

Possibilities Of Improving The Quality Of Mixed Rye Bread By Adding Sourdough

Doc.dr Vesna Boljević

Faculty of Food Technology, Food Safety and Ecology University of Donja Gorica

Abstract:

From the nutritional point of view, rye mixed bread has better characteristics than wheat bread, but in our country the production of this bread is reduced to a minimum. The reason for this is the production technology that makes it impossible to produce quality rye and rye mixed bread. Better quality rye mixed bread is obtained if sourdough is added during production. In this paper, we started from this assumption and tried to prove that quality rye mixed bread is obtained with the use of sourdough and that this technology can be implemented in our industrial bakeries without major problems. This is especially important since it could contribute to this type of bread being more often on the table of our consumers and significantly contribute to enriching their daily diet with important nutrients.

Keywords: bread, rye, sour dough, quality.

Date of Submission: 08-12-2021

Date of Acceptance: 23-12-2021

I. Introduction

In recent decades, modern bakery production has largely relied on numerous innovations in terms of modernization of technological production procedures, but also on the application of numerous additives and improvers. New technical and technological solutions are being implemented in industrial plants for the production of bread, all with the aim of achieving better quality of finished products, but also achieving greater economic effects.

It is known that the application of sourdough in the technological process of bread production gives numerous improvements in quality. This is especially true for the production of rye and mixed rye bread due to known problems resulting from the specific technological properties of rye flour. The same makes you more attractive to customers. Sour dough is a dough made from flour of various cereals, liquids and microorganisms. It is considered to be the oldest biochemical process in the production of various types of food. The basis of sourdough is lactic acid bacteria and yeasts that are naturally present on a large scale in the environment. Therefore, these microorganisms are an integral part of the flour microflora and are activated in the process of kneading dough in bread production. bacteria that create an acidic environment that helps the growth of yeast and prevents the development of undesirable microorganisms. (Đukuć, 2003).

In science and practice, not enough attention is paid to sourdough, so its use in the production of bread in our area is almost completely neglected. In addition, the production of rye mixed breads has been reduced to a minimum due to the degradation of their quality. Also, the share of rye flour, as a carrier of flavoring properties of mixed breads has been reduced to a minimum of 30%, unlike the practice in Eastern and Central Europe, where rye breads are produced with rye flour in the amount of 80% and more. Previous scientific knowledge and experience in the production of rye breads show that the quality of this type of bread is conditioned by the use of sourdough, primarily a starter of lactic acid bacteria. (Kovačević, 1995). The ripeness of rye flour is evaluated according to completely different criteria than wheat flour. In wheat flour, the role of protein is especially valued, while in rye flour, greater importance is given to pentosans, starch and sugar, therefore to the carbohydrate complex. (Weipert, 1984).

Thus, the difference in baking is primarily expressed in the fact that the protein component of rye flour is not capable of producing gluten, as is the case with wheat flour. The behavior of rye starch in the baking process is also different in comparison with wheat starch, because its gelatinization begins at lower temperatures (52-550C), unlike wheat starch, whose gelatinization starts at 60-670C.

The role of water binding in rye flour in the phase of dough kneading and fermentation is taken over by pentosans. Pentosans, as an integral part of rye flour, show a pronounced ability to swell and can bind 6-8 times more water than their own weight. This fact can explain the increased yield and prolonged freshness of rye bread, because pentosans show less water loss during the baking process (Bešlagić, 1999).

The diversity and breadth of the range of bakery products in developed countries is largely based on the processing of rye flour. Despite the tendency of a slight decline in rye production in Northern and Northeastern Europe, rye as a specific bread grain is still irreplaceable in the production of aromatic and tasty bread with long-lasting freshness.

In addition, rye bread is valued more than wheat bread due to its higher content of minerals, vitamins and crude fiber. In the production of rye bread, the bakery practice recognizes the procedures according to the stages of preparation of bread dough. For this purpose, multi-phase, two-phase and single-phase procedures are used.

The method of preparation of sourdough should be chosen according to the specifics of existing technological procedures and consumer requirements in the quality of bread. The desire to simplify the process of sourdough preparation has led to the abandonment of multi-phase processes, so that today in the bakery practice of production of mixed rye bread the following single-phase procedures are most often used: Detmold, Mannheim and Berlin.

Having in mind all the above, an attempt was made in this paper to make a modest contribution in the part:

- Studying the possibility of using starter cultures of lactic acid bacteria in the production of sourdough to be applied in the process of industrial production of mixed rye bread,
- This would then create realistic preconditions for expanding the range in the group of rye and mixed rye breads,
- To determine the parameters of the technological process of production in industrial conditions which will ensure the uniformity of rheological properties of bread dough and uniform quality of finished products,
- • Application of natural instead of chemical additives to the dough in order to simplify and facilitate technological procedures and improve the quality of bread (taste, aroma, prolongation of freshness and durability)
- • Reduction of economic losses due to microbiological spoilage of bread.

In order to realize the set tasks in this paper, extensive and systematically organized tests were performed in order to prepare different modalities of Chorleywood Bread Process with the addition of sourdough prepared using pure cultures of lactic acid bacteria. be able to apply in the industrial production of rye and mixed rye breads.

II. Material And Methods

For the production of mixed rye bread, wheat flour T-850 and rye flour T-950 were used, which come from different mills and anonymous varietal characteristics.

The paper uses methods for testing the quality of raw materials and bread, which are standardized by the AACC, or methods used by researchers in this field and which are considered the most suitable for testing this type. The following raw materials were also used in the dough mixes for the experimental and control mixes: fresh baker's yeast, table salt, margarine and improver in the quantities common in these recipes.

The production process took place in industrial conditions and included the following stages: intensive kneading of the dough on a high-speed mixer for 3 minutes (1 minute slow and 2 minutes fast), after which the dough is immediately divided into a divider where pieces of dough are separated from 580g. The next stage is the round shaping of the dough pieces on the rounder and then the intermediate fermentation where the dough pieces rest for 12 minutes. This is followed by the final shaping of the dough on the machine and the insertion of the dough into the final fermentation chamber with controlled temperature and humidity conditions (t of 38 st.C and relative humidity of 75% RH). After the completion of fermentation for 53 minutes, the dough pieces enter the tunnel oven where the baking process lasts for 27 minutes (with the baking regime at temperatures 240 ° C - 260 ° C - 240 ° C) with sewing at the entrance. in the oven.

In order to determine the influence of the addition of sourdough on the technological properties of bread dough and the quality of bread, a whole series of differential test baking was carried out in both laboratory and operating conditions. Probationary trials were performed in the industrial bakery "Inpek" Podgorica.

2.1. Trial baking of rye mixed bread

Two samples of rye mixed bread were prepared, control and experimental. The control sample is rye mixed bread that is normally produced in the bakery "Inpek" Podgorica. The experimental sample is rye mixed bread with the addition of sourdough.

Table no 1: Preparation of sourdough (ingredients):

Components	Weight in kg
Rye flour T-950	20
Wheat flour T-850	20
Water	60
<i>Lactobacillus brevis</i> starter culture	0.01

The lactic acid bacterium *Lactobacillus brevis* was used as a starter culture because early research (Hansen-Hansen, 1994) showed that this heterofermentative lactic acid bacterium produces higher acidity than homofermentative bacteria such as *Lactobacillus plantarum* and is more favorable for rye bread. The fermentation of the sourdough took place in a fermenter at a temperature of 29 °C for 12 hours with programmed stirring.

After the fermentation of the sourdough was completed and its full maturity was reached, the bread dough was prepared.

Table no 2: Recipe for the preparation of bread dough

Components	Participation in %
Rye flour T-950	40
Wheat flour T-850	60
Sourdough	30 (to the mass of flour)
Yeast	1
Kitchen salt	1.8
Margarine	2
Improver	1
Water	30 liters

Preparation and trial baking of the control sample took place with identical participation of ingredients, without the content of sourdough, but with an increased yeast content of 1.2%

III. Results and discussion

The tested rye flour T-950 came from different mills and anonymous varieties. In order to eliminate the impact of quality differences, flour samples for programmed tests were selected according to approximate average values. The basic indicators of rye flour quality are shown in Table 3.

Table no 3: Basic quality indicators of rye flour

Quality indicators	Average value
Moisture content in %	13.4
The protein content of s.m. (%)	9.00
Acid degree	3.50
pH	4.90
Amylogram	
Maximum viscosity (Aj)	300

While the role of protein is appreciated in wheat flours, pentosans, starch and sugar are given more importance in rye flours.

Comparing the average results of the quality of the tested flour, in this paper, with the quality of flour obtained from rye harvested in Vojvodina in recent years, it can be concluded that these flours were almost identical in quality. The maximum viscosity of 300 Aj ensures good baking of this rye flour, and the bread obtained from this flour has good porosity, freshness and taste.

According to the "Regulations", the quality factors of bread that are scored are divided into five groups: volume, appearance, appearance, smell, taste of the crust and middle, and scoring is performed with a score of 1 to 5 and multiplied by a coefficient of importance from 1 to 5. However, for a more comprehensive assessment in this paper, the assessment of bread quality was done by a combination of several quality factors using sensory and instrumental methods.

The effects of the addition of sourdough on the quality of rye mixed bread, primarily on its taste and aromatic properties and freshness were evaluated after 24 and 48 hours, as shown in Table 4.

Table no 4.: Influence of sourdough on the quality of rye mixed bread

Quality indicators	Samples control	Samples experimental
Rating after 24 hours		
Specific volume (ml / g)	3.20	3.03
Porosity according to Dallmann	6	7
Elasticity of the environment	very good	great
Penetrometer number	68	74
The fineness of the pore structure	fine	fine
Taste	slightly acidic	sour
Aroma	expressed	very pleasant
Acid degree of medium	5.3	7.2
pH	4.4	3.9
Rating after 48 hours		

Elasticity of the environment	good	very good
Penetrometer number	49	56
The fineness of the pore structure	almost fine	almost fine
Taste	slightly acidic	sour
Aroma	slightly pronounced	expressed

The term sensory analysis means scientifically flawless preparation, derivation and evaluation of sensory means, in which an objective assessment is performed on the basis of individual assessments and correctly applied statistical processing of results.

Sensory evaluation of bread includes: evaluation of the elasticity of the middle of the bread, porosity according to Dallmann, fineness of the pore structure, taste and aroma, whose values were expressed by descriptive evaluations. The elasticity of the medium was evaluated by the following grades: excellent, very good, good, satisfactory, unsatisfactory and bad. In our case, after 24 hours in the control sample it is very good, and in the experimental excellent, after 48 hours in the control sample it is good. experimental very good.

The Dallmann porosity was determined by comparing the cross-sectional appearance of the bread with the Dallmann reference pictures, entering the number below the cross-sectional image. In the control sample the porosity is after 24 hours 6, and in the experimental sample 7.

The fineness of the pore structure was evaluated by the following grades: spongy, fine, almost fine, slightly coarse, coarse and extremely coarse. After 24 hours in the control and experimental samples it is fine, and after 48 hours in both samples it is almost fine.

The taste of rye mixed bread did not change over time, and in the control sample it was slightly sour, and in the experimental sample it was sour.

The aroma was pronounced in the control sample after 24 hours and slightly pronounced after 48 hours. In the experimental sample, the aroma is very pleasant after 24 hours, and pronounced after 48 hours.

The acid level of the medium in the experimental sample reached a value of 7.2, which is lower than the upper limit set by the "Regulations" of 7.5

IV. Conclusion

The information obtained by examining the quality of rye flour is in line with previous knowledge that the quality of rye flour must be evaluated according to different quality criteria in relation to wheat flour. The paper emphasizes the influence of the chemical composition of rye flour, which in sourdough is a suitable medium for the development and reproduction of working microorganisms.

Comparative sensory analysis of quality determined that the breads with the addition of sourdough are characterized by a mild sour taste with a more pronounced aroma compared to breads produced by the current technological procedure, which is used in our bakeries.

The instrumental determination of the compressibility of the medium on the penetrometer determined the slow aging of the starch gel in the middle of the bread, which is in accordance with the literature data, i.e. that the addition of sourdough slows down the aging of bread or prolongs its freshness.

A comparison of Dallmann porosity, pore fineness, and medium elasticity indicated better physical properties of the bread environments of the experimental samples compared to the control samples, resulting in reduced bread crumbs.

Based on the obtained research results, it can be stated that the technological process of rye mixed bread production with the addition of sourdough can be successfully applied in an industrial plant on a bread production line as described at the beginning of this paper, but also in every bakery plant

References

- [1]. A.A.C.C., Approved methods of the American Association of Cereal Chemist, Minesota, (1990).
- [2]. Boljević Vesna, Possibilities of using pure cultures of lactic acid bacteria in bread production, doctoral dissertation, Banja Luka, (2002).
- [3]. Brummer J.M., Lorenz K., European developments in wheat sourdoughs, Cereal Foods World (1991) 36.
- [4]. Dictionary of Cereal Science and Technology, ICC, Austria, (1998).
- [5]. Kaludjerski G., Filipovic N., Methods of testing the quality of grain, flour, finished products, Faculty of Technology, Novi Sad, (1998).
- [6]. Rulebook on methods of physical and chemical analysis for quality control of cereals, mill and bakery products, pasta and quick-frozen dough, Official Gazette of the FRY (1998) 74.
- [7]. Ordinance on the quality of cereals, mill and bakery products, pasta and quick-frozen dough, Official Gazette of the SFRY 1983; 53.
- [8]. Schieberle P., Grosch W., Identification of the volatile flavour compounds of wheat bread crust comparison with rye bread crust, Z. Leben Untersuchung und forschung, (1987).
- [9]. Weipert D., Production and processing of rye with reference to processing value, Žito-Hleb, (1985) 12.
- [10]. Winata A., Lorenc K., Effects of fermentation and baking of whole rye sourdough breads on cereal alkylresorciols, Cereal Chemistry, (1997).
- [11].

- [12]. Mrvicić J.; Mikelec K.; Stanzer D.; Križanović S.; Grba S.; Bačun-Družina V. and Stehlik-Tomas V., Sour dough - traditional and natural method for increasing the quality of bakery products, *Croatian Journal of Food Technology, Biotechnology and Nutrition* 6 (2011) (3-4) (89-99), Croatia Society of Food Technologists, Biotechnologists and Nutritionists, Zagreb, Croatia
- [13]. Savanović D. and Grujić S., Defining the characteristics of bread quality using sensory methods of analysis, *Proceedings, Second International Congress "Ecology, Health, Work, Sport" 2(2008) (137-141)*, Banja Luka, Bosnia and Herzegovina
- [14]. Lakić N. and Grubačić M., Influence of sourdough addition on certain qualitative properties of bread, *Scientific paper, Journal of Chemists, Technologists and Ecologists of Republika Srpska* 8 (2012) (29-34), Banja Luka, Bosnia and Herzegovina
- [15]. Dragutin A. Đukić, Vsevolod T. Jemcev, *Microbiological Biotechnology* (2003)(376-380), Belgrade.
- [16]. Seniha Bešliagić, *Technology of grain, starch and sugar processing* (117-119), (1999), Sarajevo.
- [17]. Arendt E.K., Ryan L.A.M., Dal Bello F., Impact of sourdough on the texture of bread. *Food Microbiology*, 2007, 24, 165-174.
- [18]. Brandt, M. J.: Sourdough products for convenient use in baking, *Food Microbiol*, April 1, (2007) 24 (2): 161-4, Minden, Germany
- [19]. Chavan, R.S.; Chavan, S.R. Sourdough Technology—A Traditional Way for Wholesome Foods: A Review. *Compr. Rev. Food Sci. Food Saf.* (2011), 10
- [20]. Corsetti A., Settanni L. Lactobacilli in sourdough fermentation. *Food Research International*, (2007) 40, 539-558
- [21]. Corsetti, C.A., Settanni, S.L., Van Sinderen, V.S.D. Characterization of bacteriocin-like inhibitory substances (BLIS) from sourdough lactic acid bacteria and evaluation of their in vitro and in situ activity. *J. Appl. Microbiol.* (2004);96, 521–534.
- [22]. Damiani P., Gobbetti M., Cossignani M., Corsetti A., Simonetti M.S., Rossi, J. The sourdough microflora: Characterization of hetero- and homofermentative lactic acid bacteria, yeasts and their interactions on the basis of the volatile compounds produced. *LWT –Food Science and Technology*, (1996),29, 63-70
- [23]. Decock, P., Capelle, S. Bread technology and sourdough technology, *Trends Food sci. tech.*(2005), 16, 113-120
- [24]. Grba S. Yeasts in biotechnological production. *Pleiades*, Zagreb, (2010), 319-325

Doc.dr Vesna Boljević. "Possibilities Of Improving The Quality Of Mixed Rye Bread By Adding Sourdough." *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)*, 15(12), (2021): pp 48-52.