion of computer image into numbers, product design and storage systems. Globally, China and USA are leading countries with interest on nanotechnology. They are followed by Japan and European countries. In Türkiye, nanotechnology research and applications are recently gaining interest. For this purpose, National Nanotechnology Research Center (UNAM) is built as part of Bilkent University by the state planning department. Until recently, nanotechnology research has focused on packaging materials and nanosensors. Research resulted in applications in water distillation, cell wall damage repair, microencapsulation, odor removal, disinfection, antimicrobial and antifungal materials, shelf life extension.

Nanoparticles, nanosensors or antigen-detecting biosensor containing polymer films are developed for Intelligent packaging technology. When applicable, sensors placed in packaging films can detect spoilage microorganisms and cause a color change. Therefore, consumer will understand that product has reached the end of its shelf life.

Resarchers from Biological Systems Engineering Department of Washing State University has developed a sensor that can detect if milk is fresh or spoiled by “smelling”. Sensor is made of chemically-bound nanoparticles that can react with gases formed by the

bacteria present in milk. Since the sensor is not in direct contact with milk, it does not raise concerns like other food applications of nanotechnology.

Researchers stated that most foods produce unwanted smell due volatile gases during spoilage, however, it is not possible to detect this without opening the package. On the other hand, the newly discovered sensor can detect these gases and cause color change. Although the discovery is in its early phase, it was however shown that underlying chemical reactions are shown under laboratory conditions. Next goal of researchers is to develop a system that can show the remaining shelf life of a product. The current sensor can only show if milk is spoiled or not.

Todays consumers care about the safety and convenience of food products they will consume. This increases producers interest on developing technologies that can pre-evaluate finished product quality as well as during processing steps in a reliable and rapid way.

The biggest issue in using such systems is managing large amount of data which also causes a large increase in corporate IT database. This increase causes hardware costs associated with tracking systems.

In the future, structure measurement, artificial detection systems, electronic nose and tongue applications are expected be used more commonly not only in production industry but also for scientific research studies as an objective evaluation method.

Importance of Secondary Packaging for Food Safety

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After industrialization in the 19th century, food products produced in factories began to be sold in packaged form at the moment. Nutrition and good healthy, which is one of the most basic needs of human beings, are possible on the basis of food safety. Foodborne diseases have negative impacts on human health in both developed and developing countries. These diseases cause a serious threat to especially children, the elderly and pregnant women. These threats cause health problems and loss of life.

Box compression test (BCT) test is done for measuring vertical resistance of an empty box. This test provides information about compresion resistance of stacked boxes. Its unit is kgf. Edge compression test (ECT) measures the force required for compression of cardboardbox after applying pressure to cardboardboxes in a horizontal direction under atmospheric direction.
Packaging can be defined as a valuable material that provides protection, clean and safe transportation and storage protection for the the product. Secondary packaging provides convenient transportation for sales. This process can be used for product classification such as shrink film and cardboard boxing.

Basic functions of a package can be summarized as:

- Contain product

- Protect/preserve

- Transport

- Provide information/sales

The importance of packaging increases day by day since it protects food products. Especially, the secondary packaging has a very important functionality for the life cycle of a food product.When quality and size selection of corrugated cardboard (box) from secondary packaging is not done correctly, serious quality problems can happen.
While in the past, the most important quality control criteria for boxes was measured by dividing the box weight by the plate cross section (g / m^2), today's technology enabled the measurement of box resistance with BCT (Box compression test) and ECT (edge compression

test) instruments. BCT machine simply measures the value obtained by the formation of micro-level deformation that can occur in the carton box with increasing force applied. On the other hand, The ECT machine shows deformation value formed by applying pressure on a section of the plate.

When a product is manufactured, first of all, the configuration and number of boxes in the pallet are determined. Then, The BCT and The ECT values are theoretically calculated. Afterwards, theoretically calculated The BCT or The ECT values are validated with collapse and transport tests. In order to carry out these tests, firstly the packages those known quality and dimensions are brought to factories and then, products are placed into boxes and pallets before they are sent to a transport test at a predetermined route. If there is no deformation in the products, production of the relevant product in the factory can be approved. If there is deformation, The BCT, collapse and transport methods described above can be repeated. Food packaging and its quality control criteria is increasingly becoming important. Last but not the least, the food safety can be increased at a minimal cost at the moment.

Properties and Production Yoghurt With Pomegrate Peel

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Hypothesis : The flavanoids, phenolic compounds and antioxidants in the pomegranate peel are much higher than the water and ellagic acid it contains; Look at its antioxidant properties. Yogurt contains high calcium content, riboflavin, protein, phosphorus, vitamin A, vitamin B1 (thiamine), Vitamin B12 (Riboflavin) and Vitamin B6. Producing a consumable product by enriching it with antioxidant and adds functional properties to dairy products. In addition, converting the use of pomegranate peel into the product enables to obtain a product with both functional and functional features for zero waste.

Method: In this study, set-type yogurt was produced with 0.1-0.3-0.5% pomegranate peel and pH and sensory analysis of the products were followed for 21 days. In addition, during the shelf life, total AKS and lactic acid bacteria counts were performed in the products. Minitab program was used to evaluate the results statistically. Pomegranate peel powder has traditionally been obtained by drying pomegranate shells in the oven and grinding in mortar.

Results: When the analysis results were examined, it was determined that the best sensory concentration was 0.1%, and it was determined that the product retained its physical, chemical and microbiological properties. Studies in recent years have focused on antioxidants that have protective and retarding effects against free radicals, which are effective in the formation and aging of many diseases. Studies are increasing on the application of these natural ingredients in food and other industrial sectors as additives instead of synthetic antioxidants, whose applications are gradually restricted due to toxicity. In a study conducted by adding pomegranate juice to yogurt drink in 2015, it was stated that consumer trends are fruit or aroma-enriched milk products, yogurt is an easily digestible milk product, so consumers prefer products such as yogurt with enhanced taste and functionality (Bhandary et al., 2012).

In a study where yogurt was added by adding pomegranate seeds in 2019, the data obtained showed that the addition of pomegranate seeds lowers the pH and changes the texture of the yogurt samples. In addition, it has been observed that acidity, brix and sinericis increase

compared to control. Thanks to its high anthocyanin content, pomegranate seeds are said to significantly improve antioxidant activity for yogurt enriched with frozen seeds. In general, it can be concluded that pomegranate seeds can be used as a natural ingredient to develop a new yogurt with high nutritional properties (Bchir et al., 2019). In new product development projects, it is necessary to produce products that the consumer can love, to take an environmentalist approach while producing these products, and to pay attention to the high functional benefit of the product. With this project, it is seen that pomegranate peels used for making juice or for various purposes will be evaluated, as well as being an application that will serve zero waste, besides being an application that has a high nutritional value, increased functional benefits, can be easily digested and can be consumed sensibly.

Discussion: The polyphenolic content and all physicochemical parameters of products made using pomegranate peel should be examined and more detailed studies should be conducted on the antioxidant activity of the product. In terms of both food safety and functionality, whether the product retains all of its physicochemical, textural and microbiological properties at the end of its shelf life should be examined with analysis parameters. In addition, it is useful to develop dairy products with different antioxidant substances and to compare them with yoghurt made with pomegranate peel.

Protein Enrichment of Dairy Products

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As known, living creatures are composed of cells or a collection of cells. Therefore, protein-based foods should be consumed regularly as well as other nutrients. It provides the growth, development and renewal of worn muscles, cell growth and division, strengthening the immune system, healing of wounds, synthesis and repair of body tissues. In addition, we should also know that proteins are not produced by the human body, so they need to be taken from food. In case of no health problem, consuming protein foods as well as other foods help to prevent anemia and maintain high body resistance causes.

Before determining the need and importance of proteins for the athlete, it is necessary to understand how the body uses proteins. During digestion, proteins are broken down into so-called amino acids containing nitrogen.

It should be noted, however, that not all protein sources are the same. Proteins differ according to the source from which the protein is obtained, the amino acid profile of the protein, and the method of processing or isolating the protein. These differences affect the presence of amino acids and peptides which have reported to have biological activity. In addition, the ratio and metabolic activity of the protein are important. For example, different protein types (eg casein and whey protein) are digested at different rates that directly affect catabolism and anabolism. Therefore, it should be paid attention not only to ensure that they consume sufficient protein in their diets but also to ensure that the high quality protein.

It is seen that the concept of “health and fitness” concept has risen in global consumer trends. In Türkiye, according to 52% of the people it surveyed prefer a healthy and fit life. The current international recommendation for protein is 0.8 g per kilogram of body weight in Recommended Dietary Allowance (RDA), regardless of age. Reference Nutrient Intake (RNI) is 0.75 g / kg. These recommendations are indicated as the minimum amount to be consumed to maintain nitrogen balance and are not optimized for the level of physical activity. In summary, protein requirements vary individually and depend on various factors such as age, health status, and physical activity level. These factors are not reflected in existing recommendations to the general population. In addition to total daily protein consumption,

the frequency of daily protein consumption has been shown to play an important role in maintaining muscle mass and function.

In line with all these needs, a healthy, high-protein and lactose-free milk product was produced. High-protein lactose-free milk is a fat-free, high-protein, lactose-free milk product obtained by increasing the protein content by concentrating the milk with ultrafiltration technology, in which lactose is broken down by the addition of lactase enzyme.

Ultrafiltered milk (UF milk), is a subclassification of milk protein concentrate that is produced by passing milk under pressure through a thin, porous membrane to separate the components of milk according to their size. Specifically, ultra filtration allows the smaller lactose, water, mineral, and vitamin molecules to pass through the membrane, while the larger protein and fat molecule (key components for making cheese) are retained and concentrated.

By ultrafiltration in our company, we can obtain the protein which we need in our high protein milk product. With ultrafiltration we can increase skimmed milk's protein from 3.1-3.3% to %9-9.5.

Aseptic filling technology allows consumers to store products in room conditions and provides easier consumption with bottle packaging. Vanilla, coffee or chocolate varieties can be consumed as a pre-sport or as a snack, can be offered to consumers as a healthy and nutritious product.

A Research on Determination of Microbiological Quality of Hayrabolu Dessert

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Traditional foods which are defined as ‘‘a product frequently consumed or associated with specific celebrations and/or seasons, transmitted from one generation to another, made accurately in a specific way according to the gastronomic heritage, and associated with a certain local area, region or country’. Since ready-to-eat foods are a very suitable reproductive environment for microorganisms, they transmitted from various sources (air, water, personnel, wastes, insects and rodents, etc.) to foodstuffs at various stages from production to consumption and this situation may cause to food poisoning and infections. Hayrabolu dessert is a local dessert specific to Hayrabolu district of Tekirdağ. It is similar to Kemalpaşa dessert in terms of its ingredients and making procedures. Unlike Kemalpaşa dessert, fresh unsalted cheese is used in the production of Hayrabolu dessert. Besides, flour, semolina, cheese, eggs and baking powder are the other materials that are used to making of hayrabolu dessert. After all the ingredients are transformed into the dough, they are baked in the oven and poured with sherbet. Finally served with tahini, cream and hazelnut. In this study, the microbiological quality of Hayrabolu dessert samples sold in Hayrabolu district was investigated.

Dessert samples were taken from 5 different sales points in Hayrabolu then samples in 180 mL sterile containers were brought to the microbiology laboratory of the Food Engineering Department of Tekirdağ Namık Kemal University on the same day under aseptic conditions and cold chain. For microbiological analysis, 10 g sample was weighed under aseptic conditions and 90 mL 0.85% physiological saline solution was added. The samples were homogenized in Stomacher for 120 sec and 1/10 dilutions were obtained and serial decimal dilutions were prepared. Total viable mesophilic aerobic bacteria count, total yeast and mold count and coliform bacteria count were analyzed. In order to determine the total number of viable mesophilic aerobic bacteria, 0.1 mL of each of the serial dilutions prepared beforehand, were cultured in Petri dishes containing Plate Count Agar (PCA). Sowing petri dishes were

inoculated for 48 hours at 37 ° C and counting results were determined as cfu / gr considering dilution factor. For the yeast-mold count, 0.1 mL of each dilution was applied to the petri dishes prepared by using Potato Dextrose Agar (PDA). Coliform bacteria counts were determined by the pour plate technique using Violet Red Bile Agar (VRBA). Colony formation was evaluated after incubation of petri dishes at 37 ºC for 48 hours in an aerobic environment. As a result of the analyses, no coliform bacteria were detected in any of 5 Hayrabolu dessert samples. The total number of mesophilic aerobic bacteria was not found in 2 sample, while the highest amount was determined as $2.9x10^3$ cfu / gr. In the total yeast-mold count, the results were not dedect in a sample, while the highest amount was found to be $2.2x10^2$ cfu / gr.

According to Turkish Food Codex Regulation on Microbiological Criteria, the total number of E.coli should be less than 1x10 and the total number of yeast-molds should be less than $1x10^3$ for desserts. When these criteria are considered, it can be said that all samples have appropriate results in terms of food safety. This research revealed that the microbiological quality of Hayrabolu desserts put on market in Hayrabolu district is high therefore it is a traditional food that does not contradict the principles of food safety.

Seasonal Investigation of the Suitability of Anion and Cation Values of Spring Water for Food Safety

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Research Hypothesis: There are many parameters that affect the quality and reliability of a water to be used as drinking water. The most important of these parameters are inorganic substances in water. In this study, it was aimed to analyze the seasonal changes in anion and cation analyzes in order to determine some inorganic substances in Ion Chromatography (IC) by taking samples from water sources in Bursa / İnegöl region in certain periods.

Materials and Methods: Water samples to be analyzed within the scope of the research will be seasonally collected and stored at +4 ° C by appropriate sampling techniques in July 2019, October 2019, January 2020 and April 2020 from sources located in İnegöl district of Bursa. Anion and cation analyzes will be performed on the Ion Chromatography (IC) device by making some changes in the standard methods of EPA 300.0(Anion) and ASTM D6919-Q3(Cation). Analyzed cations and anions; fluoride, chloride, nitrite, nitrate, phosphate, sulfate, sodium, ammonium, potassium, calcium and magnesium.

Anion analysis conditions;

Mobile phase: 1.8 mM Na_2CO_3-1.7 mM $NaHCO_3$ buffer solution

Column: Shim-pack IC-SA2-250 mmL- 5µm- 4 mm and protective column

Flow: 1mLdk- (isobaric flow)

Column Temperature: 30˚C

Injection Volume: 20 µL

Analysis Time: 19 min

Cation analysis conditions;

Mobile phase: 2.5 mM $C_2H_2O_4$ buffer solution

Column: Shim-pack IC-C4 150 mm-4,6 mm and protective column

Flow: 1 mL dk^{-1} (isobaric flow)

Column Temperature: 40˚C

Injection Volume: 20 µL

Analysis Time: 20 min

Results: Method validation was carried out taking into account the limit values specified in the Regulation on Water for Human Consumption. Anion and cation analyzes were carried out by taking samples from sources K161, K162 and K163 between July 2019-October 2019 and January 2020. The results of the analysis of spring waters taken between July 2019-October 2019 and January 2020 respectively;

For source K161, (Results are given in July 2019, October 2019 and January 2020 respectively.)

Sodium: 1,152 mg/L, 1,336mg/L, 1,991 mg/L

Ammonium:Not detected

Potassium:0,685mg/L,0,889mg/L,0,808 mg/L

Magnesium:0,819mg/L,0,8999mg/L,0,580 mg/L

Calcium:4,502mg/L,4,103mg/L,2,350 mg/L

Fluoride:0,016mg/L,0,016mg/L,0,058 mg/L

Chloride:0,304 mg/L,0,565mg/L,0,587 mg/L

Nitrite: Detected in the period of October2019 at 0.054mg/L

Nitrate: In the period of October2019 and January2020, respectively;0,181mg/L was detected at 0,103mg/L

Phosphate:Not detected

Sulfate:3,999mg/L,6,1946mg/L,4,8910mg/L

For source K162,(Results are given in July2019, October2019 and January2020 respectively.)

Sodium:1,528mg/L,1,802mg/L,2,592mg/L
Ammonium:Not detected
Potassium:0,935mg/L,1,241mg/L,1,245mg/L
Magnesium:0,819mg/L,1,366mg/L,1,394mg/L
Calcium:4,502mg/L,6,372mg/L,4,730mg/L
Fluoride:0,017mg/L,0,027mg/L,0,198mg/L
Chloride:0,475mg/L,0,537mg/L,0,726mg/L
Nitrite:Detected in the period of October 2019 at 0.089mg/L
Nitrate:0,745 mg/L,0,099mg/L,0,128mg/L
Phosphate:Not detected
Sulfate:2,251mg/L,10,169mg/L,8,319mg/L

For source K163,(Results are given in July2019, October2019 and January2020 respectively.)

Sodium:1,152mg/L,2,320mg/L,3,516mg/L
Ammonium:Not detected
Potassium:0,685mg/L,1,007mg/L,0,894mg/L
Magnesium:0,517mg/L,1,164mg/L,1,138mg/L

Calcium:2,721mg/L,5,430mg/L,3,020mg/L
Fluoride:0,0342mg/L,0,0514mg/L,0,0620mg/L
Chloride:0,767mg/L,267mg/L,1,212mg/L
Nitrite:Detected in the period of October2019 at 0.0634mg/L
Nitrate:0,0370mg/L,0,334mg/L,0,455mg/L
Phosphate:Not detected
Sulfate:10,909mg/L,4,3421mg/L,2,009mg/L

Discussion: It was determined that the anion and cation values of the analyzed resources are below the limits stated in the Regulation on Water for Human Consumption. Analysis results of the April 2020 period will be added later.

High levels of nitrite, nitrate and ammonia, which are nitrogenous compounds, can have toxic effects on aquatic organisms. This situation increases the toxic effects of nitrogenous compounds in parallel with increasing pH and temperature. In general, ammonium and phosphate are not detected in sources. Nitrite is below the legal limit in all sources and was only detected in all sources in October 2019. Nitrate was detected at very low levels. It is expected that the lakes in the arid regions will be more than the lakes of sodium, potassium and chlorite regions. For this reason, an increase in these parameters was observed in October 2019 and January 2020 compared to the July 2019 period when the rainfall was high.

Public Health Benefits and Possible Damages of Disinfection Procedures Applied to Drinking Water

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Disinfection processes such as chlorination and ozonation are applied to drinking water to control microbiological effects. The addition of hypochlorite and ozone to drinking water may pose a food safety risk. Natural spring water producers are producing according to TS266 standarts. Water should not be treatment in natural spring water production. Filtration and ozone enrichment applications prevent potential microbiological risks. The filtration process ensures that organic carbon and undissolved inorganic matter are retained. With the ozone process, small molecular weight organic carbons that can pass through the filter can be broken down and precipitated in heavy metals. The greatest risk in the filtration process is the lifetime of the filter. Filters reaching saturation cause vomiting of the accumulated pollution over time. For reliable water production, spring water filters should be seen as a critical control point. If total organic carbon analysis is applied in drinking water, it will provide preliminary information about biological oxygen demand and microbiological effect.

Some organic materials such as humic acid, fulvic acid and phenolic compounds can transition by groundwater contact with soil surfaces.If ozone disinfection is performed in waters with high phenolic content, organic decomposition products with diketonic ring structure can be formed. Filtration process provides retention of humic and fulvic substances. Water with high calcium and barium content can be bound with humic acids and facilitates precipitation.

Calcium humates are broken down with ozone to form derivatives of smaller humic acid. The lower the organic carbon content, the less the possibility of microbiological reproduction. The fact that the organic carbon content is zero does not mean that there will be no microbiological growth. Ozone can affect purine and pyrimidine bases with bacteria membrane. It should be remembered that ozone can damage bacteria and affect human health. Also high ozone content causes bromate formation due to bromine content in water. Bromate may show carcinogenic effects as a result of oral exposure.

Water can be treated in the beverage industry. By applying precipitation, sand filtration, reverse osmosis, activated carbon filtration, basic parameters such as alkalinity and turbidity can be drawn to the appropriate value ranges. Chlorination process is applied to treated waters for microbiological control. Hypochlorite ions are capable of oxidation and degradation. Hypochlorite concentration during water treatment is easier to control than

ozonation. Chlorine must be removed at the last stage of water treatment. In waters with high organic carbon content, if chlorination is done, trihalomethane may occur. Trihalomethane compounds have a toxic effect. Residual legal limit values due to disinfection; Free chlorine: 0.5 ppm, ozone: 50 ppm, bromat; 3 ppm, bromoform: 1 ppm.

Results: Disinfection of drinking water is important for controlling the microbiological load. In order to make microbiological control suitable, basic chemical analysis should be done first. Water temperature, pH, Total organic carbon, phenol, humic substance, bromide values should be known. Absorption of ozone into water will become more difficult and risky if temperature and pH are not suitable. Low ozone content may be inadequate in microbiological terms. High levels of ozone can cause the bromate level to rise. Repeated chlorine analysis in the production waters used in the beverage industry is important for reliable food production and should be determined as a critical control point. The ozonation and chlorination process can be monitored online. In addition, periodic chemical analysis can be applied to verify. In order to ensure food safety in water production, filters should be used and their traceability should be checked regularly. Disinfection process is applied for microbiological control and the effects of chemical disinfection should be considered. The effect of disinfectant used after disinfection is also important for food safety.

Cold Plasma Treatment in Decontamination of Poultry Meat and Products and Evaluation in Terms of Food Safety

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Poultry meat, which is the most consumed meat type in many regions of the world, is expected to increase in consumption in the coming decades due to affordable prices, high nutritional quality and unlimited cultural and religious restrictions in the consumption of these products. It is known that it has a great importance in increasing the nutritional quality of the society with its high nutritional value, sufficient amount of essential amino acids and high protein quality. Poultry meat, which has been at an important point in human nutrition from past to present with its satiety and taste, has fresh storage and consumption restrictions in terms of food safety. Poultry products are foods with limited shelf life due to their sensitivity to enzymatic and microbiological spoilage. The risk of contamination is high at different stages of the production and supply chain, which includes process, storage and distribution. If proper processing and storage conditions are not provided, it may cause quality losses and/or food spoilage, and therefore food-borne diseases. The shelf life of these products can be increased by various preservation methods such as low or high temperature applications, reducing the water content and using chemical preservatives.

Considering the consumer demands where high quality, microbial safety, tasty ecological products are expected, researchers have focused more on alternative decontamination methods such as non-thermal Technologies. The use of ionized gas, known as plasma, is emerging as a non-thermal sterilization technology. Cold plasma is a fast, effective non-thermal technology for food applications that has many of the typical properties required by the industry, especially with the decontamination effect, to ensure food safety. The rapid microbiological inactivation obtained with cold plasma increases the interest in this subject day by day. Decontamination of poultry products is one of the most common applications with cold plasma. In this context, researchers draw attention to potential applications of cold plasma as a promising technique to increase the profitability of poultry and the safety of poultry products. Most studies have shown the successful application of cold plasma for the

decontamination of poultry meat and products. With the ongoing rapid developments in plasma science, it is predicted that it can be used in the near future by replacing traditional decontamination technologies in this industry.

This study aims to review studies on decontamination of poultry and their products using cold plasma technology, along with a summary of the mechanisms involved. In addition, by discussing the effects of cold plasma on the quality of poultry meat products, it is aimed to evaluate the applications of plasma technology in the sector, industrial limitations and food safety.