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Editorial

Innovations in Sourdough Bread Making

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Abstract: The application of sourdough is considered to be a key tool for the production of high-quality bread. Several advantages have been presented through the application of sourdough in bread making, such as increased shelf life, improved aromatic profiles and sensory characteristics, increased nutritional value, and health benefits. Technological benefits have also been recorded, such as the successful application of sourdough in gluten-free breads. Likewise, an upsurge of interest in sourdough applications in bread making as well as in other foodstuffs (pasta) has been witnessed in recent years. Many factors are considered important for sourdough preparations; however, the proper selection of the starter cultures is considered the most central. This Special Issue of *Fermentation* aims to disseminate recent innovative research regarding sourdough bread making, as well as authoritative reviews that compile information from previously published material.

Keywords: sourdough bread; innovations; volatiles; starter cultures; lactic acid bacteria; fermentation; immobilized cells; gluten-free

Bread is considered to be the most traditional food consumed globally for centuries. A typical bread recipe consists mainly of cereal flour (e.g., wheat or rye), water, sometimes salt and a leavening agent, responsible for CO_2 release and, subsequently, dough development. Generally, three categories of leavening agents are applied: chemicals, baker's yeast and sourdough. The first two types have already been commercialized and produced at industrial levels, while the industrialization of sourdough is starting to grow. The implementation of sourdough methods is an important trend in bread production seen during the last 20 years, mainly due to consumers' demands for bread of superior quality, free of chemical additives and free of gluten [1,2]. The main advantages of sourdough application can be summarized as (i) lower bread deterioration rates (delay in staling), (ii) higher endurance against mold and rope spoilage, (iii) the satisfaction of consumer demands for safer products with reduced chemical preservatives, (iv) enhanced nutritional properties, (iv) a lower glycemic index (GI) for bread and reducing starch digestibility, and (vi) improved flavor and texture and more appealing organoleptic properties compared to yeasted breads. In addition, biotechnological applications in sourdough bread making can offer health benefits. The last is an important claim that meets the consumers' contemporary demands and is in agreement with the new trend in the food industry represented by functional foods.

Likewise, the increasing popularity of sourdough bread consumption with multiple health benefits is provoking the development of the sourdough market. The feasibility of innovative processing in sourdough bread production is driven by the constantly growing awareness of consumers and demands for enhanced nutritional value. However, sourdough is not spread and broadly commercialized in the majority of countries worldwide today, where artisan bread is preferred and produced. This shows the need to proliferate sourdough industries throughout the world. Subsequently, the expansion of consumers' demand for fermented sourdough bread has shifted the global market to industrial standardization, such as the usage of defined starter cultures that will prevail inside the typical sourdough microflora, leading to specific features [3]. Microflora are strongly affected by

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flour composition (carbohydrates, proteins, minerals, lipids and enzyme activities), and various process parameters such as the temperature, fermentation time and number of sourdough propagation steps [4–6]. All these make sourdough production a complex procedure that needs control. Traditional sourdough bread produced by spontaneous fermentation is costly, unstable and time consuming [7]. Today, the food industry seems to prefer defined starter cultures, in order to stabilize and facilitate the procedure. Likewise, the proper selection of the starter culture is critical. Many microorganisms have been utilized in sourdough production, most of them belonging to LAB. LAB have a positive influence on texture, flavor, nutritional attributes and chemical and microbiological spoilage, due to various metabolites provided to the dough, such as enzymes, organic acids, exopolysaccharides and even antimicrobial compounds [8,9]. All these metabolites offer many advantages in the bread. Proteolytic systems of LAB (proteinase and peptidase activities) can enhance the free amino acid concentration during sourdough fermentation. These biochemical procedures lead to improvements in volatile composition since many free amino acids are considered to be precursor compounds for certain volatile compounds [10]. In addition, the actions of phytases posed by LAB increase the degradation of phytic acid and therefore increase the mineral, amino acid and protein bioavailability of sourdough [11]. Exopolysaccharides contribute to the viscoelastic properties of dough, leading to increased loaf volume and to lower crumb hardiness [12]. The enhanced production of various organic acids such as lactic and acetic acid contributes to an increase in the shelf-life and hygienic safety of bread [5].

In addition, various techniques such as immobilization, spray drying and freeze drying are being implemented today, in order to ameliorate the shelf-life of sourdough and accommodate its use by the commercial sector [13].

This Special Issue is devoted to the development of innovative and emerging processing methods in sourdough bread making. The application of functional novel starter culture compounds in sourdough bread making, the potential health benefits offered through sourdough bread consumption, and the development of novel biotechnological methods such as dehydrated sourdough constitute subject areas that need to be addressed.

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