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Editorial

Special Issue: State-of-Art of Microbial Concerns in Food Safety

Ramona Iseppi and Patrizia Messi *

Department of Life Sciences, University of Modena and Reggio Emilia, Via G. Campi 287, 41125 Modena, Italy; ramona.iseppi@unimore.it

* Correspondence: patrizia.messi@unimore.it

The microbiological quality of food remains an essential factor for industrial production and for consumers, as foodborne illnesses are still a widespread health and economic problem.

The biology of most foodborne pathogens is well-known; however, all of the mechanisms that allow them to adapt and survive in different environmental conditions are not yet fully understood. Foodborne pathogens can enter the manufacturing process and reach the final product through raw materials, water, air in the manufacturing area, process surfaces, factory personnel, and processing and packaging equipment. The prevention and inhibition of microbial growth in foods is of utmost importance for the current globalized food production.

Foodborne illnesses are caused by most food groups, such as eggs, meat, poultry, fish, dairy products, fruits, and vegetables. Many of these foods are characterized by a diversified microbial community responsible for fermentation processes.

Ventricina del Vastese is a traditional dry fermented sausage from central Italy not yet characterized for the presence, identity, and safety of coagulase-negative staphylococci (CNS), a technologically important bacterial group for this type of product. Dry fermented sausages are made from raw meat that is fermented and matured by a composite microbiota. The microbial groups with the most relevant roles in the ripening process are lactic acid bacteria (LAB) and coagulase-negative staphylococci (CNS), which combine to make these products safe and tasty. The main role of the LAB is the acidification of the product to different extents, depending on the technological process, with inhibition of the most pathogenic and deteriorating microorganisms, while the most relevant role of the CNS is to favor the development of the optimal red color, flavors, and aromatic compounds, all elements characterizing this product.

With respect to local productions, study [1] shows how the characterization of the dominant microbiological consortia is necessary in order to know the bacterial species and the strains involved in the transformation of the product and for a selection of traits that are the most technologically suitable and free of risk to be used as native starter cultures for the improvement of product quality and safety.

Russo et al. [2] reported a preliminary description of the microbial diversity of donkey milk maintained both at room and refrigerated temperature using a metagenomic approach. The results of this study revealed that refrigerated storage reduced the microbial biodiversity of the product, resulting in a decrease of Gram-negative bacteria, and a consequent predominance of *Pseudomonas* spp. The microbial species found in fresh donkey milk could negatively affect the quality of the raw product, posing a moderate safety concern, especially considering the target group of consumers (infants, immunocompromised people, and the elderly).

Cold storage does not prevent the growth of some psychrotrophic bacteria in ready-to-eat (RTE) foods, which include many types of products that do not need to be cooked or reheated before serving. These include sandwiches, popular RTE food that can contain some high-risk ingredients (raw vegetables, eggs, and salad dressings), and whose

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preparation involves manual handling, which increases the number of potential sources of contamination. Many pathogenic and ubiquitous bacteria (*Listeria*, *Staphylococcus*, *Shigella*, *Yersinia* spp.) found in environments such as soil or water can come into contact with these raw or fresh ingredients. Many human pathogens can also be transmitted through bare-hand handling, such as *S. aureus* [3]. Camellini et al. [3] characterized the bacterial load present in RTE sandwiches and found the presence of some pathogens of interest for food safety, such as *Listeria*, *Staphylococcus*, *Enterococcus*, *Yersinia*, *Aeromonas*, and *Acinetobacter* spp. In relation to the virulence characters, this study showed that some strains had hemolytic and gelatinase activity, and even a resistance profile with multiple resistance to antibiotics. Once again, these studies underline the need to increase the level of attention and awareness, following good hygiene practices throughout the food chain, to prevent contamination by pathogens during preparation, handling, and storage. The implementation of good manufacturing practices, the availability of the hazard analysis and critical control points (HACCP) system, and new production and packaging technologies must aim at the elimination and/or reduction of the presence of food pathogens. In addition, reliable microbial assessment techniques must be used to ensure the safety and quality of food products throughout their shelf life. Despite their effectiveness, traditional diagnostic methods take time and, above all, require qualified personnel. Therefore, new reliable and rapid techniques are sought, such as, for example, infrared thermography, which allows immediate temperature measurements and short processing times to obtain a thermal image, non-contact measurements, and food destruction for monitoring in real time. The study by Lipińska et al. [4] showed that infrared thermography can be used as a method for monitoring the growth of *Bacillus subtilis* ATCC 6633 contamination in mortadella. The results obtained demonstrated that the thermal imaging method allows one to distinguish uncontaminated samples from samples contaminated by *B. subtilis*. However, before this method can be commonly used as a routine tool for food quality assessment, several limitations must be overcome, most notably the need to cool or heat the product to increase temperature contrast.

Food preservation becomes essential to guarantee quality and safety. A variety of chemical preservatives are widely used to increase the healthiness and shelf life of food products. In recent years, following the demands of consumers, the food industry has moved towards the use of alternatives that allow them to guarantee the wholesomeness of food, keeping the nutritional values and their organoleptic properties unaltered. Technologies such as Pulsed Electric Field (PEF) treatment, which is capable of inactivating pathogenic and spoilage microorganisms in food, are being extensively researched. Feng et al. [5] evaluated the damaging effects of pulsed electric fields on *Rhizoctonia solani*, which causes rice sheath blight. To date, the main treatment method for rice sheath blight is the application of chemical fungicides, which are effective, but can lead to drug resistance and other negative effects on environmental ecology in the long term. The study showed that PEF was able to destroy the cell membrane and cell wall structure of *R. solani*. This technology, in combination with the substances in use so far, has a good disease prevention performance, which can significantly reduce the amount of chemicals and meet the requirements of healthy food in the protection of rice plants.

Recent research aims to develop products using natural ingredients to ensure the shelf life of processed foods while maintaining their safety, nutritional value, and sensory attributes such as plant extracts and natural antimicrobials produced by microorganisms, such as lactic acid bacteria (LAB). The antimicrobial activity of a plant active extract from garlic (*Allium sativum* L.) and onion (*Allium cepa* L.) against *Listeria monocytogenes* was studied by de Niederhäusern et al. [6] in two meat products. The study highlighted the anti-listeria activity of the two extracts when added during the sausages' manufacturing process and during the shelf life of packed vacuum-cooked ham slices.

An ethanolic extract of propolis was used to inhibit the growth of the mold *Fusarium solani* on the shells of table chicken eggs stored at room temperature for 28 days. The

authors of this study [7] demonstrated that the 10% propolis extract was able to inhibit the growth of *F. solani* on the shells of hen's eggs, thus improving their microbiological safety.

Lactic acid bacteria (LAB) have gained particular interest due to their dynamic characteristics and ability to produce bacteriocins. Among the different probiotic strains, some of them can produce bacteriocins that exert antimicrobial properties against pathogenic microorganisms. The ability of probiotics to produce bacteriocin, together with their other antagonistic/antimicrobial properties, has made them promising candidates as natural food biopreservatives. Biopreservation aims to use non-pathogenic microorganisms or their metabolites to increase shelf life and improve food safety via the inhibition of pathogenic and/or spoilage microorganisms that can contaminate foods. However, minimizing microbial contamination during processing, storage, and distribution remains critical to ensure food safety [8].

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