A HEALTHY APPROACH OF BREADMAKING: SUPERIOR VALORIFICATION OF LACTIC STARTERS

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Abstract: *Bakery products are beneficial to human consumption due to their high protein content. As a natural source of protein, wheat flour is considered the main raw material in bakery. This must be consistent and its properties must be determined by performing laboratory tests. For the curent research, three types of flour were analyzed using physicochemical methods: determination of acidity, wet gluten content and hydration power. Following these analyses, it was concluded that only one type of flour is in compliance with the actual standards. The flour was used to prepare starter cultures in order to highlight the possibility of using them in bakery as well as their role in the bread process. Using two starter cultures, two types of bread were obtained. Based on the two types of bread, different analyses were performed to highlight their characteristics.*
Keywords: *bakery products, superior quality, flour, milk, starter cultures.*

1. INTRODUCTION

Appearance is one of the basic clues to the visual appreciation of bread quality. Particularly, it is important for bread made of wheat flour, because the appearance defines quality. Several studies have shown that bread and bakery products can be eaten directly after production because the flour used has previously been subjected to a hydrometric treatment which improves the properties of the flour - especially the color of the gluten contained - the hard gluten becomes plastic, and weak gluten becomes elastic. Also, the hydrometric treatment increases the flour extraction as a consequence of the decrease of the mineral quantity, reducing the electricity consumption during milling. Following application of this type of treatment, digestibility of starch and proteins is increased, improving structure by fermentation with yeast or starter cultures.

Modern bread making processes involve the use of biotechnology-specific parameters by highlighting the properties of cereals and starter cultures by using enzymes as process biocatalysts by applying the latest discoveries and continuous fermentation technologies.[5]

As is known, starter cultures, also called starter organisms, are those cultures that are obtained from a pure stock culture and which, passing through the intermediate cultures - passages, become later able to be used to produce fermented foods. Starter cultures can only be used by a single microorganism, known as monocultures, or from several microorganisms. At metabolic level, starter organisms are biocatalysts that trigger biochemical processes that completely transform the substrate with which they come into contact. These biocatalysts are lactic bacteria, enzymes and vitamins.[6]

In the fermenting process of bread, starter cultures play a particularly important role, contributing to the conferring of organoleptic and palatable characters. Their main feature is to guide biochemical processes that provide a degree of innocuity, including the ability to preserve the product. Another important aspect of the role of starter cultures in bakery means their predilection for accumulation in an acidic environment, stimulating the production of lactic acid which limits the development of pathogenic alterations and microorganisms, avoiding the formation of toxic substances in this category consisting of biogenic amines. Regarding the organoleptic character of the bread obtained by the use of starter cultures, research has determined that they provide the appropriate sensory and nutritional characteristics, as well as obtaining products from similar batches.[2]

In order to use a microbial culture as a starter culture for the production of fermented products, it must contain a certain number of living, viable micro-organisms on the product unit, be neither pathogenic, not toxic, not to produce antibiotics for therapeutic purposes in humans and have the specific activity of producing lactic acid. [11]. Fulfilling these conditions is absolutely necessary because starter cultures are consumed alive with the food, in case of the present study, bread.

The use of lactic bacteria for the production of starter cultures in bakery is a less well-researched issue, but of particular importance. Research in this study supports the idea that lactic bacteria can effectively contribute to the development of the bakery industry and implicitly to the creation of new products.[3],[1]

2. MATERIALS AND METHOD

2.1. Materials

The raw material used for carrying out the present study - different types of wheat flour, was obtained from several milling units in the surroundings of Brașov County. It was kept in the laboratory for an interval of hours before, in order to keep it at ambient temperature of about 23 °C before being subjected to the analysis.

2.2. Methods

Analysis of different types of raw material flour. Several types of physico-chemical analyses have been carried out on wheat flour assortments. The analyzes were performed by two operators in order to verify the correctness of their performance and at the end of the determinations the data were centralized and an average of the results was made. A first type of analysis was the determination of the acidity of the three types of flour. The titration method was used with sodium hydroxide solution 0.1N in the presence of phenolphthalein as a color indicator. A mixture of 5 grams of flour and 50 milliliters of distilled water was made, which was mixed until homogeneous mixture. Titration was performed until the color of the mixture became pink and persisted for one minute.
The second analysis was to determine the wet gluten content of each flour assortment. To perform this type of analysis, 25 grams of flour and 12.5 milliliters of sodium chloride in a porcelain mortar were poured into a porcelain mortar and kneaded until a homogeneous dough was obtained. The obtained dough was washed under a stream of water immediately after kneading over a silk surface. Dough fragments, fallen on the sieve during washing, were added to the washed dough. Washing was considered completed when the drops dropped by hand on squeezing gluten over a glass of clear water did not disturb the water, and when there was no bran in the mass of gluten left after washing.
The third analysis was performed to determine the hydration capacity of the three flours. This type of analysis involves mixing 10 grams of distilled water with 10 grams of flour, then adding another 10 grams of flour progressively until the dough formed no longer contains flour, which is the end of the analysis.
Following laboratory tests on the three types of flour, one was chosen to meet all the requirements of the Standard. This type of flour was further used to make bread. In order to obtain the two types of bread corresponding to the starter cultures, the three-phase method was used: starter, leaven, dough.

2.3. Preparation of starter cultures

Approved flour was used to make two starter cultures. A starter was obtained using yeast, and lactic cultures were used to prepare the second starter. The two cultures were heat treated at 50 °C for 40 minutes.

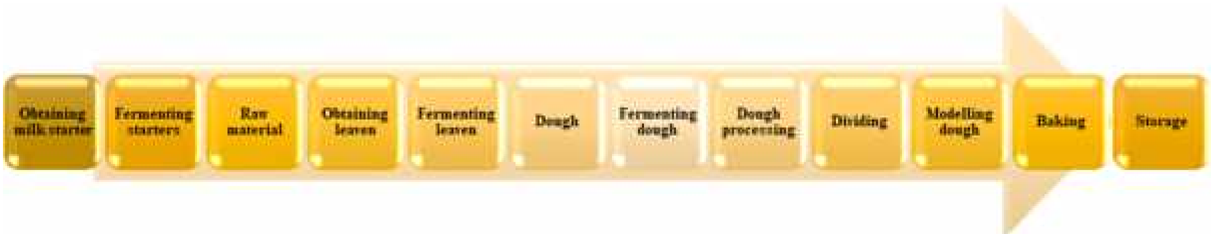

Fig.1. Technological flow for obtaining bread with different starters

2.4. Leaven preparation

There were used the two starter cultures obtained and was added water with a temperature of 28°C, flour and salt as an addition. Two leaven were prepared and subjected to heat treatment at 40 °C for two hours.

2.5. Dough obtaining

After a two-hour interval, the leaven were used to prepare two types of bread dough. Additional amounts of flour, yeast and water were added. The dough was obtained by manual kneading, making two types of dough corresponding to the two types of starter cultures mentioned: one classic and one acid. The two types of dough were kept for a minimum temperature of 40 °C for 40 minutes.
Subsequent to the fermentaion of the two types of dough followed the modeling, division and weighing of the divisions. Dividings of 500 g of dough were obtained, which were placed in baking form and kept at 25 °C for 40 minutes to stimulate the activity of the starter and yeast used.
The baking process was carried out in a range of 35-40 minutes at 200 ºC depending on the type of bread obtained using the laboratory electric oven. After completing this process, the two types of bread were cooled to perform laboratory analyses.
Analysis of the two types of bread obtained. In order to verify the physico-chemical properties of the prepared bread products, a series of analyses were carried out to study their volume, porosity and acidity. The study of the three aspects was carried out after 72 hours of storage of the two types of bread at a temperature of 25 degrees.
The volume study was carried out using a parallelepiped shaped bowl filled with poppy seeds. Poppy seeds have been used since they have a small volume, which allows accurate determination of the bread volume. The level of poppy seeds in the box was brought to the mark, and then their mass was measured. The volume of the box was calculated, and then each of the samples of bread was analyzed. The box was filled to the mark with poppy, covering the bread. The amount of remaining macer was weighed, and the result of weighing was considered the volume of the respective bread.
The bread porosity analysis was performed according to the regulations in force, by determining the volume of pores and voids in the analyzed sample. Thus, two samples of each piece of bread were made by cutting a 2 cm slicing. The volume of the pore sample was examined, then the volume of the sample without pores was determined by grinding and compressing the sample in a container.
The acidity of the core of the two types of bread was determined by titration with sodium hydroxide 0.1N, in the presence of phenolphthalein, until a persistent pink one-minute color appeared in the mass of the sample. For the determination of acidity, 25 grams of bread sample was mixed with 200 milliliters of distilled water, the two parts being mixed until homogeneous and subsequently filtered.

3. RESULTS AND DISCUSSIONS

Taking into account the results of the analysis conducted on the two types of bread, bread with dough and bread with lactic starters, were obtained a series of experimental values which were interpreted and compared with the National Standards values.
Concerning flour, in order to obtain satisfactory results, there was used only one type of flour from the three types, and those with the best results regarding physico – chemical analysis was used in the next stage of breadmaking, for bread obtaining.

Table. 1. Physico - chemical analysis of the three flours according to SR 877-95 [1996] Wheat flour for bakery.

No.	Codification	Acidity ^{0}T		Hydration capacity %		Wet gluten content %		Quality class	Observations
1.	White wheat flour A	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	White wheat flour type 650	Very good, corresponding
		2,5	2,7	68,8	69	31,8	32		
		2,6		68,9		31,9			
Values according to STAS		2,2-3,0		over 60 %		15-50 %			
2.	White wheat flour B	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Wheat flour type 1300	Satisfactory
		4	4	57,9	58,1	31,1	31,3		
		4		58		31,2			
Values according to STAS		3,0-4,0		58-64 %		24-25 %			
3.	Flour type C	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Wheat flour	Unsatisfactory

		3,5	3,7	50,2	50,0	40,5	40,3	type 900	
		3,6		50,1		40,4			
Values according to STAS		3,0-4,0		58-64 %		24-25 %			

For each type of flour several features have been studied to obtain essential information about their properties. Analyzes were performed by two operators to avoid possible errors that may occur during the determinations. A first analysis was the determination of acidity. For Type A white flour, the average of the two determinations resulted in a value of 2.6 ^{0}T, which, according to standard SP 3127-95 white wheat flour (type 480, 000, 550, 650), falls within the limits of 2,2-3,0. For type B flour, the average of the two samples is 4 ^{0}T, a value that falls within the limits of standard SP 2498-95 Black wheat flour (types 1250 and 1350). For type C flour, the average of the two samples is 3.6 ^{0}T, a value that falls under SP 3128-95 Semi-white wheat flour (type 800 and 900). From the point of view of acidity, all three types of flour fit according to STAS.

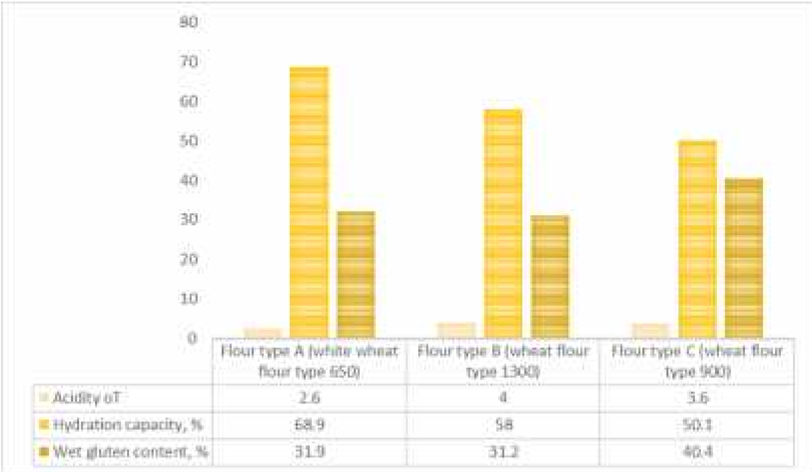

Fig.2. Physico – chemical analysis of the three types of flour

Due to the hydration capacity, the following aspects were found, namely: Type A flour has a very good hydration power, with a sample average of 68.9% (according to STAS - over 60%); Type B flour has a hydration power at the lower limit of the standard, resulting in a satisfactory flour with a sample average of 58% (58-64% standard); and Type C flour has a poor hydration capacity of 50% below the 58-64% standard limit.

As a result of this analysis, it could be noticed that only Type A flour and Type B flour were appropriately framed in STAS, the type C flour not being included in the standard.[10]

For the analysis of wet gluten, the following were noted: Type A flour has a gluten content of 31.9% and falls within the standard between 15-50%, with a well-defined aspect of the gluten bile on a flat surface; Type B flour exceeds the upper limit of the standard (24-25%), with a value of 31.2%, the gluten ball flattening slightly at the top; and C-type flour has an average moisture content of 40.4%, a value that far exceeds the upper limit of the standard (24-25%), giving a mucilaginous, disgusting appearance.

In the process of bread making, white flour type A 650 was used as the raw material since it achieved the best physico-chemical characteristics.

Table 2. Physico – chemical properties of white bread (after 72 hours)

No.	Type of bread		Bread mass, g	Baking mode	Volume, cm^3	Porosity % min.		Acidity, °T	Observations
						Core volume with pores, cm^3	Core volume without pores, cm^3		
1.	Bread with yeast as starter culture	Sample 1	432,6	shape	295	73	65	3	According
		Sample 2	425,8	shape	293	73	64	3	
2.	Bread with lactic cultures as starter cutures	Sample 1	433,6	shape	290	70	54	2,2	According
		Sample 2	443,9	shape	290	70	52	2	

After removing the bread from the oven, it was analised after 72 hours, in order to observe the satisfactory or unsatisfactory evolution of the bread during the 3 days.
From an organoleptic point of view, after 72 hours, this unadjusted bread does not suffer any change in smell or taste, only the consistency of the bread loses its elasticity, becoming slightly stiff.
The bread was molded in shape with a mass of 500 grams each. Immediately after baking, when removed from the oven, the bread was weighed using the electronic balance, resulting in losses resulting from the maturing and baking process, the mass having a value of 475.75 grams of bread from starter cultures with yeast and a value of the bread mass of starter cultures with 471.66 grams of lactic crops.
The bread was kept in an airtight container covered with a cotton towel at a room temperature of 22-25 °C for 72 hours.[8]
At the re-breading of the bread after the 72 hours it was found that its mass decreased to an average of 429.2 grams in the case of the yeast starter bread and 438.75 grams in the case of bread from the starter cultures with lactic crops , due to the loss of water that arose from the product evaporation phenomenon.
In the case of bread from yeast starter cultures, the bread volume differs slightly, sample 1 having 295 cm^3 and sample 2 having 293 cm^3. This difference is considered to be a defect in modeling, since operations such as weighing, dosing, mixing, modeling were performed by human operators, thus interfering with random errors.
In bread from starter cultures with lactic culture, the volume is constant, with a value of 290 cm^3, which means that the modeling was done correctly for both samples.
After the half-life of the bread, the pore core volume and the pore-free core volume were analyzed. On the yeast stater bread, a difference of about 10 cm^3 between the two samples is observed in the case of the pore core volume and the porosity of the pore-free core volume is the same for both samples of 65 cm^3.
Bread of starter cultures with lactic cultures has a pore core volume equal to the two 54 cm^3.
According to STAS SR 878/1996, bread acidity has an average value of 2 ^{0}T. This value is valid for a standard amount of yeast used in an exact bread making recipe. It is also taken into account that this analysis took place 72 hours after the bread was made.

4. CONCLUSIONS

Bread is a baking product of crucial importance in food, and raw material and auxiliary materials are used in its manufacture, the most important raw material being wheat flour. In order to obtain the best quality products, the flour has to comply with and meet the required standards.[4]
The final quality of bread depends on the quality of raw and auxiliary materials, but also on a number of decisive factors in obtaining such bread, such as: flour quality, dough kneading, dough temperature, fermentation, manipulation, modeling, baking, practically the entire technological process .

The goal of every bakery professional is to obtain a high quality bread that is well aerated, tasty, appetizing, but most important to be healthy, with exceptional nutritional value without additives and food additives.
In order to achieve the objectives of the experimental research, three types of unalloyed flour were proposed as raw material: 650 white flour, 1300 black flour, 900 black flour. After analyzing the flour, a number of quality characteristics were determined SR 877-95 [1996], the best results being recorded by the 650 white flour, which constituted in the next step the raw material used. Other materials used to make the dough were yeast, dietary salt, lactic culture from whey and water.[7]
Through this scientific work, it has been desired to demonstrate the particular properties of starter cultures based on lactic starters derived from milk for the production of bakery products as compared to yeast starter cultures. Bread made with this lactic culture starter culture has a higher protein content, since they come from flour, but the highest amount of protein comes from milk whose whey has been extracted.
As a result of the organoleptic analysis of this bread, the following were noted: after the baking, the bread retained the shape in which it was molded, the crust is crispy and has a brown-brown color, the core is elastic, unpalatable, taste and smell are pleasant, aromatic, with no odor or taste of whey.
After 72 hours, the bread does not undergo major organoleptic transformations. The smell and the taste remain just as pleasant, just the consistency changes slightly, becoming drier, but without becoming improper for consumption.
The same organoleptic characteristics are also valid for yeast starter loaves after storage for 72 hours, the smell and taste remain just as pleasant, only the consistency becomes stiffer.
Thus, through this experimental laboratory work, the dough growth capacity with the starter cultures based on whey-based lactic crops, without altering the physico-chemical, rheological, biochemical properties of the dough, which ultimately depends on the quality of the bread and which has kept its integrity for 72 hours without the smell and taste of the rancid or mold stains.
Bread based on starter culture, lactic crops can be called "Traditional New Product," because it has only water, flour, salt, whey, without other breeders to confer better tolerance to maturation, an increase in volume faster in a shorter time or longer storage time.

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