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Desenvolvimento de um Pão Biológico

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Resumo

Este trabalho teve como objetivo o desenvolvimento de um pão biológico de trigo com boas características de textura e sensoriais, usando ingredientes biológicos, tal como leveduras biológicas certificadas e sal biológico, variando as quantidades adicionadas à massa. Foram também realizadas várias experiencias para estabelecer o processo tecnológico mais apropriado. O produto otimizado foi caraterizado considerando as suas propriedades físicas e químicas. Este pão apresentou características químicas similares com outros pães de trigo, tendo um valor energético semelhante (232.8 Kcal/ 100g). O parâmetro L é elevado tanto para a côdea como para o miolo, com predominância das tonalidades vermelha e amarela. O pão biológico mostrou elevada elasticidade e uma percentagem elevada de alvéolos (cerca de 25%). A avaliação sensorial global foi de 6.2 numa escala máxima de 10.

Palavras chave: pão biológico; propriedades físico-químicas; análise sensorial; cor; textura.

Development of a Biological Bread

Abstract

The objective of this work was to develop a wheat biological bread with good textural and sensorial characteristics, using biological ingredients, such as usual and certified biological yeasts and biological salt varying the added amounts to the dough. Several experiences were also done to find the most appropriate processing stages until establishing the best operation conditions. The optimized product was characterised considering the chemical and physical properties. This bread presented similar chemical characteristics to other wheat breads, with similar energetic value (232.8 Kcal/100g). The L colour parameter is high both in crust and loaf, with predominance of red and yellow colorations. It showed high elasticity and high alveoli percentage (about 25%). The global sensorial appreciation was 6.2 in a maximum scale of 10.

Keywords: biological bread; physic-chemical properties; sensorial analysis; colour; texture.

Introduction

Bread has always been one of the most popular and appealing food products due to its superior nutritional, sensorial and textural characteristics, ready to eat convenience as well as cost competitiveness. Bread is essential to the diets of many people worldwide.

Bread is essentially made with cereals, of which the most commonly used for being considered the nobler, is wheat (*Triticum genus*, and more specifically *Triticum sativum*). Wheat flour is an excellent source of fibre, particularly insoluble fibre (Bonnand-Ducasse et al., 2010; Leon and Rosell, 2007).

As the artisan baking process extended to the industrial scale, the use of flour enhancing agents has been generalised as a way to improve the process characteristics and shelf life of the products obtained (Gallagher et al., 2003). For decades enzymes have been added to flour in bread production in order to improve the volume, flavour, aroma, structure of the shell and crumb, tenderness and shelf life (Nunes, 2008). Among the various intrinsic properties of bread, volatile flavour compounds play a key role in the perception of fresh bread flavour, which is also determined by the type of bread, ingredients, method of production and shelf life (Giménez et al., 2007; Heenan et al., 2009; Jensen et al., 2011)

Yeasts influence the rheological properties of the dough, making it more elastic and porous, allowing obtaining a more digestible and nutritious bread (Nunes et al., 2006). The type of yeast more frequently used in baking is *Saccharomices cerevisiae* acting on simple sugars, producing carbon dioxide and ethanol (Cauvain and Young, 2006). The alcohol formed is released during the cooking process while the carbon dioxide contributes to the expansion of the bakery products, being therefore essential for their final characteristics, texture and quality (Scanlon and Zghal, 2001).

The ingredients of bread will impart characteristic colours, texture, and nutritional value which may improve the bread quality. Therefore, a proper balance of ingredients needs to be obtained to produce high-quality bread. Concerns about the quality of breads go beyond the ingredients in the loaves themselves. One of the main quality criteria on bread is related with texture, and the development of a desirable volume, related to alveoli formation.

Nowadays, consumers are much more attentive to fresh food and to products from organic farming. According to Council Regulation (EC) No 834/2007, of 28 June, organic processed products should be produced by the use of processing methods which guarantee that the organic integrity and vital qualities of the product are maintained through all stages of the production chain. Furthermore, the processed food should be labelled as organic only where all or almost all the ingredients of agricultural origin are organic. Moreover, for the purpose of consumer information, transparency in the market and to stimulate the use of organic ingredients, it should also be made possible to refer to organic production in the ingredients list under certain conditions.

Thus, the objective of this study was to develop and produce a biological bread with good physic-chemical, textural and sensorial properties.

Material and Methods

The ingredients used for biological bread production was biological wheat flour type 55, biological yeast (Bioreal, Germany), salt and water. Three process steps were achieved: (1) first dough; (2) biological dough; and (3) biological bread. First were done some preliminary tests in order to determine the most appropriate type of yeast and the convenient quantity of salt (Figure 1). After established the process parameters and ingredients, the biological bread was produced with 0.42% of biological yeast and 1.4% of salt.

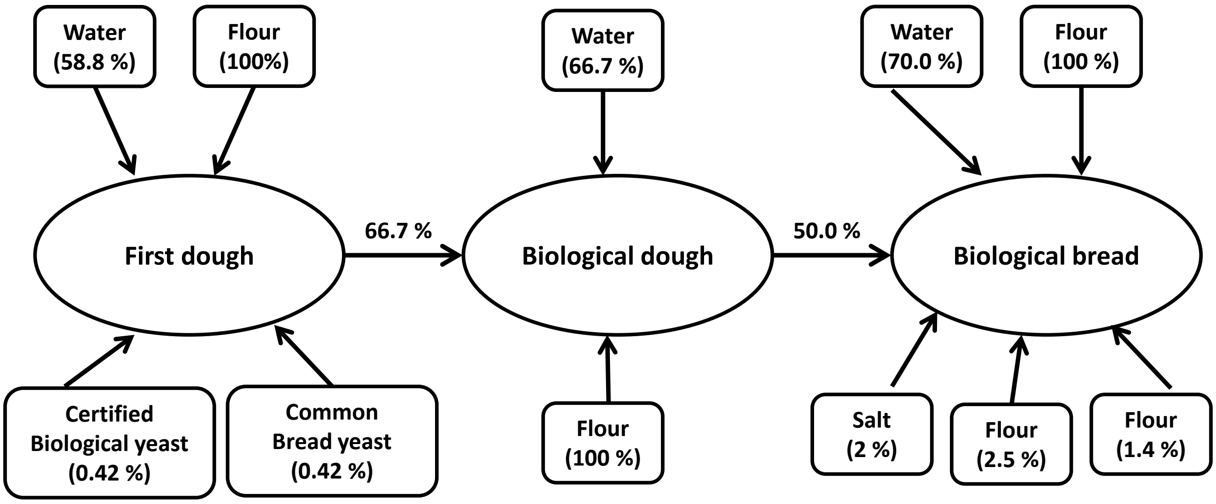

Figure 1. Ingredients quantities to produce biological bread. A- yeast quantity determination; B- salt quantity determination.

Chemical properties were performed, namely moisture content, ash content, crude fat, crude fibre and protein content, using the official methods of AOAC (2000). The carbohydrates content was calculated by difference. Water activity was determined by a Hygrometer AwVc (Rotronic, USA) at a constant temperature of 25 ºC.

To analyse the dimensions and volume of the loaves, the thickness, width and length were measured. For calculating the volume the form was approximated to an ellipsoid. For this determination 3 replicas were made in each bread sample. To determine the density, pieces of bread were carefully cut in the form of parallelepipeds. From each sample were taken 15 cubes with 1 cm edge, which later were weighed on a precision scale. Density was determined as the reason between the measured mass and the calculated volume.

The colour parameters were evaluated using a colorimeter Chroma Meter CR 400 (Konica Minolta, Japan) expressing the results in the CIELab system coordinates: L* which is the brightness and varies between 0 (black) to 100 (white), the a* which ranges from -60 (green) to +60 (red) and b* ranging between -60 (blue) to +60 (yellow). To evaluate colour, 30 measurements were made in each bread, both in the crust and in the crumbs, in a total of 60 measurements per sample. The cylindrical color coordinates were also determined: value, hue (hº) and chroma or saturation (c) according to eq. (1) to (3) (Ribeiro, 2009):

$$Value = \frac{L*}{10} \quad (1)$$

$$H^{o} = \tan^{-1}\left(\frac{b*}{a*}\right) \quad ; \quad \text{if a*>0 and b*>0} \quad (2)$$

$$C = \sqrt{a*^{2} + b*^{2}} \quad (3)$$

To do the alveolar characterization image analysis was used, using the program Image J, developed by Wayne Rasband at the National Institute of Mental Health United States of America. From each sample, 5 fresh slices were prepared from each bread sample, with a thickness of 10 mm (pattern cutting), which were then scanned (scanner Canon CanoScan Lide 20). In the image corresponding to each slice a cut was made in the central zone (a rectangle of 273 x 291 pixels), to eliminate the effect of the crust area (Figure 1). The program Image J enabled to determine the number and size of the alveoli, as well as the total area and the alveolar percentage in that area. The program can convert the image into a two colour system, which allows a better alveolar differentiation, and thus a better evaluation.

Texture profile analysis (TPA) to all the samples was performed using a Texture Analyser TA.XT.Plus (Stable Micro Systems, UK). The analyses were performed immediately after manufacture, and for that were cut out seven slices (10 mm) per sample, removing a cube per slice (crumb) 30 mm edge. The texture profile analysis was carried out by two compression cycles between parallel plates using a flat 75 mm diameter plunger, with a 5 second period of time between cycles. A force load cell of 5 kg was used and the test speed was 0.5 mm/s. The textural properties: hardness, springiness, cohesiveness, adhesiveness and chewiness were calculated

Sensory analysis was performed in a laboratory prepared for that purpose, on the day of delivery of the samples by a panel of 50 untrained tasters, aged between 18 and 60 years, who were asked to rate the following attributes: crumb colour, crust colour, aroma (bread, firewood or fermentation), taste (bread, wood or fermentation), elasticity, density, and finally the overall appreciation. In this test the taster expressed the intensity of each attribute through a scale where verbal Hedonic expressions are translated into numeric values in order to allow statistical analysis. The scale of values varied from 0 (less intense) to 10 (more intense).

All of the data represents averages of at least three different determinations. Results were analysed using the SPSS® for Windows version 19.0.

Results and Discussion

The proximate chemical composition of biological bread is showed in Figure 2, and it is very similar to traditional wheat bread produce in *Fabrica do Pão* enterprise, presenting an energetic value of 232.8 Kcal/100 g.

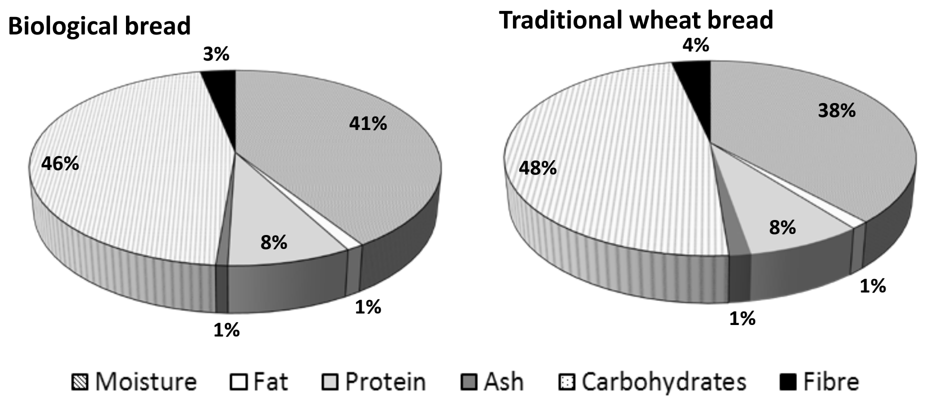

Figure 2. Chemical composition of biological bread and traditional wheat bread.

Biological bread presented a volume of 1997.7 cm^3, meaning that is a big size bread (Table 1). As to the crumbs density, for regional breads produced with wheat flours in this enterprise, the values found varied from 0.25 to 0.56, being the average of 0.35 (Rodrigues, 2012). Thus, the biological bread presented high value. Regarding the colour coordinates, it was found that the samples were quite dark (with L values standing near the middle of the scale), for both crust and crumbs. The a* and b* are positives, indicating the predominance of the red colour over green as well as of the yellow over blue, respectively. The results show a lighter colour (higher L and Value) and less intense brown (lower a* and b*). The crust presented high value of chroma, meaning a more vivid colour.

Table 1. *Physical parameters of biological bread.*

Parameter			**Biological bread**
Dimensions (cm^3)			1997.7±288.5
Density (gcm^{-3})			0.42±0.06
Colour			
	Crust	L*	61.3±4.61
		a*	8.59±2.00
		b*	23.35±4.26
		Value	6.13±0.46
		Hue	1.22±0.05
		Chroma	24.87±4.50
	Crumbs	L*	65.4±2.97
		a*	0.90±0.13
		b*	11.02±0.78
		Value	6.54±0.30
		Hue	1.49±0.01
		Chroma	11.06±0.78

The alveolar characterisation of the biological bread is shown in Figure 3. It revealed a low total area, a high alveolar percentage, a low number of alveolus, as well as a low alveolus average size, when compared to similar breads, such as the regional bread mentioned before (162799.9 $pixel^2$ total area, 22.9 % alveolar, 241 alveolus number, and 7102.9 $pixel^2$ alveolus average size) (Rodrigues, 2012). This means that this sample presented a low porosity, which explains its higher density value for this type of bread.

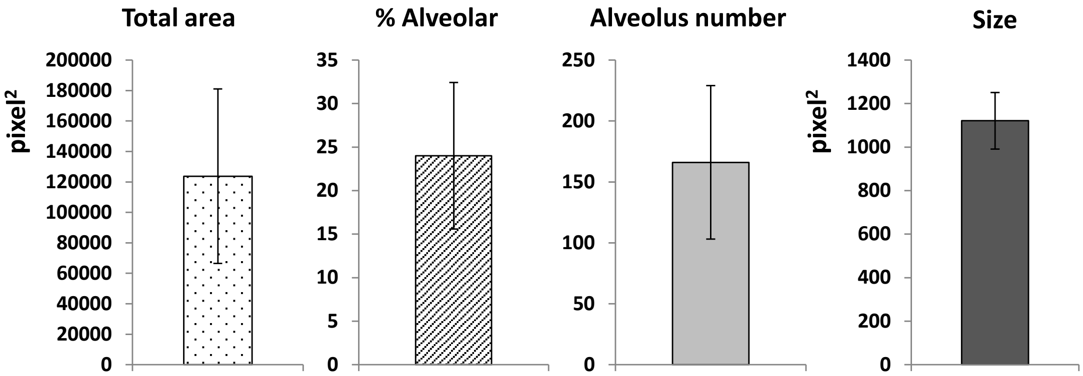

Figure 3. Alveolar characteristics of biological bread.

By analysing the results of the textural properties in Table 2, it was found that the properties hardness and chewiness were higher, which might be explained by the higher density as previously reported. In terms of cohesiveness (0.51) and elasticity, the biological bread showed lower values when compared with other wheat regional breads (averages values for cohesiveness of 0.73 and elasticity/ springiness of 93.3 %). The values found for adhesiveness were not shown because in all cases they were practically zero, thus indicating that these products do not have measurable adhesiveness. There is a great variability due to the natural heterogeneity of the samples.

Table 2. *Texture parameters of biological bread.*

Parameter	Crust	Crumb
Harness (N)	77.6±38.0	25.3±6.6
Springiness (%)	87.4±23.2	89.8±2.5
Chewiness (N)	40.6±28.9	11.4±2.5
Cohesiveness (dimensionless)	0.59±0.08	0.51±0.03

With respect to sensorial analysis, it was found a great discrepancy and consequently a great dispersion of the results (Table 3). Globally the biological bread was appreciated (with similar punctuation as traditional wheat bread), with a high punctuation in colour parameters and density (in accordance to analytical measurements), and also with respect to the taste and aroma of the bread.

Table 3. *Sensorial analysis of biological bread.*

Parameter		Biological bread
Colour	**crust**	5.2±2.0
	crumb	3.4±1.9
Aroma	**bread**	5.9±2.0
	firewood	2.7±2.4
	fermented	3.1±2.3
Taste	**bread**	5.6±2.1
	fermented	2.6±2.4
	salt	3.0±2.2
	wood	2.4±2.3
Elasticity		3.8±2.2
Density		4.5±2.2
Overall appreciation		6.2±2.3

Conclusions

Biological bread is an organic product produced by the use of processing methods which guarantee that the organic integrity and vital qualities of the product are maintained through all stages of the production chain, in order to ensure the health of consumers.

The biological bread produced was similar to traditional wheat bread in terms of the chemical characteristics, but it was quite different considering the morphology and physical parameters. The panellists appreciated this bread, however, more studies must be dome in order to improve some properties, such us density and colour of the biological bread.

Acknowledgments

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