INVESTIGATIONS REGARDING THE USE OF SOY FLOUR AND ZARA IN THE BAKERY PRODUCTS

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ABSTRACT: This paper evidences the positive influence of the addition of zara, a byproduct of dairy industry, in order to obtain dough with soy flour. A 34 – 40 % zara addition in the liquid used for the preparation of dough serves as nourishing compound, improves the dough quality and contributes to the decrease of water consumption in dough preparation.

KEYWORDS: *zara, soy flour, bakery, dough*.

THEORETICAL CONSIDERATIONS

The fortifying of proteins represents an intensive concern for bakery industry [5]. The contribution of mixture of wheat flour and soy flour it is known in proteins synthesis. This process has values that vary in limits 85 – 88 %, depending on the amino acids content [1]. To develop the fermentation process of dough it was used zara, which is a byproduct of dairy industry [3].
Zara has a positive influence in nutritional fortification of bakery products, because of the chemical composition: lactose, proteins and fats [4]. As improvement the fats content contribute supplementary to development of fermentation process [2].
The efficiency of proteins addition in bakery products is obvious through the superior use of zara and the consumption decrease of technological water necessary in dough making [6]. The water consumption decreases depending on the zara quantity [7].

MATERIALS AND METHODS

To realize the factorial experiments (4 independent variables and 31 experiments), the following components have been used:
- soy flour without fats, with 42 % proteins and 8 % humidity;
- zara, byproduct of butter technology, with the following chemical composition:
  - lipids 0.3 %;
  - proteins 3.4 %;
  - lactose 3.6 %;
  - mineral substances 0.7 %.
- wheat flour type 650;
- water and 55 % zara, reported to the mixture of wheat flour and soy flour (zara content varies in accordance with table 1 of experimental program);
- NaCl 1.5 %, bakery dregs 3 %, reported to the mixture of wheat flour and soy flour;
The kneading time was of 10 minutes.
The independent parameters that are the variables with technological influence in the dough fermentation process are presented in tables 1 and 2.

Table 1. Experimental conditions

Independent variables	X_i	Codified values					
		-2	-1	0	1	2	Δx
		Actual values					
Soy flour, (%) reported to mixture flour	X_1	0	3	6	9	12	3
Zara , (%) reported to mixture flour	X_2	20	25	30	35	40	5
Duration of fermentation, (minutes)	X_3	56	58	60	62	64	2
Temperature of fermentation, (°C)	X_4	26	28	30	32	34	2

The selection of independent parameters refers to:
- Reducing of soy flour adding reported to the wheat flour until 12%;
- The water content reported to the soy flour.

RESULTS AND DISCUSSION

In order to correlate the experimental results, a regression equation particularized from general equation:

$$y = b_0 \pm b_i x_i \pm b_{ij} x_i x_j \pm b_{ii} x_i^2,$$

was used.
The dependent variables indicate the unfolding of fermentation process and the dough quality that is reproduced in table 3 and in the figures 1 - 7.

Table 2. Experimental program for dough fermentation

No.	X_1= soy flour [%]		X_2 = zara [ml]		X_3 = duration [minutes]		X_4 = temp. [°C]	
	Codi-fied	Real	Codi-fied	Real	Codi-fied	Real	Codi-fied	Real
1	-1	3	-1	25	-1	58	-1	28
2	1	9	-1	25	-1	58	-1	28
3	-1	3	1	35	-1	58	-1	28
4	1	9	1	35	-1	58	-1	28
5	-1	3	-1	25	1	62	-1	28
6	1	9	-1	25	1	62	-1	28
7	-1	3	1	35	1	62	-1	28
8	1	9	1	35	1	62	-1	28
9	-1	3	-1	25	-1	58	1	32
10	1	9	-1	25	-1	58	1	32
11	-1	3	1	35	-1	58	1	32
12	1	9	1	35	-1	58	1	32
13	-1	3	-1	25	1	62	1	32
14	1	9	-1	25	1	62	1	32
15	-1	3	1	35	1	62	1	32
16	1	9	1	35	1	62	1	32
17	-2	0	0	30	0	60	0	30
18	2	12	0	30	0	60	0	30
19	0	6	-2	20	0	60	0	30
20	0	6	2	40	0	60	0	30
21	0	6	0	30	-2	56	0	30
22	0	6	0	30	2	64	0	30
23	0	6	0	30	0	60	-2	26
24	0	6	0	30	0	60	2	34
25	0	6	0	30	0	60	0	30
26	0	6	0	30	0	60	0	30
27	0	6	0	30	0	60	0	30
28	0	6	0	30	0	60	0	30
29	0	6	0	30	0	60	0	30
30	0	6	0	30	0	60	0	30
31	0	6	0	30	0	60	0	30

The acidity degree of dough presents the most propitious values at a 12 % soy flour addition. It is depending on the added quantity of zara and the duration of fermentation. In this case zara can be used until 40 % of total liquid when the fermentation duration is 60 – 62 minutes and fermentation temperature is 32 °C.

Table 3. Regression equations for dependent variables at dough fermentation

Dependent variable, y_i	Regression equation
Acidity degree, ml NaOH N/1	$Y = 3.71 - 0.023\, x_1 + 1.11\, x_2 + 0.28\, x_3 + 0.76\, x_4 + 0.014\, x_1x_2 + 0.22\, x_1x_4 + 0.56\, x_3x_4 + 1.18\, x^2_1 + 0.712\, x_4^2$
Dough deformation, %	$Y = 25.17 - 0.94\, x_1 + 0.028\, x_2 + 0.15\, x_3 + 0.44\, x_4 - 0.18\, x_1x_2 + 0.16\, x_1x_4 + 1.27\, x_3x_4 - 0.29\, x_1^2 + 0.14x_2^2$
Final temperature of fermentation, °C	$Y = 31.55 + 0.014\, x_1 + 0.022\, x_2 - 0.29\, x_3 + 0.38\, x_4 + 0.09\, x_1x_2 - 0.17\, x_1x_4 + 1.81\, x_2x_3 - 0.28\, x_1^2 + 0.27\, x_2^2$
Humidity, %	$Y = 43.8 + 0.022\, x_1 - 0.018\, x_2 + 0.22\, x_3 + 1.44\, x_4 - 0.18\, x_1x_2 + 0.76\, x_1x_3 - 0.48\, x_1x_4 + 0.11\, x^2_1 - 0.33x_3^2 + 0.27\, x_3^2$
Appearance, marks by 1 to 5	$Y = 4.4 + 0.29\, x_1 + 0.34\, x_2 + 0.018\, x_3 + 0.044\, x_4 + 0.48\, x_1x_2 - 1.15\, x_1x_3 + 0.49\, x_1x_4 + 0.14\, x^2_1 + 1.11x_2^2 - 0.71\, x_4^2$
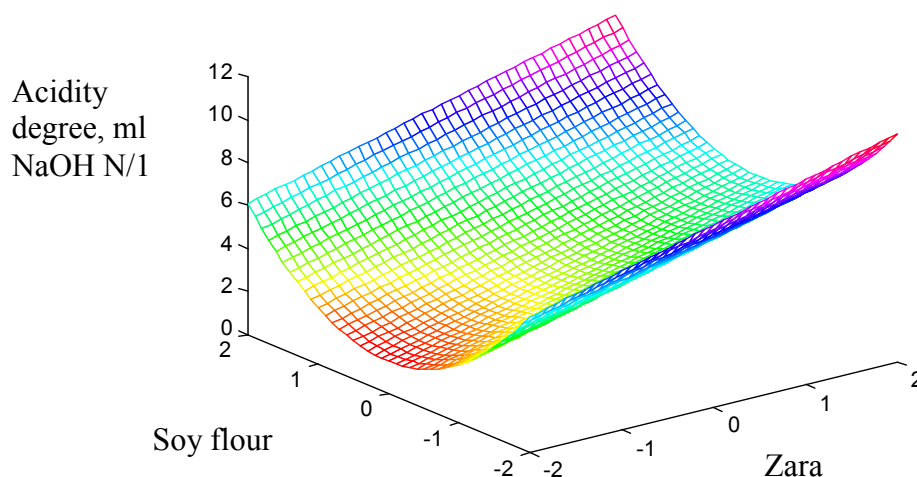
Fig.1. Acidity degree variation of dough made of wheat flour and soy flour mixture and zara, when the temperature and duration are constantly in central domain (30 °C, 60 minutes)
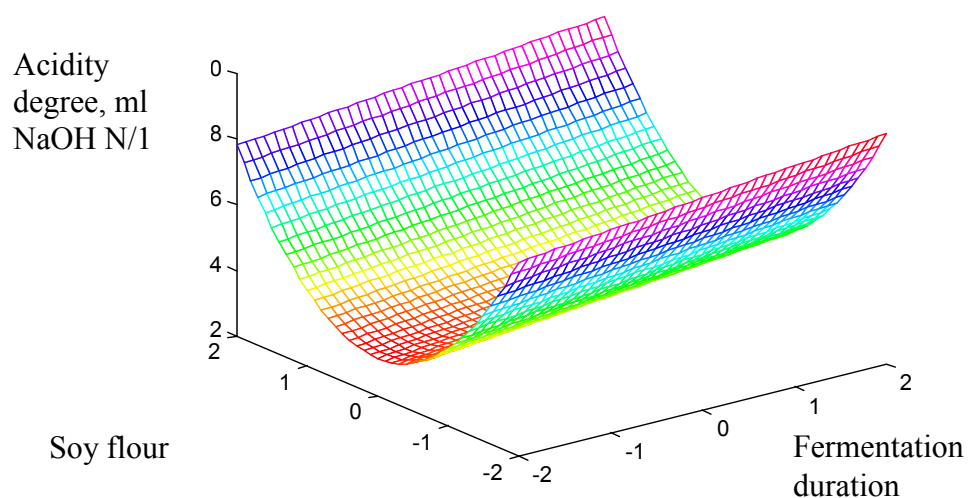
Fig.2. Acidity degree variation of dough made of wheat flour and soy flour mixture and zara, when the zara adding and temperature are constantly in central domain (30 %, 30 ℃)
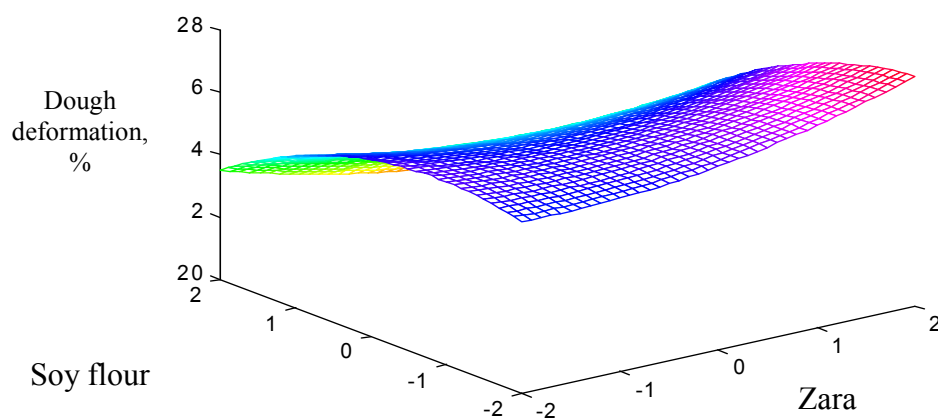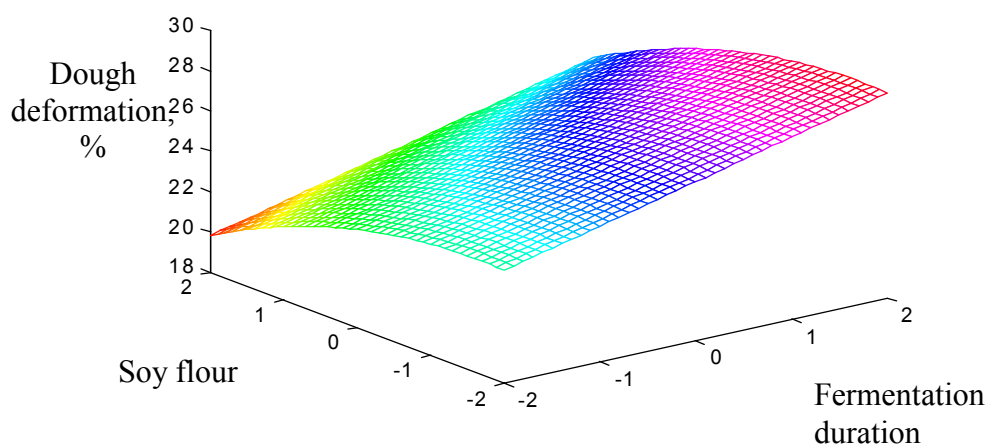

Fig.3. Dough deformation variation of dough made of wheat flour and soy flour mixture and zara, when the temperature and duration are constantly in central domain (30 ℃, 60 minutes)

Fig.4. Dough deformation variation of dough made of wheat flour and soy flour mixture and zara, when the zara adding and temperature are constantly in central domain (30 %, 30 °C)

In these conditions was obtained a development of dough of 24 – 26 %, which is established by the deformation of dough (figures 3 - 6).
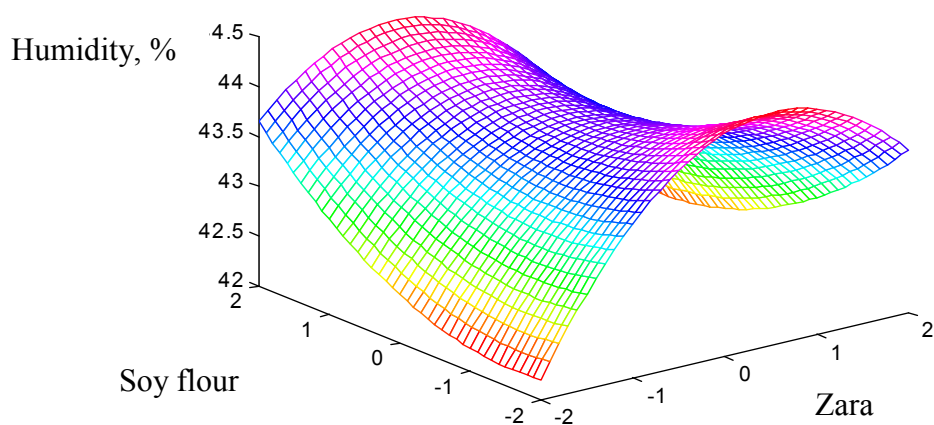
Fig.5. Humidity variation of dough made of wheat flour and soy flour mixture and zara, when duration and temperature are constantly in central domain (60 minutes, 30°C)
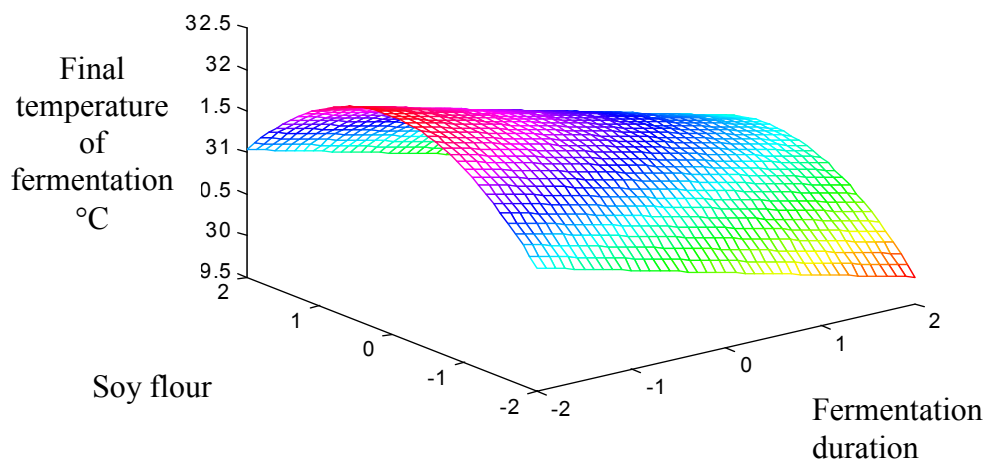
Fig.6. Final temperature variation of dough made of wheat flour and soy flour mixture and zara, when the zara adding and temperature are constantly in central domain (30 %, 30 °C)

In the final stage of development the final temperature of dough was 31 – 32 °C.
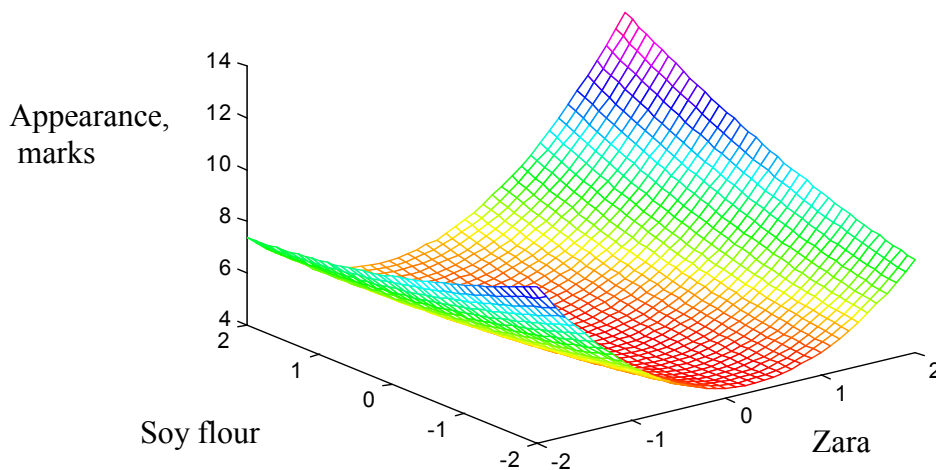

Fig.7. Appearance variation of dough made of wheat flour and soy flour mixture and zara, when the duration and temperature are constantly in central domain (60 minutes, 30 °C)

The appearance of dough established by marks is influenced positively by the soy flour, zara, temperature and fermentation duration (fig.7).

CONCLUSIONS

The dough obtaining with soy flour with 42 % proteins and use of zara, byproduct of the butter technology, represents a solution in obtaining bakery products fortified with proteins.

The quantity of soy flour by 6 % and zara adding by 40 % had influenced positively the dough quality. The temperature and duration of fermentation was maintained constantly. The dough presented the improved features confirmed by the acidity degree and deformation of dough with 15 %.

To realize the bakery products with proteins can be a useful desideratum for the people with gluten intolerance.

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