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Editorial

Natural Strategies to Improve Quality in Food Protection

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In a world of climatic and social challenges and related changing eating habits, the health and environmental consequences of the persevered use of synthetic chemicals and overprocessed foods are triggering radical changes in the way we approach food protection. Therefore, new food processing methods based on natural products could represent an alternative way to guarantee both food security and safety while preserving health and environment. Postharvest losses are mainly caused by microorganisms and arthropod pests; however, the wide use of synthetic chemicals is being limited by an increasing public concern regarding residues in food and by the development resistance to pesticides. Also, extensive use of preservatives and overprocessing methods are often required to extend the shelf life of processed food, negatively impacting on nutritional quality.

Plant secondary metabolites represent an invaluable source of molecules with antimicrobial activity against a wide range of bacteria, yeasts, molds, and viruses. Indeed, the antimicrobial effect exhibited by many herbs and spices extracts is due to their phytochemical constituents [1]. The concentration of these bioactive compounds is usually variable depending on plant variety, seasonal factors, and geographical factors, but biotic and abiotic stresses may increase the concentration of the secondary metabolites that plants produce as defense factors. Among these phytochemicals, polyphenolic extracts and essential oils are the most studied and used antimicrobials in food and are often applied as antioxidants and flavor- and color-enhancing agents [2, 3]. The development of nano- and microstructures able to stabilize and/or deliver bioactive compounds of natural origin has recently attracted the attention of researchers and industry. Since phytochemicals are degraded during processing and storage and they are often characterized by a strong odor, these new encapsulation techniques are useful to stabilize and deliver bioactive compounds, micronutrients, fibers, prebiotics, and probiotics in food and to mask undesired flavors [4]. These approaches can also help replace the traditional processes with new mild and ecofriendly techniques. Heat treatments, for example, can reduce the bioactivity of phytochemical compounds; even though in some cases, this process induces the formation of novel compounds with increased antioxidant potential [1, 5].

The use of natural products in food protection against arthropods is attracting particular interest, thanks to a combination of efficiency in pest control with a reduction of typical issues associated to chemical pesticides [6, 7]. The natural availability of these products can have economic benefits especially in developing countries [8, 9]. Although an increasing number of laboratory studies is accounting for their efficacy, the published evidence on the real implementation of natural products in pest management programs is somewhat thin, especially outside of R&D projects [10]. Although the biopesticide market is quickly increasing, according to Chandler et al. [11], it needs a major boost in order to override the prevalence of synthetic chemical pesticides. However, as pointed out by the same authors, investments in this direction can be constrained by failure in reducing fixed costs, farmers' risk aversion to unknown products, integration costs into current pest management programs, and lack of profit from a niche market. Indeed,

companies have to go through a strict procedure to be able to commercialize pesticides based on natural products, which has a cost. Furthermore, the authorization process is conceived for conventional synthetic pesticides, with regulatory barriers that can severely hinder, or even prevent, products to enter the market.

The current special issue addresses research and review articles related to new developments on the use of natural extracts or natural compounds to improve food quality, safety, and security.

The possibility of using different doses of cornelian cherry juice as a functional additive in the production of beef burgers was investigated in this special issue by A. M. Salejda et al. The cornelian cherry juice effectively reduced lipid oxidation and allowed maintaining the sensory characteristics of the beef products. This indicates the feasibility of using the active compounds of cornelian cherry juice (iridoids and polyphenols) to prolong the shelf-life of meat products and, at the same time, to offer novel nutraceutical products. The obtained results can be applied in the meat industry to develop novel products.

Another study demonstrates that extracts from different herbs, which are specific to spontaneous flora in Romania, can be incorporated successfully into a fermented dairy product, in particular into yoghurt. A. Dabija et al. examined the effects of aqueous extracts prepared from four herbs (thistle, hawthorn, sage, and marjoram) on the yoghurt's qualitative characteristics. The results showed that the physicochemical and rheological properties of the yoghurt with herbs extracts addition were improved compared to the control sample after 28 days of storage. Marjoram extract exhibited the best antioxidant properties and nutritional values, while the thistle extract showed the best physicochemical and rheological properties. Since yoghurt is a source of bioactive peptides, these obtained results certainly encourage the production of yogurts fortified with natural antioxidants from natural sources.

In another study about fermented milkless beverages, U. T. Jasińska et al. focused on probiotics immobilization to prolong their survival, a current challenge for food industries. The immobilization of probiotic bacteria in alginate, or low-methoxylated pectin hydrogel particles, significantly increased the survival rate of these strains in fermented milkless beverages compared with free bacteria cells. The authors also evaluated the impact of the immobilizing method on the sensory properties of the beverages. The results confirmed that the supplementation of fermented beverages with microencapsulated bacteria does not affect the overall sensory quality of beverages during the storage period.

Another approach to improve food quality is based on mathematical and statistical methods, which can help to optimize processes and workflows or to help in estimating risk levels. R. H. Abiyev et al. constructed a Z-number-based fuzzy system to predict the food security risk level using data about cereal production in Turkey, demonstrating the applicability of the designed system in real life.

Since the use of insecticidal molecules extracted from plants is attracting considerable interest from both researchers and consumers, O. Campolo et al. focused on reviewing the literature about the use of plant essential oils (EOs) in stored products protection carried out in last 15 years. Although the efficacy of EOs as repellents and/or insecticides has been already recognized, this is the first critical review on their use in foodstuff protection, a challenging sector where pest control techniques are quite limited. The authors presented the major findings about the insecticidal activity and the impact on insect life-history traits (e.g., fertility and fecundity) of EOs on stored products' pests. Furthermore, the authors reviewed the available information about their putative modes of action, suggesting that EO-based insecticides may act on insect-specific metabolic pathways, different from those of vertebrates, making them safe towards nontarget organisms.

The studies reported in the present issue offer the opportunity to deepen the possibilities of using natural extracts to improve quality in food protection. Moreover, the use of mathematical models can further help companies and researchers to raise the level of food quality and safety. We are assisting to increase efforts in testing the efficacy of natural products in food protection. Researchers are improving formulates and their integration into production chains, while policy-makers are putting efforts to ease their regulation, with the joint aim to help the transition from conventional approaches. Therefore, now it is time to climb through the looking glass, search beyond the lab bench, and to push our research efforts into real-world situations boosting the transition from conventional strategies to a more environmental-friendly food protection.

Conflicts of Interest

The Lead Guest Editor and the other Guest Editors do not have any possible conflicts of interest or private agreements with companies.

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