8  Sourdough breads and related products

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8.1  Introduction

Grinding of cereals and addition of water results in the formation of a dough which, after some time, will turn into a sourdough characterized by acid taste, aroma and increased volume due to gas formation. This fermentation event may have been one of the first microbial processes employed by man and led to the use of sourdough for breadmaking. Baking of leavened bread can be traced back to Egypt in 1500 BC, and the study of the microbiology of sourdough has a history of nearly 100 years. Not all sourdoughs are subjected to baking. More fluid soured doughs are consumed in various parts of the world. Boza in Turkey and Mageu in Africa are examples of a group of raw foods that had once also a tradition in Europe. For example, in Scotland these were known as sawens or plumpmeries (Fenton, 1974). There are even smooth borderlines to beer-like beverages. These are considered as products of alcoholic fermentation performed by yeasts and require the digestion of the starch by amylases. Without specific technological precautions, however, it will always be, as in sourdough, a lactic acid bacteria (LAB)-yeast association that primarily develops in the cereal-derived substrates. An example is provided by ‘Berliner Weiß’ beer, which is characterized by a deliberate LAB-yeast fermentation and by the strong acid taste of the beer.

The key role of LAB and yeasts in sourdough was recognized by the pioneers in the study of sourdough microbiology such as Holliger (1902), Beccard (1921) and Knudsen (1924). As sourdough is an intermediate but not an end-product, the microbial activities in the dough have to be judged on the basis of their impact on the quality of the baked goods that are produced with its aid. These are characterized by their flavour, nutritional value and texture, i.e. the size and distribution of pores and the elasticity of the crumb. To some extent these characteristics can be achieved without the involvement of LAB by application of yeast and/or chemicals, but the traditional process and various new modifications rely on the metabolic activities of LAB in the sourdough. By one definition (Anon., 1994) sourdough is described as ‘a dough whose microorganisms (e.g. LAB and yeasts) originate from sourdough or a sourdough starter and are metabolically active or can be reactivated. Upon addition of flour and water they continue to produce acid’.
An overwhelming multitude of baked goods are produced with the aid of sourdough. These include above all breads from wheat, rye and mixtures thereof as well as the well-known Italian products such as Panettone, Colomba, Pandoro and different types of brioches. Another sourdough application was described for production of soda crackers (Sugihara, 1985). Taking into account that the major part of rye bread and a substantial share of that made from wheat (30% in Italy; Ottogalli et al., 1996) is made from sourdough, an impressive role of this fermentation product becomes evident.

### 8.2 Microbial ecology of sourdough

Factors influencing microbial growth and activity in sourdough are shown in Figure 8.1 (Hammes et al., 1997). The effective endogenous parameters are determined by the cereal substrate which contains the carbohydrates, nitrogen (N)-sources, vitamins and minerals. The fermentable carbohydrates

![Diagram of Microbial ecology of sourdough](image)

**Figure 8.1** Factors affecting growth and metabolic activity of the sourdough microflora and the quality of sourdough bread. (Modified according to Hammes & Vogel, 1997.)