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# Evaluation of Sourdough Effect on Microbiological Shelf Life and Sensory Properties of Iranian Barbari Bread

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**Abstract:** The aims of this research were to apply the sourdough LAB containing specific starter cultures for Barbari bread production and evaluation it's microbiological shelf life and sensory properties. The effects of fermentation times (8, 16 and 24 h), fermentation temperatures (28, 32 and 36°C) and type of starter culture (*Lactobacillus sanfransicencis* (ATCC 14917), *Lactobacillus plantarum* (ATCC 43332) and a mixture of both LAB) were analyzed in a completely randomized design with factorial experiment and 4 replications was conducted. Microbiological shelf lives of samples were determined by plating serial dilutions on to plate count agar, at days 1 to 7. Breads sensory properties were determined in 1, 24, 48 and 72 h intervals, after baking according to AOAC standard method. The results showed that, sourdough had significant effect ($p \leq 0.05$) on microbiological shelf life and sensory properties of Barbari bread in comparison with control sample. Moreover the produced sample with *Lactobacillus plantarum* (24 h fermentation time and 32°C fermentation temperature) had the most microbiological shelf life and the sample produced with a mixture of both LAB (16 h fermentation time and 28°C fermentation temperature) had the best sensory evaluation, 72 h after baking.

**Key words:** Biological system, lactic acid bacteria, fermentation, starter culture, sourdough baking

The use of sourdough process as a form of leavening is one of the oldest biotechnological processes in food production and have been used for thousands of years for improve flavour, texture and microbiological shelf life of bread. Sourdough is a very complex biological system and an important modern fermentation method of cereal flours and water. Today, sourdough baking is an alternative to the use of additives (Katina, 2005; Thiele, 2003). A common trend of sourdough fermentations is the unique symbiosis of certain hetero and homo-fermentative lactic acid bacteria with certain yeasts and depending on the composition of microflora and fermentation conditions (Gül *et al*., 2005; Katina, 2005; Simsek *et al*., 2006). These factors do not act separately but in an interactive way, adding to the complexity of the system. Most of the beneficial properties attributed to sourdough are determined by the acidification activity of lactic acid bacteria (Katina *et al*., 2006). The aims of this research were to apply the sourdough LAB containing specific starter cultures for Iranian Barbari bread (traditional wheat bread) production and evaluation it's microbiological shelf life and sensory properties.

Characteristics of the wheat flour used in this research were: extraction rate, 86.5%; moisture, 13%; protein, 12.5%; fat, 1.72%; ash, 0.75% of dry matter and falling number, 460 s (based on AOAC and AACC standard methods). In this study, two strains of LAB were used. These starters were *Lactobacillus sanfransicencis* (ATCC 14917) and *Lactobacillus plantarum* (ATCC 43332). After activation of these starters, the biomass from actively growing lactic acid bacteria culture was collected with centrifugation (5000 g, 15 min and 4°C) and resuspended in sterile tap water that was immediately mixed with wheat flour until dough formation (Dal Bello *et al*., 2007; Katina, 2005). Fresh cells were added to sourdough at a level of $10^8$ cfu $mL^{-1}$ (Mac Farland method). For sourdough preparation, equivalent 1.5% from this cell suspension and 0.25% active dry yeast extract, containing *Saccharomyces cerevisiae* of flour (w/w) with the same amounts of wheat flour and tap water were mixed. Wheat sourdough was prepared with the mentioned strains either as single starters, or in combination (same amount). The mixture was allowed to ferment at three different fermentation temperatures (28, 32 and 36°C) and three different fermentation times

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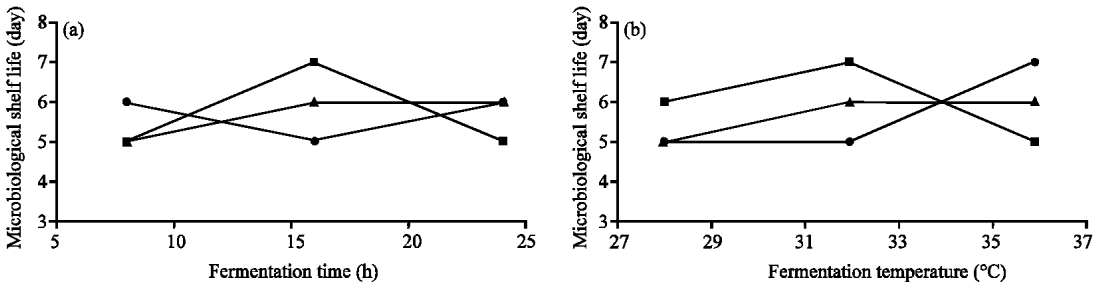


Fig. 1: Evaluation of fermentation time (a) and temperature (b) effects on microbiological shelf life of samples (●) *L. plantarum*, (■) mixture of LAB and (▲) *L. sanfransicencis*

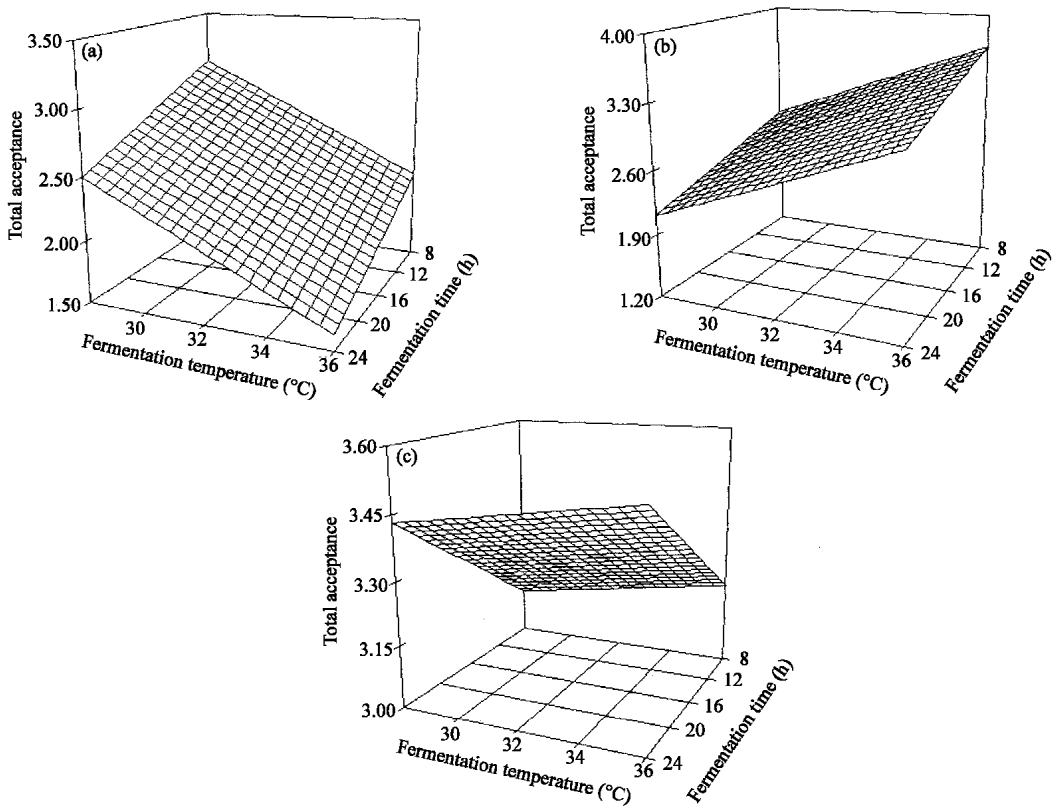


Fig. 2: Influence of fermentation time and temperature on total acceptance of samples, fermented with *L. plantarum* (a), mixture of LAB (b) and *L. sanfransicencis* (c)

(8, 16 and 24 h) without agitation (Katina *et al*., 2006; Thiele, 2003). In order to bread production an amount of 0.4% NaCl and 0.5% (w/w) active dry yeast extract, containing *Saccharomyces cerevisiae* (commercial bread leavening) and 25% (w/w) sourdough samples were added to each 100 g flour and mixed at 60 rpm for 20-25 min. The amount of water was adjusted according to the water absorption (60%) determined by farinography. The dough was left for bulk fermentation for 30 min at 30±1°C and 75% relative humidity. At the end of the fermentation time, the moulded dough pieces were proofed for 90 min at 30±1°C and 85% relative humidity, then baked at 220±5°C for 15-16 min in an oven and cooled in aseptic conditions for 30 min. The control for the sourdough bread samples was wheat bread without sourdough (Dal Bello *et al*., 2007; Gül *et al*., 2005; Katina, 2005).

Microbiological shelf lives of samples were determined by plating serial dilutions on to plate count agar, at days 1 to 7 (Katina *et al*., 2002; Mentes *et al*., 2007). The control sample, non-fermented with

sourdough, had the lowest microbiological shelf life and more of other treatments, significantly improved ($p \leq 0:05$) microbiological shelf life in comparison with control sample (Fig. 1). The produced sample with *Lactobacillus plantarum* (24 h fermentation time and 32°C fermentation temperature) had the maximum microbiological shelf life. Other researchers (Katina *et al*., 2002; Mentes *et al*., 2007) reported the same results. A selection of starters with antimicrobial potential will intensify the role of sourdough in preventing fungi and rope spoilages, as the combination of acids and other antimicrobial metabolites is effective also in wheat sourdough bread (Katina *et al*., 2002). Breads sensory properties were determined in 1, 24, 48 and 72 h after baking according to AOAC standard method (Gül *et al*., 2005; Katina *et al*., 2006). The sourdough prepared with *Lactobacillus plantarum* (24 h fermentation time and 36°C fermentation temperature) had the most effect in improving sensory properties, 1 h after baking (Fig. 2). Moreover the sample produced with a mixture of both LAB (16 h fermentation time and 28°C fermentation temperature) had the best sensory evaluation, 72 h after baking. Use of sourdough has been reported to improve bread sensory properties (Katina *et al*., 2006). Controlled acidity level of wheat sourdough and subsequent bread is premise for improved sensory properties.

In this study, significant effect of sourdough process conditions on Iranian Barbari bread microbiological shelf life and sensory properties was clarified.

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