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Investigation of Gluten Free Bread' properties Using Lactic Acid Corn sourdough

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ABSTRACT: Celiac disease (CD) is a syndrome characterized by damage of the small intestinal mucosa caused by the gliadin fraction of wheat gluten and similar alcohol-soluble proteins (prolamines) of barley and rye in genetically susceptible subjects. Aims of our study were investigation of gluten free bread' properties using lactic acid corn sourdough. At this study, two factors were investigated, first factor included *Lactobacillus plantarum* and *Lactobacillus fermentum*. Also, the percentage change in the composition of sourdough bread was considered as the second variable. *Lactobacillus plantarum* (DSMZ, strain ATCC 20179) and *Lactobacillus fermentum* (DSMZ strain ATCC 9338) were prepared as a lyophilized from Microbiology Laboratory of Food Science and Technology Department of Tehran University. This study showed that the using of sourdough bread can improve quality and also to delay the staling process. Use higher values for corn and rice can perfectly increase the quality of bread and decrease staling of bread. Lactic acid bacteria in sourdough produce organic acids antimicrobial materials and they are effective in delaying moldy bread. As a result, by using of sourdough amount of bread waste can be reduced because these wastes produce by corruption.

***Keywords*:** celiac bread, lactic sourdough staling, shelf life.

INTRODUCTION

Celiac disease (CD) is a syndrome characterized by damage of the small intestinal mucosa caused by the gliadin fraction of wheat gluten and similar alcohol-soluble proteins (prolamines) of barley and rye in genetically susceptible subjects (Fasano and Catassi, 2001). Sourdough has been used since ancient times and its ability to improve the quality and increase the shelf-life of bread has been widely described. During sourdough fermentation, lactic acid bacteria (LAB) produce a number of metabolites which have been shown to have a positive effect on the texture and staling of bread, e.g (Arendt et al., 2007). The use of sourdough has been established as a very important process to modern baking technology, due to the superior quality and prolonged shelf-life of the sourdough baking products (Ganzle, Ehmann, & Hammes, 1998). The advantages of sourdough over yeasted breads can be highlighted by its influence on the following features: (i) technological properties including improved dough machinability, (ii) nutritional properties, like phytate hydrolysis, (iii) organoleptic properties such as improved bread volume, crumb texture and unique flavour and (iv) extended shelf-life (De Vuyst & Neysens, 2005). Katina et al., 2005 have stated that sourdough fermentation can modify the healthiness of cereals in a number of ways, including improvement of texture and palatability of whole grain products, enrichment in fibre or reduction of gluten, stabilisation or increase of various bioactive compounds, improvement of mineral bioavailability, etc. Plessas et al, (2008) evaluated application of *Kluyveromyces marxianus*, *Lactobacillus delbrueckii* ssp. bulgaricus and *L. helveticus* for sourdough bread making. The amount of starter culture added to the flour, the dough fermentation temperature and the amount of sourdough used were examined in order to optimise the bread making process. The use of mixed cultures led to higher total titratable acidities and lactic acid concentrations compared to traditionally made breads. Highest acidity (3.41 g lactic acid/kg of bread) and highest resistance to mould spoilage were observed when bread was made using 50% sourdough containing 1% K. marxianus and 4% L. delbrueckii ssp. Bulgaricus. Gallagher et al, (2003) evaluated some characteristics of gluten free breads, gluten free breads was supplemented with seven dairy powders,

Increasing the inclusion levels of the powders decreased loaf volume and Powder addition generally decreased the crumb L*/b* (white/yellow) ratio. The aim of this study was investigation of gluten free bread' properties by using lactic acid corn sourdough.

MATERIALS AND METHODS

At this study, two factors were investigated, first factor included *Lactobacillus plantarum* and *Lactobacillus fermentum*. Also, the percentage change in the composition of sourdough bread was considered as the second variable (Table 1). *Lactobacillus plantarum* (DSMZ, strain ATCC 20179) and *Lactobacillus fermentum* (DSMZ strain ATCC 9338) were prepared as a lyophilized from Microbiology Laboratory of Food Science and Technology Department of Tehran University.

Table 1. List of Treatments

A_1	Plantarum 10%	D1	Maize Fermentum 5%
A2	Plantarum 5%	D2	Rice Plantarum 5%
B2	Maize Fermentum 10%	G	Maize and Rice Blank
B3	Fermentum 10%	E	Maize Blank
C1	Rice Plantarum 10%	F	Rice Blank
C2	Fermentum 50%		

RESULTS AND DISCUSSION

Changes in pH levels in sourdough**:** pH levels were between 2. 5-3.8 ranges and pH of controls were 4.2 and 4.6. pH of sourdough inoculated with Lactobacillus plantarum (rice plantarum) were significantly higher than *Lactobacillus fermentum* (50:50 fermentum and corn fermentum) and *Lactobacillus plantarum* (plantarum 50:50). And *Lactobacillus plantarum* (50:50 plantarum) were more efficacious in reduction of pH. And pH of control samples were low because they had not strains of lactic highest.

Changes in pH levels in samples of bread: pH of bread with sourdough that it inoculated with *Lactobacillus plantarum* (plantarum 5%) was significantly higher than *Lactobacillus fermentum* (fermentum corn 5% and fermentum 5%, fermentum corn 10% and fermentum 10%) and Lactobacillus fermentum (plantarum rice 10% and 5% plantarum and Lactobacillus plantarum 10), respectively. *Lactobacillus plantarum* (plantarum 10%) has done better than others in lowering pH and lack of samples without sourdough had the highest pH.

Changes in TTA levels in samples of bread: TTA levels were between 0.65-0.8 ranges. The acidity of the sourdough bread samples inoculated with *Lactobacillus plantarum* (plantarum rice 5%) and *Lactobacillus fermentum* (fermentum 5%) significantly more than the *Lactobacillus plantarum* (plantarum 10%) and *Lactobacillus fermentum* (fermentum corn 10%), respectively. PH value decreased with increasing sourdough and correspondingly increased the TTA.

Changes in moisture levels in samples of bread: Moisture levels were between 32-42% ranges. Moisture bread with sourdough inoculated with *Lactobacillus plantarum* (plantarum 10%) and *Lactobacillus fermentum* (fermentum 10%) significantly more than the *Lactobacillus plantarum* (plantarum 5%, plantarum rice 10%) and *Lactobacillus fermentum* (fermentum 5% and 10% fermentum and *Lactobacillus plantarum* rice, corn 10%), respectively. This study showed that the use of sourdough bread can improve quality and also to delay the staling process. Also moor et al., (2007) reported that sourdough improves the delay in staling of GF bread, although the positive effects were smaller than those found in wheat bread. Our result was in order of result of Corsetti et al., (1998). Use higher values for corn and rice can perfectly increase the quality of bread and decrease staling of bread. Lactic acid bacteria in sourdough produce organic acids antimicrobial materials (Gerez et al., 2009) and they are effective in delaying moldy bread. As a result, by using of sourdough amount of bread waste can be reduced because these wastes produce by corruption.

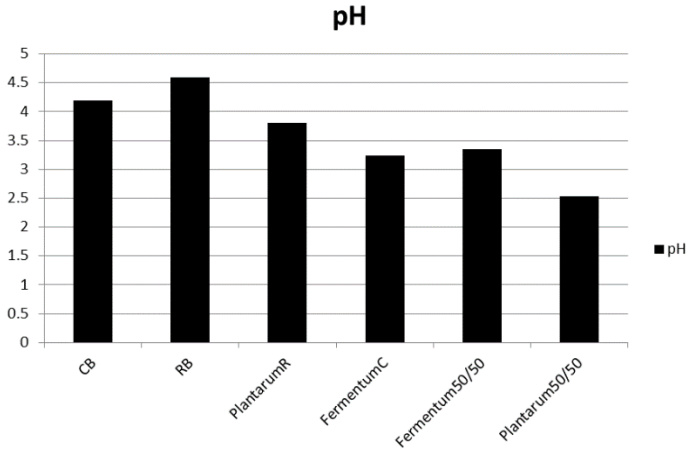

Figure 1. pH levels in sourdough

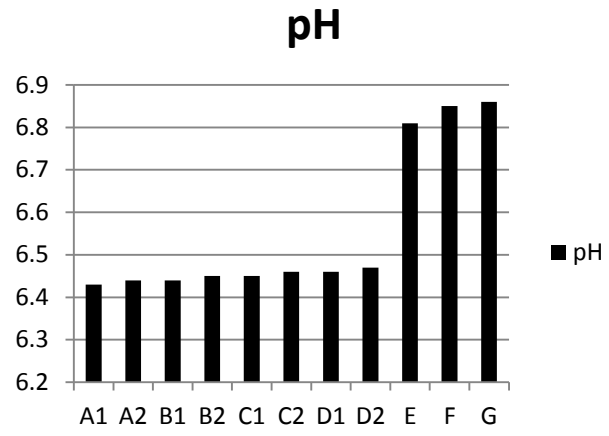

Figure 2. pH levels in samples of bread

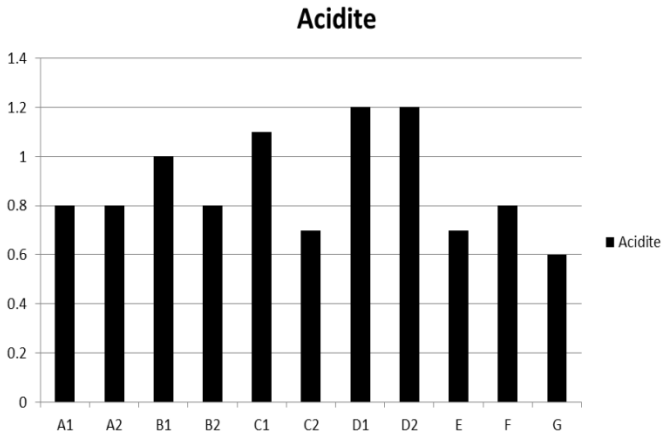

Figure 3. TTA levels in samples of bread

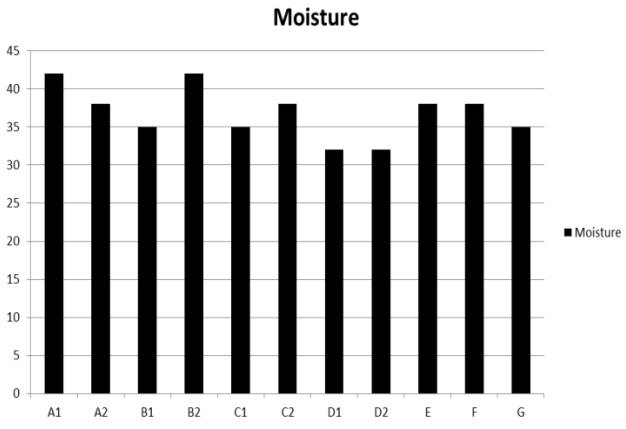

Figure 4. moisture levels in samples of bread

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