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The properties of part baked frozen bread with guar and xanthan gums

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ABSTRACT

Barbari bread is a traditional Iranian flat bread. In this study the effect of hydrocolloids such as guar and xanthan gums and their combination with amylase and lipase on improving the quality of part baked frozen bread was investigated. Fresh bread sample also baked to compare, with part baked frozen one. Regarding the fresh bread, the guar gum increased the volume, porosity and color, reduced the firmness of bread in comparison with control sample and xanthan gums. The overall result showed the guar gum had better effect when combination whit enzymes (amylase and lipase).

1. Introduction

Barbari bread is a traditional Iranian flat bread. This bread is made from mixture of wheat flour, salt, sugar and yeast or sour-dough then fermentation, shaping and baking. The Barbari is elongated oval bread and is thicker than other Iranian flat breads. Today, researchers introduced new technology to produce bread with higher quality, longer shelf life and high nutritional value, such as modified atmosphere packaging, frozen technology and using different additives (Bhattacharya, Langstaff, & Berzonsky, 2003; Lacsonin & Davos, 2000; Lorenzo, Zaritzky, & Califano, 2009).

Production of the part baked frozen bread is a method which interrupted baking process, the first stage is the crumb formation and the crust color is not developed. The bread can be stored at frozen temperatures for extending the shelf life during long periods of time. Full baked bread can be easily completed at consumption point (Bárcenas, Benedito, & Rosell, 2004; Bárcenas, & Rosell, 2007; Le-Bail, Leray, Perronnet, & Roelens, 2011; Vulicevic, Abdel-Alal, & Lu, 2004). However the freezing–thawing cycles produce dramatic effects on the bread properties (Bárcenas et al., 2004; Matuda, Chevallier, Filho, LeBail, & Tadini, 2008). An alternative way to minimize the negative effects of frozen storage is using different types of bread improvers such as emulsifiers, hydrocolloids and enzymes (Bárcenas, & Rosell, 2007; Gomes-Ruffi, Cunha, Almeida, Chang, & Steel, 2012; Haros, Rosell, & Benedito, 2003; Matuda et al., 2008).

The gums were successfully used in bread production process to water retention and controlling moisture mobility, the gas retention of dough, acting as texture improvers and retarding the staling (Guarda, Rosell, Benedito, & Galotto, 2004; Mandala, Kapetanakou, & Kostaropoulos, 2008; Rosell, Benedito, & Bárcenas, 2004). Adding Types of hydrocolloid to part baked frozen bread depend on their individual function properties (solubility, rheological properties, synergistic effect with other ingredients, etc.) (Mandala et al.,

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2008).

The enzymes are using in different stage of baking because there are effective on reduced firmness of crumb, delay staling of baking, improve dough-handling properties and enhance bread quality (Gray & Bemlire, 2003). Enzymes involve natural ingredients, and don't remain in final product has substantial compliance among consumption. Lipase modified the main polar lipids by create more polar lipids in the bread dough (Poulsen, SØ, Rasmussen, Madrid, & Zargahi, 1998), that better dough stability and specific volume are obtained due to the increase in polarity and the surface activity of the lipids. The addition of α-amylase, has anti-staling effect, improves the elasticity of bread crumb and increased loaf volume of bread (Almeida, Chang, & Joy Steel, 2013; Poulsen et al., 1998).

The aim of this study was investigated the effect of xanthan and guar gums and their combination with α-amylase and lipase enzymes on improving quality of fresh and part baked frozen Barbari bread.

2. Materials & methods

2.1. Materials

Wheat flour sample (cvs, Pishgam) with 10.52% moisture, 10.8% proteins 0.79% ash, 26.7% wet gluten, following AACC. (2000) was obtained from silo No.3, Mashhad, Iran. Bread recipes also contained active dry yeast (Razavi Co., Mashhad, Iran), vegetable oil Ladan Co. Behshahr, Iran), salt and sugar (Local market). Lipase enzyme (25 klu/g) and α-amylase (2500 FAU/g) supplied by Novozyme CO, and xanthan and guar gums afforded from Rodhia CO. France.

2.2. Methods

2.2.1. Dough and bread preparation

The bread formula used for Barbari bread consisted of flour (100 parts), compressed yeast (2 parts), salts (2 parts) and sugars (1parts), vegetable oil (1 part) water (based on water absorption at 500 BU) (Cereal Research Centre). The amount of gums replaced in bread formulation showed in Table 1. Guar and xanthan gums at two levels (0.4 and 0.8), amylase and lipase at optimal levels (0.07 amylase and 0.05 lipase based on flour), according to previous study of Hejrani, Sheikholeslami, Mortazavi, and Ghiyafe Davoodi (2014), the optimal level were added to dough, to investigated the synergistic effect of them with gums. The amount of gums and enzymes replaced in bread formulation showed in Table 1.

All ingredients were added and, mixed following with adding water, dough was mixed in a spiral mixer (Escher, Italy), for 8 min, and after resting for 30 min; it was divided into 250 g pieces and rounded mechanically modeled. The bread was part baked in an electric oven with an incorporated proofing chamber (Zuccihelli, forni, Hal, Italy) at 210 °C for 7 min to obtained texture structure before starting coloring reaction. PBF Barbari bread sample were packaged in polyethylene bags and frozen in a blast freezer. After storage at −18 °C for 15 day, PBF bread was thawed at room temperature for 10 min and rebaked at 260 °C for 8 min. The fresh bread baked at 230 °C for 15 mine (Bárcenas & Rosell, 2007). Physical and textural analyses were carried out 2 h after final baking.

Table 1
Different gums and enzymes replaced in bread.

Samples	Ingredients (% based on flour)			
	Xanthan	Guar	α_amylase	Lipase
Control	0	0	0	0
X1	0.4	0	0	0
X2	0.8	0	0	0
G1	0.4	0.4	0	0
G2	0.8	0.8	0	0
X1AL	0.4	0	0.07	0.05
X2AL	0.8	0	0.07	0.05
G1AL	0.4	0.4	0.07	0.05
G2AL	0.8	0.8	0.07	0.05

2.2.2. Bread quality

Some physicochemical parameters of fresh and PBF bread were determined. Moisture content of bread determined according to the AACC Method No:44-15-01 (2000). Bread volume was determined by a rapeseed replacement method (AACC Standard No:10-05, (2000). Specific volume (volume/weight) was calculated. The porosity of bread determined by prepared the 25 mml slices from the middle of crumb bread, get picture by scanner and saved in computer, using image j software and measurement porosity by activation 8byte options and created grayscale images, activated the binary option, the binary images were created, and using the ratio of bright and dark spots as an indicator for estimated bread porosity (Wilderjans, Pareyt, Goesaert, Brijs, & Delcour, 2008).

2.2.3. Texture evaluation

The peak force and the peak deformation point of the crust were measured by punching the sample at three different points: in the middle of the crust area and at the left and right sides and at 1 cm distance from the middle point of Barbari bread. The average value was determined for each specimen. Experiments were performed using texture analyzer (CNS Farnell, Hertfordshire, UK). A cylindrical probe was used with a die of 2.5 cm diameter, the cross speed was 50 mm/min and descended 30 mm (a sufficient distance to pass through the slice of 10 × 10 cm of bread) into the bread at trigger value 0.05 N (Pourfarzad et al., 2009).

2.2.4. Image analysis (L*a*b*)

For image analysis of bread, first of all, slices of 50 × 50 mm were cut from the center of the bread samples using a metal template (Peressini & Sensidoni, 2009). Slice images were captured using a flatbed HP Scanner 48.50 HP Photo Scanner (Hewlett−Packard, Palo−Alto,CA) and saved in JPG format. Using Image J software, 1.40 g square of 500 × 500 pixels was selected from the center of the bread samples and feature analysis was performed in this area. RGB color space was converted in L*a*b* space. L* is the sample index in brightness variable between the zero to 100 (pure black, pure white). A* index showed significant amount of color closed to green and red, b* index closed the blue and yellow, a* and b* ranged between −120 and +120.

2.2.5. Sensory evolution

The sensory evaluation of the fresh and PBF bread was done by 10 trained panellists (Selection of faculty research center, by triangle test) using a hedonic scale of five points for overall acceptability (Gacula & Singh, 1984; Sahraiyan, Naghipour, Mahdi Karimi, & Ghiafe Davoodi, 2013).

2.2.6. Statistical analysis

Results of the study analyzed with complete randomized design of triplicate analyzes. The data tests were statistically analyzed by using SPPS version 17, and the Duncan test using to determined significant difference between samples. A p-value of less than 0.05 was considered significant.

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