

## COMPARISON OF BREADS MADE BY DIFFERENT LEAVENING TECHNOLOGIES

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### ABSTRACT

Breads made with leaven and leaven substitutive products by different technologies were evaluated to find similarities and differences between the traditional making process and the industrial technologies. Volume and formal ratios of loaves, acidity degree and moisture contents of crumb, water activity and storage parameters were evaluated. Results show that the breads made with leaven with a moderately long fermentation matches to the requirements of the Hungarian Standard, but breads made with commercially available leaven substituent also showed favourable physical and chemical properties. Breads made with lactic acid showed favourable sensory properties, but low volume. Consumable times of breads were not influenced by the method of leavening. Results also proved that the most favourable result can be achieved by traditional leavening fermentation method considering sensory, physical and economical aspects.

### 1. INTRODUCTION

The bread is one of our much liked and most traditional foodstuff. Beside taste, nutritional value, storability, the consumer expects proper appearance and volume of bread and they depend on the properties of flour and the bread making process, the applied other additives and the microbiologic processes in the dough.

The main expectation on the microbiologic process is the high gas production, namely to produce a more gaseous dough and a more aerated bread (Arendt et al., 2007). Commonly, microbes develop the properties of dough is a mixture of natural yeasts and lactic acid bacteria (Williams and Pullen, 1998). Yeasts, mostly *Saccharomyces cerevisiae* ferments the sugars of flour into ethanol and CO<sub>2</sub>, and as the latter one release in the dough, the developing gluten network retain it while the volume of loaf is increase. Thus, the most part of final volume of bread came from the microbial activity of yeasts (Véha and Markovics, 2010).

Not only the gas formulation is the aim of the use of microbes. Smell, acid taste and aromatic compounds are also significant microbe products of leavening and most of the aromatic compounds formed during baking, mainly as the products of lactic acid bacteria (Schieberle, 1996). Fermentation quotient, the ratio of the formed lactic and acetic acid, characterizes the aroma profile of dough and bread also, and the breads of different cultures, regions and consumer types show significant differences ((Rosenquist and Hansen, 1998). The preserving effect of leavening is also important; the formed organic acids decrease the pH of dough, thus decreases the microbial deterioration (Corsetti and Settanni, 2007).

The demands of Hungarian consumers on bread are almost unique in the world; most people prefer the product with the highest volume here and do not like the acidic taste of bread which is characteristic of leavened products. Thus, the importance of lactic acid fermentation is not significant and in the last decades direct bread making process became general, without leaven, using high amount of yeast and industrially produced leaven substituent. This product gives the acidity value for bread which is necessary for avoid microbial spoilage but do not influence the taste of product significantly. The international trends tend to more natural, tasty and healthy foods (Brummer and Lorenz, 1991) and the sourdough had a renewal worldwide. For example, sourdough is used in more than 30% of Italian bakery products and more than 200 different bread types (Ottogalli et al., 1996;



Corsetti and Settanni, 2007). These demands appeared in Hungary also and the interest in leavening bread making increased recently.

The aim of this study was to evaluate the effect of different leavening technologies on the physical and storability related properties of breads. The use of traditional leaven, lactic acid leaven and leaven substituent was examined on the volume and formal quotient of pilot breads, on the acidity value and water activity of crumb and on the storability time.

## 2. MATERIALS AND METHODS

Four types of test breads were made; the first one with commercially available leaven product, the second and third ones with yeast fermented leaven applied in baking industry and the third one with lactic acid leaven. The difference between the second and third type was the fermentation time; in the case of second bread the fermentation time was optimal (6 hours) but the leaven applied in the third recipe was overfermented (8 hours). The leaven size for yeast leaven was medium. Three leaven size were tried for lactic acid leaven; small (4,1% leaven for the amount of flour), medium (7% leaven for the amount of flour) and large (14,4% leaven for the amount of flour). The applied materials were BL-80 winter wheat flour, water, leaven or leaven substituent, yeast and salt. The ratios of different raw materials were experimentally determined.

Doughs were made by 2 minutes fast and six minutes slow mixing times. Resting time was 25 minutes interrupted after 15 minutes to remould. Leavening temperature was 33°C with 80% air humidity. The leavening times were 42 to 46 minutes for doughs made with leaven substituent, optimally fermented leaven and lactic acid leaven, but it was only 28 minutes for overfermented yeast, due to the higher pH acidity degree. Delivery masses were 510-515 g. Baking was performed at 250°C. Quality parameters were evaluated after the breads cooled.

The evaluated quality parameters were volume, formal ratio, acidity degree and water activity for both doughs and breads. The volume and formal ratio were determined by MSZ 6369-8:1988, acidity value according to MSZ 6369-11:1987 and water activity was evaluated by laboratory water activity measurer. Storage test was made by exterior parameters; 10 sliced breads were stored in dry cool place in closed plastic bags. Every breads were inspected and one of them were opened on every day. The appearance of the first mould brought the end of storage test.

## 3. RESULTS AND DISCUSSION

The use of leaven substituent and optimally fermented original leaven resulted the highest bread volumes (Table 1). The lactic acid leaven and overfermented original leaven resulted only moderate long volumes, likely due to the high acidic degree, the dominance of lactic acid bacteria and their oppressive effect on yeasts.

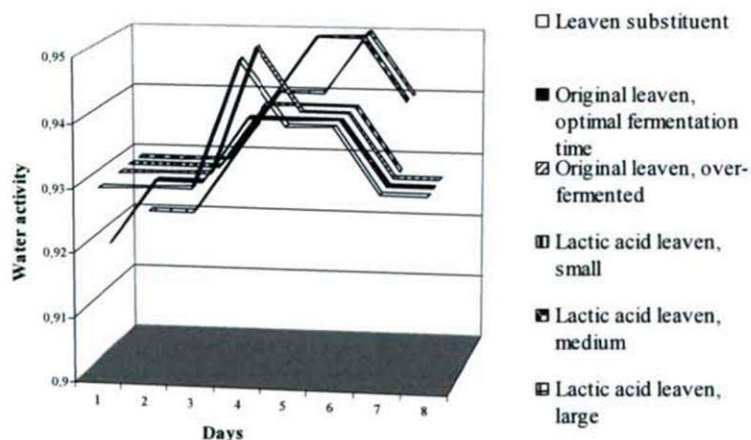
The formal ratio strongly depends on the flour and leaven properties, a value from 1,6 to 2,0 is the consumer's requirement. Higher values mean flat form caused by overfermentation, lack of gluten content and the quality of leaven, while lower values can be observed short leavening time, strong gluten and leaven properties. Results show that the formal ratios of breads made with original overfermented and lactic acid leavens were appropriate. A projecting value can be seen for bread made with medium lactic acid leaven. The overfermented original leaven also made the dough hard as well as the leaven substituent and the maybe due to the too acidic conditions the product became small.

*Table 1. Quality parameters of breads made with different leavening methods*

	Leaven substituent	Original leaven		Lactic acid leaven		
		optimal fermentation time	over-fermented	small	medium	large
Bread volume, cm <sup>3</sup>	2436	2466	1875	1474	1659	1836
Formal Ratio	1,56	1,62	1,57	1,67	1,87	1,68
Acidity value, SH <sup>o</sup>	3,69	4,09	4,45	2,66	3,31	4,13
Moisture content of crumb, %	44,03	43,55	43,69	44,60	44,00	44,81

The acidity degree of breads must be between 3 and 5 SH<sup>o</sup> concerning the requirements of the Codex Alimentarius Hungaricus. Only the bread with small amount of lactic acid addition did not met this demand with its value of 2,66 SH<sup>o</sup>, the low amount of added leaven resulted lack in aromatic compounds. The highest values was found in breads made with large amount of lactic acid leaven and with overfermented original leaven. The moisture content of breads influences its structure, crumbling and storability. In our experiment the causes of differences in bread crumb moisture contents were the leaven and added water contents of different breads. Breads made with original leaven showed the lowest crumb moisture contents and the ones made with lactic acid leaven showed the highest values.

The changes in water activity were measured until the first mould appeared. It can be seen in Figure 1 that similar trends were found in the case of the breads; the values were recorded in a narrow region and an increase was followed by a decrease after 4 to 6 days. The absolute values were similar for the different breads, and it seemed that the water activity did not influenced the storability; the breads made with leaven substituent and original leaven kept their microbiological suitability 8 days long, but the ones made with lactic acid leaven only 7 days long.



*Figure 1. Changes in water activity of bread slices during storage*



#### 4. CONCLUSIONS

Our results prove that lactic acid leaven is suitable for high quality bread making. Although the volume of these breads are slightly lower than the ones made with leaven substituent or traditional leaven, the formal ratios were more favourable of them. The appearance of the product is one of the main selection criteria of consumers during purchasing, but nowadays it is not sure that the highest volumes breads are the most preferred ones, due to the wide-ranging offer of flour additives which give better appearance of product but influences negatively the other sensory and storage properties. The better formal ratios, the more natural appearance are well received more in several cases. The volumes of breads made with lactic acid leaven may be increased with more yeast addition.

Results in lactic acid leaven addition on the acidity value and the storability showed that these breads fit for the Hungarian requirements, except the one made with low leaven addition. Notwithstanding, probably due to the less added leaven, the storability of the breads made with lactic acid leaven was slightly shorter than the ones of other breads but it met the consumers' demands. Considering the results, the best performance was shown by the bread made with original leaven, but the ones made with lactic acid can be a way of the selection enlargement of bakery products and may bring new tastes and products into the market.

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