

## THE SUPERIOR USE OF CEREAL RESOURCES FOR THE OBTAINING OF THE DIETETIC BAKERY PRODUCTS

### Obtaining the dough with barley flour addition

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**ABSTRACT:** This research program was done in order to obtain bakery products with barley flour addition. It confirms the complex effect of barley flour about reological and quantitative features of dough.

**KEYWORDS:** barley flour, bakery produces, dietetic products

**RESUME :** Le programme de recherche a été effectuée pour l'obtention des produits de panification avec un ajout de farine d'orge. Il a confirmé l'effet complexe de la farine d'orge sur les traits rhéologique et qualitatif de la pâte.

**MOTS CLE:** farine d'orge, produits de panification, produits diététiques

## THEORETICAL CONSIDERATIONS

Today, the bakery industry knows an intensive program for diversifying the assortment of raw materials through the superior utilization of cereal resources contained in bread assortments obtained from barley, oat, and soy [1].

The barley area justifies the reserve of raw material of barley flour. In our country the barley crops are found in all regions, either in the shape of fall or spring crop [2, 3].

The barley flour with a reduced use in the bakery industry can find a large utilization for obtaining dietetic products that request considerable fiber content. The chemical composition of barley flour that contributes to the development of bakery features, is obvious through:

- the flours obtained of barley varieties, have a small gluten content, but can replace the wheat flour in balanced and compatible proportions;
- the gluten complex respectively: gliadine and glutenine, has specific features, that can request suitable conditions to obtain the dough;
- the maximum of jellification can be placed in the 85-93 °C limits, the values similar to those from the jellification of wheat flour.

The chemical composition established for barley flour, is the following: glucides 74.3 %, proteins 9.5 %, raw fat 1.4 %, cellulose 1 %, mineral substances 1.5 %, amilolitic activity in variable conditions of 180 – 300 mg maltose for 10 g flour. In order to obtain the bread assortments with dietetic utilizations were used dough with mixture of barley and wheat flour [4 - 6].

## MATERIALS AND METHODS

The experimental program was conceived with the utilization of programming model of experiences in the centered system by second degree, having four independent variables and 31 experiments (Table 2).

The independent parameters with technological influence in the fermenting process of dough, are presented in table 1:

*Table 1. Experimental conditions*

Independent variables	X <sub>i</sub>	Codified values					
		-2	-1	0	1	2	Δx
		Actual values					
Barley flour %	X <sub>1</sub>	0	3	6	9	12	3
Sodium chloride type A, %	X <sub>2</sub>	0.75	1.50	2.25	3	3.75	0.75
Duration (minutes)	X <sub>3</sub>	31	33	35	37	39	2
Temperature (°C)	X <sub>4</sub>	30	35	40	45	50	5

Raw materials and the conditions of utilization are:

- wheat flour type 800;
- water 50 ml at 100 g mixture of barley and wheat flour;
- bakery dregs, 5 %;
- kneading duration, 10 minutes.

The experimental program was done in order to limit the adding of fall barley flour in comparison with wheat flour until 12 % quantitative ratio, to assure the equilibrium of gluten content.

Table 2. Experimental program for dough fermentation

No	X <sub>1</sub> = barley flour, %		X <sub>2</sub> = NaCl, %		X <sub>3</sub> = duration, minutes		X <sub>4</sub> = temperature, °C	
	Codified	Real	Codified	Real	Codified	Real	Codified	Real
1	-1	3	-1	1.50	-1	33	-1	35
2	1	9	-1	1.50	-1	33	-1	35
3	-1	3	1	3	-1	33	-1	35
4	1	9	1	3	-1	33	-1	35
5	-1	3	-1	1.50	1	37	-1	35
6	1	9	-1	1.50	1	37	-1	35
7	-1	3	1	3	1	37	-1	35
8	1	9	1	3	1	37	-1	35
9	-1	3	-1	1.50	-1	33	1	45
10	1	9	-1	1.50	-1	33	1	45
11	-1	3	1	3	-1	33	1	45
12	1	9	1	3	-1	33	1	45
13	-1	3	-1	1.50	1	37	1	45
14	1	9	-1	1.50	1	37	1	45
15	-1	3	1	3	1	37	1	45
16	1	9	1	3	1	37	1	45
17	-2	0	0	2.25	0	35	0	40
18	2	12	0	2.25	0	35	0	40
19	0	6	-2	0.75	0	35	0	40
20	0	6	2	3.75	0	35	0	40
21	0	6	0	2.25	-2	31	0	40
22	0	6	0	2.25	2	39	0	40
23	0	6	0	2.25	0	35	-2	30
24	0	6	0	2.25	0	35	2	50
25	0	6	0	2.25	0	35	0	40
26	0	6	0	2.25	0	35	0	40
27	0	6	0	2.25	0	35	0	40
28	0	6	0	2.25	0	35	0	40
29	0	6	0	2.25	0	35	0	40
30	0	6	0	2.25	0	35	0	40
31	0	6	0	2.25	0	35	0	40

## RESULTS AND DISCUSSIONS

The influence interpretation of the independent variables was accomplished by the particularization of the general regression equation:

$$y = b_0 + b_i x_i + b_{ij} x_i x_j + b_{ii} x_i^2 \quad (1)$$

The dependent variables that express the progress of fermentation process are:

- dough acidity expressed as acidity degrees;
- dough development which is established by its deforming at the ending of the process, compared with the initial situation.

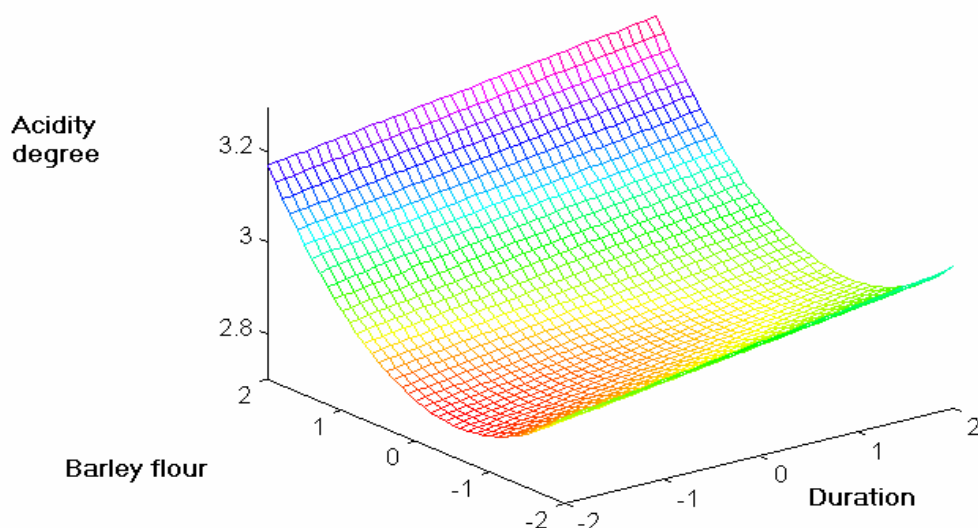
D = dough diameter.

The regression equation particularized for the dependent variable at dough fermentation are presented in table 3:

*Table 3. Regression equations for dependent variables at dough fermentation*

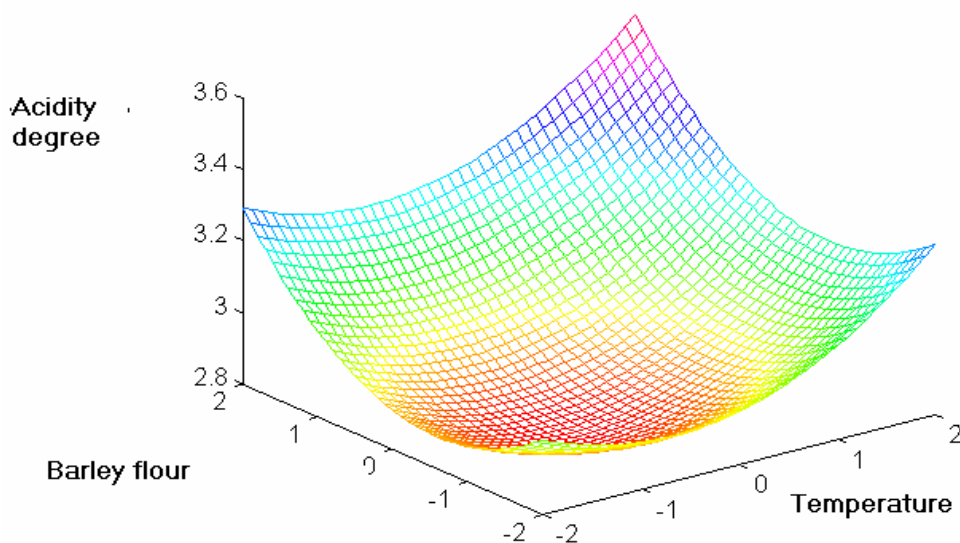
<b>Dependent variable, <math>Y_i</math></b>	<b>Regression equation</b>
Dough acidity	$Y_1 = 2.85 + 0.07x_1 + 0.11x_2 + 0.03x_3 + 0.066x_4 + 0.395x_3x_4 + 0.06x_1^2 + 0.048x_2^2$
Dough deformation	$Y_2 = 0.332 + 0.014x_1 + 0.023x_2 + 0.005x_3 + 0.012x_1^2$

The graphical representation of the regression equations depending on the correlation between dependent variables and independent variables was presented in figures 1, 2 and 3 for the dough acidity and in figures 4, 5 and 6 for the dough deformation.

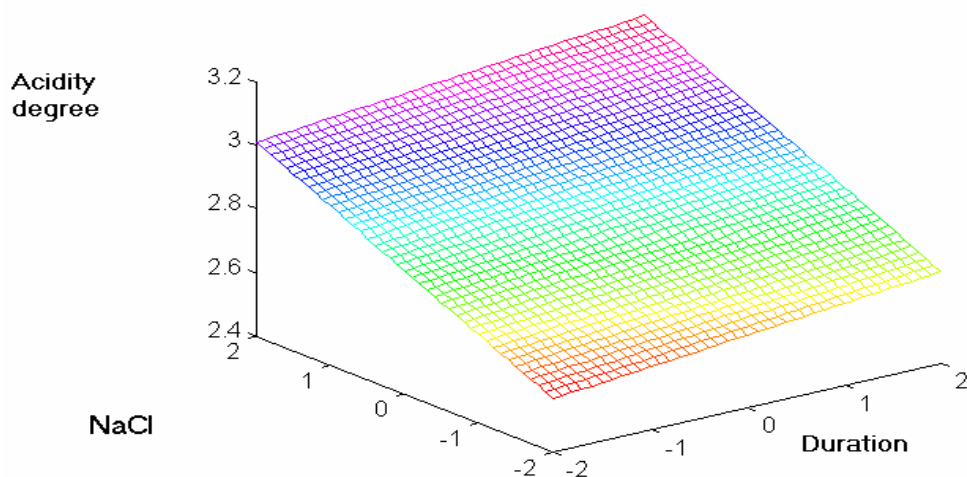


*Fig.1. The dough acidity variation with barley flour addition, depending on the barley flour content (%) and duration (minutes)*

The dough acidity has maximum values in conditions of minimum barley flour addition. In figure 2 it is observed an increasing of the dough acidity when the barley flour quantity decreases. The duration influence concerning the fermentation process of dough is less important, in the situation when the barley flour quantity is maxim.



*Fig.2. The dough acidity variation with barley flour addition, depending on the barley flour content (%) and temperature (degree)*

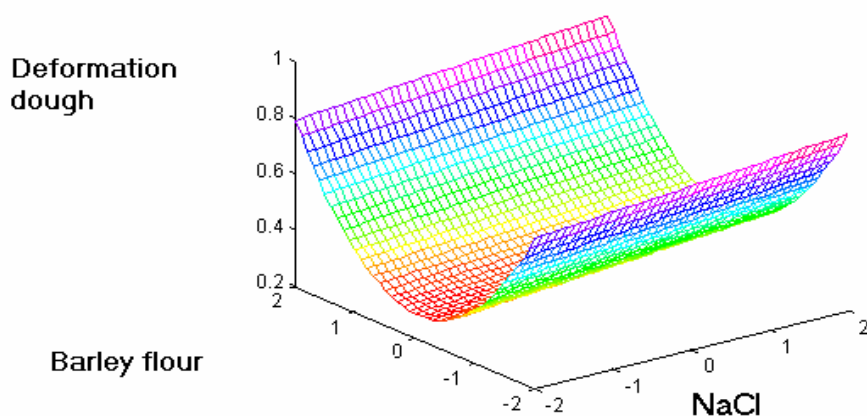


*Fig.3. The dough acidity variation with barley flour addition, depending on the NaCl content (%) and duration (minutes)*

The maximum of fermentation process is obtained when the barley flour content is minim and does not exceed 6 %. In this case the total dough acidity reaches the value of 3.2 acidity degrees.

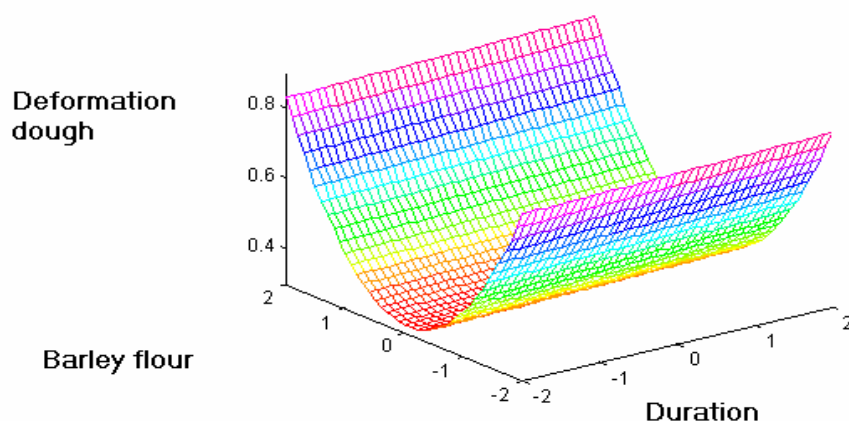
Figure 3 shows that dough acidity with barley flour addition, increases when the sodium chloride quantity is below 2.5 % and the duration of the process is 37 – 39 minutes.

Further on it is reproduced the influence of barley flour adding on the dough deformation.



*Fig.4. The dough deformation variation with barley flour addition depending on the barley flour content (%) and NaCl content (%)*

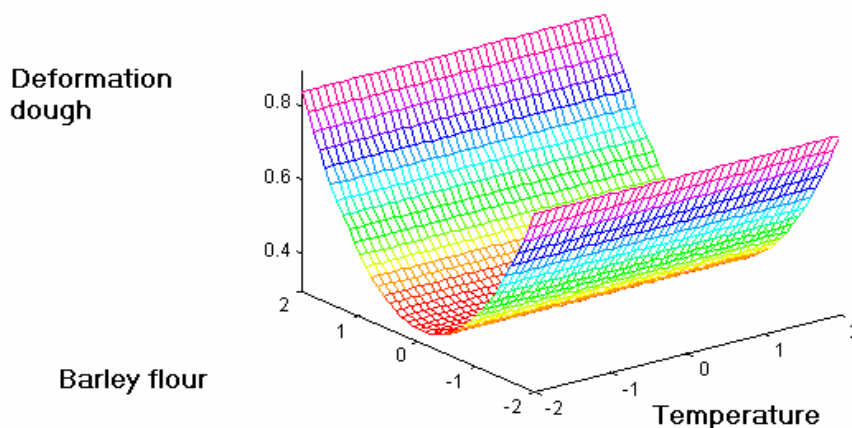
For a normal dough increase, the barley flour quantity varies between 3 and 6 %. The necessary and enough temperature are 30 – 35 °C, and the fermentation time is 35 minutes.



*Fig.5. The dough deformation variation with barley flour addition depending on the barley flour content (%) and duration (minutes)*

In Figure 5 is observed that the dough deformation with barley flour addition is maxim when the barley flour content is minim. In this case, the duration of the process has a less meaningful significance.

The same things were observed in figure 6, namely the dough deformation is minim when the barley flour content is 12 %. This is due to the small gluten content of barley flour.



*Fig.6. The deformation dough variation with barley flour addition depending on the barley flour content (%) and temperature (degree)*

## CONCLUSIONS

The negative influence of barley flour of fermentation process is explained by the small gluten content of barley flour.

This research has the goal to obtain the bakery produces rich in cellulose by barley flour addition.

The research program establishes the following technological parameters that can be used in the process in order to obtain the bakery produces:

- the barley flour addition, 3 – 6 %;
- fermentation temperature, 35 °C;
- fermentation duration, 35 minutes.

It was constantly maintained the bakery dregs content of 3 % and the kneading duration of 10 minutes.

A maximum addition of 6 % barley flour can be considered a positive solution with effects in the nutrition and digestion system of food products.

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