RESERCH REGARDING THE OBTAINING SOURDOUGH BAKERY PRODUCTS ON IAȘI UNIVERSITY OF LIFE SCIENCES BAKERY MISCROSECTION

Otilia Cristina MURARIU [1], Adnana SANDU [1], Oana Mărgărita GHIMPEȚEANU [2], Carmen Maria PETCU[2], Ioan PUIU[1], Florin Daniel LIPȘA[1]

e-mail: puiu_ioan@uaiasi.ro

Abstract

Within the University of Life Sciences in 2018, an advanced technological line for bakery products production was established. One of the aims of the research carried out within it was to find alternative solutions for the development of the technology for obtaining Clean Label bakery products within natural levain. The present study aims to describe the technology of obtaining both natural levain and bakery products with this type of levain. Natural levain is represented by a dough obtained from wheat flour, water, sugar, salt dehydrated fruits (plums and apricots) that has been subjected to an acidifying fermentation in a controlled environment. The obtained products consisted of 4 experimental variants, respectively: V1 – white bread with natural levain, V2 – brown bread with natural levain and seeds, V3 – white bread with natural levain, apricots and plums and V4 – white bread with natural levain, cranberries and walnuts. These products were evaluated from qualitative point of view (physical-chemical) and the results showed that this category of Clean Label products can represent a sustainable alternative, with an extended shelf life, with a constant quality, criteria that meet the requirements of rigorous consumers.

Key words: levain, bread, bakery

Wheat is unique among cereal grains because wheat flour alone has the ability to form a dough that exhibits nutritive and rheological properties required for the production of leavened bread and other foods with functional attributes like cookies, pasta, crackers, and others (Gary G. *et al*, 2013).

From scientific perspective, the bread obtaining is fascinating. Proteins in flour are hydrated by water; strengthened by salt, developed by mixing, kneading, or folding; fermented with yeast or natural levain; and finally, baked into a delightful bakery product (Ohara B., *2018*).

The flour quality influences the quality of bread specially to hold fermentation gas, primarily CO_2. In common bread, yeast (*Saccharomyces* spp.) provides the gas during fermentation). In sourdough bread production, fermentation is caused by yeast and *Lactobacillus* spp., which depends of the type of natural sources of starter culture. Both the gas production and the ability of gluten to retain leavening gasses are critical in end-use functionally, especially product volume and texture (Gary. G. *et al*, 2013). Without the presence of leavening gas, the final products would be dense and very hard in texture. In dough, CO_2 is produced by yeast during fermentation.

In this study, sourdough cultures derived from wheat, the conventional source of sourdough starter, apricots and plums, an alternative source of non-cereal yeasts were tested on physico-chemical properties of levain and bread.

The use of sourdough in bread recipe as a leavening agent is one of the oldest processes in bread making (Rocken *et al*, 1995). Sourdough consists of a mixture of water, flour fermented by spontaneous or added microorganism from added sources (apple/apricots/plums). These components are the basis of the process of obtaining baking products with natural levain. There is a large diversity of lactic acid bacteria and yeasts capable of fermenting flour obtained from cereals and pseudocereals (Șerban L. *et al*, 2017). These microorganisms produce some chemical reaction during fermentation with effects on the rise of the dough, flavor of the final products extension of the shelf life, improving of the nutritional and sensory profile of the products (Limbad *et al*, 2020).

The demand of consumers for traditional bread products with sourdough addition increased

[1] "Ion Ionescu de la Brad" University of Life Sciences, Iasi, Romania
[2] University of Agronomy Sciences and Veterinary Medicine, Bucuresti

with the the increasing demand of natural, tasty and healthy food (Brummer J.M. *et al*, 1991).

In sourdough systems are incorporated more microorganism comparative with yeast (*Sadeghi, 2008*). The technology of sourdough involves a culture of yeast and lactic acid bacteria that are cultivated through several generations to achieve a stable system and then used to ferment doughs. At each refreshing, some of the previous dough is retained for use as a starter for the next dough that is mixed and fermented to maintain the viability of the culture. The process of consecutive microbial reinoculation is named back slopping (Haggman and Salovaara, *2008*).

Various lactic acid bacteria have been reported to have beneficial effects on the quality of bakery products. According to new nomenclature starting in 2020, *Levilactobacillus brevis* and *Lactiplantibacillus plantarum*, which are codominant with heterofermentative lactic acid bacteria, and *Lactobacillus casei* which present the capacity to produce exopolysaccharides (Hadaegh H., *et al*, 2017).

Bread quality is improved by using sourdough in bread production from the nutritional point of view due to the fact that it reduces phytic acid, a natural antinutrient found in wheat flour especially for the types with high extraction rate (Clarke C.I. *et al*, 2002). Using natural levain in bread making it improves product quality and from the nutritional point of view due to the fact that it reduced phytic acid, a natural antinutrients found in wheat flour if it is of a high extraction rate (Hansel *et al*, 1994).

The aim of this study was to investigate the effect of natural levain with rehydrated apricots and plums on 4 variants of bakery products quality.

MATERIAL AND METHOD

The obtained products consisted of 4 experimental variants, respectively: V1 – white bread with natural levain, V2 – brown bread with natural levain and seeds, V3 – white bread with natural levain, apricots and plums and V4 – white bread with natural levain, cranberries and walnuts.

For V1 – it was used 50% white flour 000 and 50% semi white flour type 650, levain, water and salt. For V2 it was used 60% semi white flour, 40% whole grain flour 1250 type, water, levain, oilseeds (sesame, sunflower, pumpkin, cumin) and salt. For V3 it was used 50% white flour 000 and 50% semi white flour type 650, levain, water, salt and dehydrate apricots and plums. For V4 it were used 50% white flour 000 and 50% semi white flour type 650, levain, water, salt and dehydrate cranberries and walnuts.

Ingredients. Flour: In bakery products, wheat flour is the most important raw material, it provides bulk and structure to most of bakery products, including breads, cakes, cookies and pastries. Wheat is unique among the cereals in that its flour presents the ability to form dough when is mixed with water. As the heart and soul of bread, the type of flour makes a difference in the bread. Pay attention the amount of protein in the flour. In wheat dough exist a protein named gluten that has the ability to retain the gas produced during fermentation or by natural levain. The higher the protein, the more gluten there is in the flour, which is needed to develop the structure of the bread.

Whole grain flour contains the germ and bran of the grain. These are full of fiber and nutritious, but they also increase the density and heaviness of bread. Working with whole-grain flours also requires more water to hydrate the absorbent bran, and extra consideration to the dough, as the bran can tear the gluten and make it difficult to develop the dough.

Water. Hydration is critical for dough. Regarding the tap water, if is high in chlorine can have a negative effect on sourdough starter. Also, temperature is another key factor in bread baking, so the temperature of your water is important and it should be considered one of the ingredients. The temperature of the water is what ultimately creates the temperature of the dough, and that determines how long the dough will take to rise levain breads ferment best at a temperature between 24°C and 26°C.

Salt: in bread baking, salt performs the important function of adding strength to dough. It also slows or inhibits the fermentation process, which lets the dough develop structure and flavor over time. The absence of salt will determine the obtaining of gooey and sticky dough, ended up with a poorly flavored loaf of bread.

Yeast: This is the magic ingredient that makes bread dough rise. Yeast occurs naturally in the air or in fermentation room, and we'll use that natural yeast for bread made with a levain or sourdough starter.

An overview of the process

Scaling → Mixing → Kneading and Folding → Rising or Bulk Fermentation → Shaping → Proofing → Baking → Cooling

Scaling: Each ingredient is weighed. The temperature of water is corrected and set out all the equipment.

Levain or sourdough starter: in this study it wasn't used any commercial yeast.

We use a starter that was a living culture that was cared for continuously and typically "fed" each day. There are as many compositions of sourdough as there are bakers in the world and – odd as it may sound – they become a personal reflection of the owner. Leavening bread with only a living sourdough starter made in USV Bakery Microsection is an art to form and creates a really, unique loaf of bread, though it has required a lot of practice.

Mixing: is represented by combining of all the ingredients until the dough is hydrated and there are no dry spots. The ingredients were mixed 5 minutes and then the dough was kneaded for 10 minutes. This is the step of the begins the develop of the gluten in dough. Proper mixing will create an even, homogenous dough that is soft and easy to work it. Mixing also creates friction, just like folding like

folding and kneading do, so a good thorough mix will kick-start the development process.

Kneading and Folding: Stretching or folding the dough creates strength and structure in the gluten networkand it's this strength that allows the bread to form properly. A loaf that hasn't had adequate gluten development will be difficult to shape, won't hold its shape in the oven, and will resut in a flat loaf that won't rise. Dough with great gluten development will be strong, stretchy, and easy to shape.

Rising or bulk fermentation: the initial rise took place when the yeast gets to work, eating the sugars and starches in the dough and turning them into gases, which fill the dough with air. This step creates flavor and lightness in the final loaf of bread. The inactive time was 2 hours to rest and 3 hours to rise.

Shaping: consist in giving form and structure to the dough, determining the final shape of the loaf. A well-shaped loaf with adequate tension will present a tall rise and a beautiful product. Dough was formed in two shapes: boules and loaf.

Proofing: consist on the second rise of the dough before enter into the oven. This step is critical because it will determine the lightness of the final product. Over proofing took place when dough is sticky and slack. The proofing dough presented beautiful, open, airy crumbed raised gently as it was baked in the oven.

Baking: Heat treatment transforms dough into bread, and the temperature at which is paramount importance, as is the application of steam during this step. If steam is not used, bread will form a crust too quickly, and won't have time to expand in the oven. Steam creates a moist environment so that loaf can open up fully before browning. A proper baking, at the right temperature will produce a light loaf with a beautiful crisp crust.

Cooling: bread should be allowed to cool for at least 30 minutes before slicing and packing. This step sets the crumb and crust. Bread baked in a Zucchelli oven was removed and cooled on a wire rack.

Determination of acidity consists in titrating the analyzed sample with NaOH solution in the presence of phenolphthalein. The elasticity of the bread crumb consists in pressing a piece of crumb of certain shape, a determined time and measuring the return to the initial position, after removing the pressing force. The porosity of the bread crumb consists in performing the calculation between the total volume of the gaps in a known volume of the crumbs, knowing its density and mass.

Determining the moisture content of the crumb consists of drying the crumb of the sample under 130°C. The protein amount was determined by the Kjeldahl method. NaCl determination consists in the titration of chlorine ions with $AgNO_3$ in the presence of $KCrO_4$ as an indicator.

Mineral substances consist in determine the residues resulting from the calcination of the analyzed sample.

RESULTS AND DISCUSSIONS

During fruits and wheat flour fermentation, typically up to 48 h at moderate temperatures, metabolic activity of the microorganisms present is in interaction with the flour constituents.

Lactic acid bacteria produce lactic and acetic acids, lowering the pH typically below pH 5. The apricot and plums juice after 46 h of fermentation show an 4.3 pH and after adding the flour to feed the fermentation the pH values increased on pH 4.9 (*figure 1*).

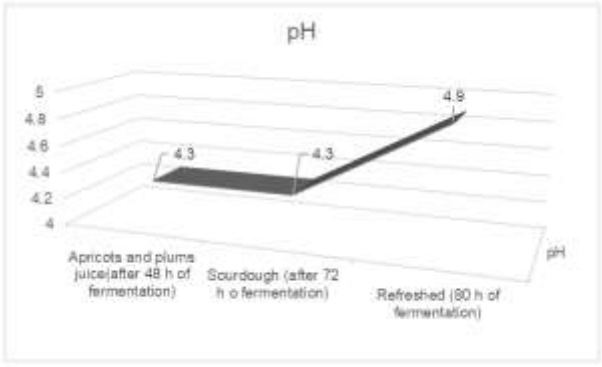

Figure 1 **The evolution of pH values during sourdough preparation**

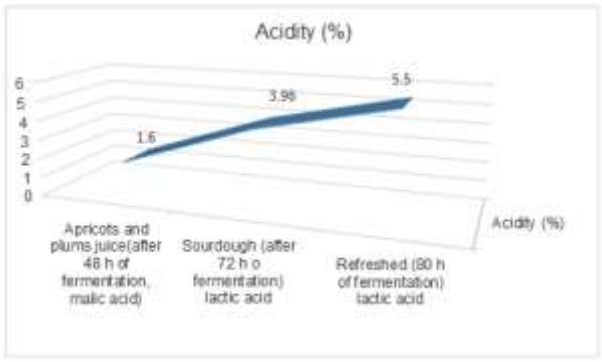

Figure 2 **The evolution of acidity during sourdough preparation**

Yeasts produce CO_2 and ethanol. Interaction between yeasts and lactobacilli are important for the metabolic activity of the sourdough. The conditions of the fermentation contribute to the activation of enzymes present, and adjustment of pH selectivity enhances performance of certain enzymes present, such as amylase, proteases, hemicelluloses and phytases.

The results of the quality characteristics of the 4 sourdough bread variants produced with white flour (000 and 650 types) and brown flour are presented in *table 1*.

The humidity results for the four experimental variants of sourdough bread showered values that varied between 42.4% for V1 (white sourdough bread) and 44.3% for V2 (brown sourdough bread with oil seeds) (*table 1*). It can be observed that the humidity of V2 – brown sourdough bread with oil seeds presented the high values, aspects positively correlated with the high degree of the flour extraction that requires a superior hydration capacity.

The water content of bread can vary between 40 – 60%, noting that the values obtained were within the lower limit of the specific range. During the analysis, it was followed to keep the storage parameters constant, respectively the air humidity of 60% and the temperature in the storage space of 20°C.

Table 2

Physico-chemical parameters of sourdough bread

	Protein, %	Ash, %	H_2O, %	NaCl, %	Elasticity, Sec.	Porosity, %
V1	10.2	0.628	42.4	0.49	1.7	91.2
V2	12.5	0.798	44.3	0.62	2.4	87.4
V3	10.4	0.71	43.6	0.41	1.9	89.6
V4	11.8	0.85	42.8	0.58	2.1	90.5

The porosity of the sourdough bread obtained from white flour (000 and 650 types) was improved for white bread without adds (V1 variant), with a value of 91.2%. The lowest value of porosity was identified for brown sourdough bread with oilseeds, of 87.4%. whit sourdough bread with adds, respectively V3 and V4 showed a corresponding porosity of 89.6% and 90.5% respectively (*table 1*).

The differences highlighted in the porosity of the four sourdough bread variants can be caused by different degrees of maturation of the different types of flour (000/650/1250) used. Variants V2 and V4 presented the highest values of elasticity of 2.4 sec. and 2.1 sec. (*figure 1*).

The ash content varied between 0.628% for V1 and 0.85% for V4 (*table 1*).

The salt content shows low values which varied between 0.41% (V3) and 0.62% (V2).

CONCLUSIONS

The effects of sourdough fermentation on the physical and nutritional properties of bread quality are among the most diverse and depend on the interaction between the raw flour and the microbial strain used in levain as the fermenting agent.

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