HIGH-FIBER WHEAT BREAD PRODUCED WITH FERMENTED BRAN

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Abstract: *Dietary fiber is a common and important ingredient of a new generation of healthy food products demanded more each day by the consumer. One of the main sources of dietary fibre is cereals and cereal products. This study is dedicated to investigate the application of new sources of dietary fiber such as fermented bran for increasing the nutritional value of wheat bread. The objectives of the present investigation were to compare the effects of spontaneous fermentation of the bran fraction and fermentation with added yeast or added yeast and lactic aceid bacteria (Lactobacillus delbrueckii subsp.bulgaricus) on the quality of wheat bread supplemented with bran. Prefermentation with yeast and lactic acid bacteria had the greatest effect on the general quality of obtainig breads: improved the loaf volume, crumb struture and the shelf-life of bread supplemented with bran. Fermentation of wheat bran with yeast or with yeast and lactic acid bacteria improved the loaf volume, crumb structure and shelf-life of bread supplemented with bran. Even though we used bran instead flour for the fermentation, the results are similar to the effect of sourdough on bread quality. Spontaneous fermentation of the bran fraction did not have the same positive effects on bread quality.*

Keywords*:* *yeast, lactic acid bacteria, fermentation*

Introduction

Cereals (wheat, rye, oat, corn, sorghum, millet and rice) have been an all times and will always be the most important plant group for the human existence and activity. Some researchers estimated, even from the beginning of this century, the potential advantages of food fibres in preventing some chronic affection. For a healthy person, the recommended fibre ratio is placed at medium value of 30grams fibres/day, half of which must derive from cereals.

Due to the main humankind concerns regarding the increase of population health state in general and obesity control in particular, we may say that the development of some cereal and pseudo-cereal processing technologies becomes of fundamental importance.

The make of no refined based – products is highly necessary especially that lately it has been demonstrated that weight increase is directly related to food ratio from refined cereals [1]. This show how important is for us to make the difference between the products of whole grain and those of refined cereals to help weight control. One way to obtain high-fiber wheat bread is to add bran in the bread formulas. [6]

A major disadvantage could be the fact that when we used bran in order to supplement the wheat bread, ussualy we could observe a wakenes of structure and baking quality of wheat dough and, also, a decrease of volume and elasticity of the crumb. The effect has been atributed to the dilution of gluten wich would affest the gas-holding

capacity of the dough [2]
The increased concentration of insoluble and soluble cell wall material may also have detrimental effects on dough structure. Bran particles can machanically disrupt the structure of the gluten network. The baking quality of bran could be influence also by the size of particle or by the chemical components like soluble pentosane and ß-glucan. [4]
As the specific volume of bread is one of the important quality characteristics, differnt bran pretreatmens have been used to improve the volume of breads supplemented with bran.
The aim of the present study was to improve the quality of wheat bread supplemented with bran by prefermentation of the bread fraction. We compared the effects of spontaneous fermentation and fermentation with yeast or with yeast and lactic acid bacteria on the quality and the crumb structure of bread supplemented with 20% wheat bran.

Materials and methods

In order to obtain some available experimental data we used commercial white wheat flour and wheat bran, provided by local producers. The chemical composition of the material is given in table 1.
The analytical flour quality was determined according to the international standard methods (ash content – ICC104/1, wet gluten – ICC105/2, protein content – ICC106/2). The moisture content of the wheat flour and bran were determined by oven drying at 130^0C for 1 hour. [3]

Table 1.

Analytical Parameters of the Raw Materials

Component	Wheat flour	Wheat bran	80% Flour +20% Bran
Moisture	13.42	14.3	13.86
Protein (N x 6,25	8.5	8.2	8.5
Total dietary fiber	2.7	52.0	12.6
Total pentosan	1.9	26.0	7.3
Starch	78.8	12.0	64.2
Wet gluten	27.11	-	27.05
Ash	0.49	0.54	0.51

Starch content was determined by Megazyme colorimetric method and total dietary fiber byenzymatic-gravimetric method of Douglas. [3]
The starter culture of *Lactobacillus delbrueckii subsp.bulgaricus* (JOINTEC) was obtained from S.C.Liliput S.A. Constanţa. Instant active dry yeast from Rompak S.A. Pascani, was used for bran pretreatment and baking.
In order to obtain some available experimental data our breads we use formulas which are given in table 2.

Table 2.

Bread Formulas

Component, g	Control bread	Bread with bran addition
Wheat flour	500	400
Wheat bran	-	100
Yeast	7.5	7.5
Salt	7.5	7.5
Sugar	7.5	7.5
Fat	7.5	7.5
Water	345	400

The doughs were mixed with a spiral mixer for 8 min. After a floor time of 20 min at 28^0C, the dough was divided into 400g loaves. The loaves were proofed in pans (55 min at 35^0C) and baked at 200^0C for 25 min. [5]

After baking, the samples were cooled 6-8 hours in controlled atmosphere (UV lamps). In order to be scoring (after 24 hours), the samples were sliced for packed in plastic bags. Crumb structure was determined after 24 hours of cooling by means of a Stereomicroscope

In order to obtain the fermented bran we used an adapted method (M.Salmenkallio-Marttila, K.Katina, K.Autio, 2001): 100g bran was mixed with 350 g of water and dry micoroganisms (1.25g of yeast ore 1.25g of yeast and 0.162 of *L. Bulgaricus JOINTEC*) in a large bowl; the bowl was covered with aluminum foil and incubated in temperature room. After tretment, the *p*H an total titrable acidity (TTA) were measured. The TTA was expressed as cm^3 of 0.1 M NaOH/10g of bran suspension.

The experiments are made in the research laboratory of "Ştefan cel Mare" University of Suceava, Faculty of Food Engineering.

Results and discussions

In order to obtain some available data we made the following samples:

P1: Bread with 20% bran without pretreatment
P2: Bread with spontaneus bran fermentation, 4hour
P3: Bread with spontaneus bran fermentation, 16hour
P4: Bread with prefermentation bran with yeast, 4hour
P5: Bread with prefermentation bran with yeast and lactic bacteria, 16 hour
P6: Control bread without bran

- **Effect of bran fermentation on the loaves volume**

Baking experiments showed that wheat bran at a substitution level of 20% decreased loaf volume by 19% in comparision to white control bread (figure 1)

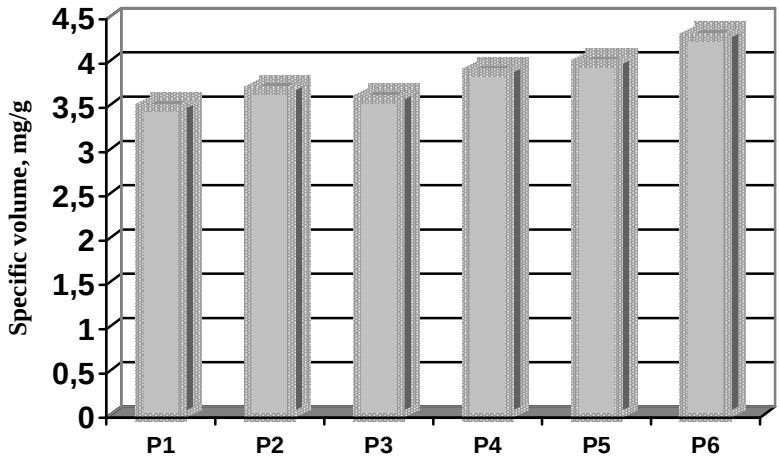

Figure 1. Effect of bran fermentation on loaf volume off breads supplemented

As it could see in figure 1, bran treated by short fermentation with yeast (P4) and long fermentation with yeast and lactic acid bacteria (P5) improved the specific bread volume over untreated bran by 10-15%.

The 4 hour spontaneous fermentation of bran (P2) slightly improved specific volume, whereas the 16-hours spontaneous fermentation (P3)had no effect on bred volume.

➢ **Effect of bran fermentation on the pH and TTA of Bran-Water Slurries**

As it could see in table 3**,** bran possessed a good buffering capacity, that's why the pretreatment had only a slight effect on the pH of the bran slurries.

Table 3.

Effect of bran fermentation on the pH and TTA of Bran-Water Slurries

	P2	P3	P4	P5
Yeast	no	no	yes	yes
Lactobacillus delbrueki subsp.bulgaricus	no	no	yes	yes
Fermentation time, hour	4	16	4	16
Temperature, ^{0}C	28	25	28	25
Initial pH	6.6	6.6	6.6	6.6
Final pH	6.6	6.5	6.6	5.8
Initial TTA	3.3	3.3	3.3	3.3
Final TTA	3.3	4.4	5.9	8.7

The bran fermented by lactic acid bacteria and yeast was the most acidic (pH=5.8, TTA=8.7), whereas spontaneous fermentation of the bran for 16 hours had a smaller effect, pH= 6.5 TTA = 4.4. Wheat sourdoughs usally have value of pH=3.5 to 4.5 and TTA values from 8 to 22, depending on the ash content of the flour and the starter culture used. Higher ash content of the flour gives more acidic pH and higher TTA values.

If we compare the pH and TTA values presented in the literature we can see that the lactic acid bacteria-yeast fermented bran was not very acidic.

Addition of baker's yeast to the sourdough slow the souring. Bran contains a much higher number of microbes than flour. So we could notice that adding starter cultures to the bran instead of spontaneous souring is advisable for the production of bread with an even repeatable quality.

➢ **Effect of bran fermentation on the crumb firming.**

In order to analyze the crumb firmness it were made tests on breads from each of the dough with Voland –Stevens crumb firmness analyzer in baking day and after each half of next three days.The results are given in figure 2.

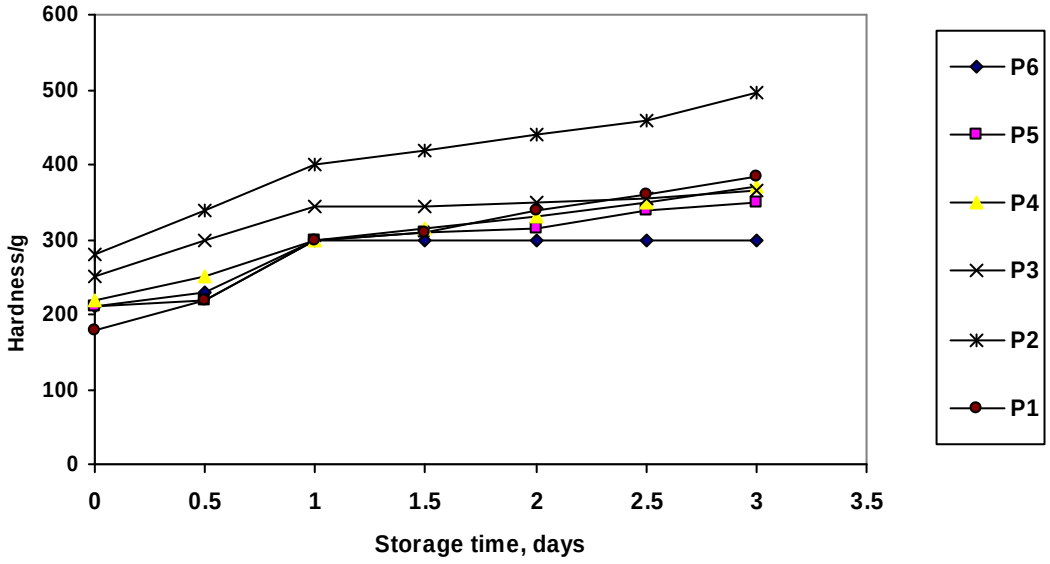

Figure 2. Effect of bran fermentation on crumb firmness of bread supplemented

Four– hours fermentation with yeast (P4) and 4-hours spontaneous fermentation of the bran (P2) slowed the crumb firming slightly during three days of storage in comparision with white control bread (P6).
The bread baking with bran treted by 4-hours fermentation with yeast (P4) was slightly more firm than white control bread (P6) after storage for three days, but the firming rate (the changes in firmness from day0 to day 3) was much smaller.
The 16-hours fermentation with yeast and lactoc acid bacteria (P5) improved the crumb softness and keeping qualities most.
On the day of baking, all breads supplemented with bran were firmer than the white control bread (P6), but after storage for only one day, the crumb firmnes of the white control bread (P6) was the same as that of the bread baking with fermented bran.

After 3 days of storage the bread baking with yeast and lactic acid bacteria (P5) was softer (20%) than the white control bread (P6).

Conclusions

Fermentation of wheat bran with yeast or with yeast and lactic acid bacteria improved the loaf volume, crumb structure and shelf-life of bread supplemented with bran.

Even though we used bran instead flour for the fermentation, the results are similar to the effect of sourdough on bread quality.

This a very interesting result especialy if we take into consideration the fact that we used *Lactobacillus delbrueckii subsp.bulgaricus* instead of *Lactobacillus brevis* (usualy used for flour fermentation in bakery).

Endogenous enzymes of flour, especialy amylases and proteases, as well as the enzymes produced by yeast and *Lactobacillus delbrueckii subsp.bulgaricus* during fermentation seem to have a positive effect on the dough properties and the structure of bread.

Acid produced during the fermentation lower the pH level of the dough, thereby affecting the enzyme activity and gluten characteristics.

If we use bran fermented for repalcing 20% of flour and by optimizing the baking process it is possible to produce good consumer quality wheat bread containing up to 10% dietary fiber.

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