EFFECT OF GLUTEN VITAL ON THE ALVEOGRAPH CHARACTERSITICS AND BREAD QUALITY OF FLOUR WHEAT DOUGH WITH A WEAKER POTENTIAL FOR BREAD MAKING

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It is a known fact nowadays that in the process of breadmaking, the glutenic proteins have a very important role in all the phases that take place in the procees of dough development that is given specific rheological properties. In order to increase the quantity of gluten in the dough, vital gluten is added in different doses according to its composition and flour quality. This experimantal study shows the research that have been carried out regarding the way in which different quantities of vital gluten (1%, 2%, 3%, 4%, 5%) added in the dough obtained from a poor quality flour influence the rheological properties of the dough and the quality of the finite product. The rheological experiments have been carried out through baking samples. From the alveographic point of view, the effect of vital gluten addition is reflected in the increase of dough resistance (P), a decrease of extensibility index (G) and an increase of the energy absorbed by the dough while stretching it. The results of baking tests have shown an increase of the volume, elasticity and porosity of bread up to an added dose of 3%, followed by a slight decrease due to the increase of the added dose of vital gluten.

Key words: *vital gluten, poor-quality flour, alveograph, baking tests*

Gluten properties are among the properties of flour that have the greatest influence on the viscoelasticity of dough. It is well established that several factors, such as disulphide bonds, hydrogen and ionic bonds and small Van der Waals bonds and hydrophobic interactions, are responsible for the development of the gluten network. Indeed, the unique viscoelastic properties of wheat flour doughs that allow leavened breads to be produced are closely associated with the properties of their gluten proteins. During mixing, these proteins are hydrated and develop into a continuous matrix that entraps other flour components and imparts the required viscoelastic and related properties that allow the dough to retain gas. [11].

Two gluten protein fractions are very important in breadmaking: gliadins (prolamines) and glutenins (glutelines). The essential component in gluten is glutenins, with a large molecular mass, which break apart and interact with one another forming a network. From the rheological point of view, glutenins are characterized by a large elasticity and a low extensibility [3, 4, 5, 10, 12].

The glutenins have been studied by a large number of authors [1, 6, 7, 8, 10, 12] and their important role has been confirmed by many researches.

The gliadins have been studied less than glutenins, maybe because the focus was on explaining the glutenins' role on dough rheology, and especially on gluten elasticity, property associated with glutenins. Also gliadins have been less studied because of their heterogeneity and because of the large number of fractions which are very hard to associate in the pure state. If glutenins have been associated with elasticity, gliadins are associated with viscosity and plasticity of the dough [1, 9].

The basic principle of gluten usage in bakery derives from its ability to fit in perfectly with the glutenic proteins in flour which has been additived, resulting a perfectly homogenous and stable glutenic network.

Vital gluten is obtained from wheat, through a specific technology which implies the separation of gluten and starch in a water bath. The moist gluten is then subjected to a controlled drying so that the native qualities are maintained. These qualities depend proportionally to the wheat's quality from which the gluten is obtained, but also on drying parameters used in the separation process.

The addition of vital gluten increases the technological potential of wheat flours up to a certain dose. The usual gluten contains 75% proteins, meaning that the increase in protein content in flour from 10% to 12% would require the addition of 1,1 kilos of gluten for 100 kilos of flour. Because of the poor functionality of the protein in gluten, in reality 1,8 kilos of gluten would be required for 100 kilos of flour to get the same effect. In many countries it is added in concentrations of 1 to 5% to increase the gluten quantity of flour and to ensure the right texture and volume, especially for the products where a large quantity of additives, like soy flour, milk powder, rye flour is added.

As a raw material of vegetal origin for protein products making, gluten is second after soy flour, with an ever increasing demand lately.

MATERIAL AND METHOD

The experiments there have chosen flour with a weaker potential for bread-making as raw material. Control flour was analyzed by performing Romanian standard methods: STAS 6124-73, STAS 90-88, STAS 6283-83 and SR ISO 3093:1997. In experiments, a flour with 13.9% moisture, and 10.72% crude protein content was used. The determined values for physical-chemical properties are mentioned as following: ash content 0.64%, wet gluten content 23.8%, gluten deformation 13 mm, and falling number 255s. Data acknowledge that the control flour has a weaker potential for bread-making from that the point of view.

Starting from chosen flour for analyses, different samples of flour were used in experiments, improved with different doses of vital gluten (1%, 2%, 3%, 4%, 5%).

The rheological behavior of the dough prepared from wheat flour was carried out on Chopin alveograph according to SR ISO 5530.

RESULTS AND DISCUSSION

The rheological properties of the dough were studied with the Chopin alveograph (*tab. 1*), based on the parameters which define the alveograms shown in *figure 1*.

Table 1

The parameters shown by the alveograph for the dough obtained from low-quality flour that has been supplemented with different doses of vital gluten

Characteristics	M	1%	2%	3%	4%	5%
Maximum Pressure (P), mm	67	77	83	91	100	109
Extensibility (L), mm	81	80	79	75	66	64
Swelling Index (G), mm	20	19.9	19.8	19.3	18.1	17.8
Energy $W \cdot 10^{-4}$J	165	194	211	247	221	255
Ratio P/L	0.83	0.96	1.05	1.21	1.52	1.70
Elasticity Index (Ie), %	46.3	48.6	50.0	56.9	47.1	52.7

By comparing the data in *table 1* it can observe a decrease of L parameter and an increase of P parameter (linked to dough resistance) and of W parameter (the energy required for swelling up to breaking point of the dough) concomitant with an increase of the gluten dose. This variation of the rheological parameters can be attributed to the water redistribution process between the system components, because of the higher protein content which in turn retain a larger amount of water meaning a decrease in the mobility of the system, of the dough. Consequently there will be an increase of dough viscosity, which can be seen from the alveographic point of view as a decrease of the L parameter and a decrease of the extensibility index G. The addition of vital gluten increases the quantity of gluten in the dough, forming a glutenic network much more arranged, which better holds all the other dough components, and leads to an increase in the energy absorbed by the dough when being stretched (W) and in dough resistance (P).

In terms of physical properties of the finished product (*fig. 2*) it can be observed that concomitant with an increase of the protein dose up to a certain level there is also an increase in the bread volume, caused by the changing of the gliadins/ glutenins ratio which reflects in the elasticity and extensibility of the gluten.

By increasing the level of vital gluten over the optimal dose for the specific conditions of the baking test, the bread volume decreases because of the excessive elasticity of the dough, which makes the growth of the bread in the oven very difficult.

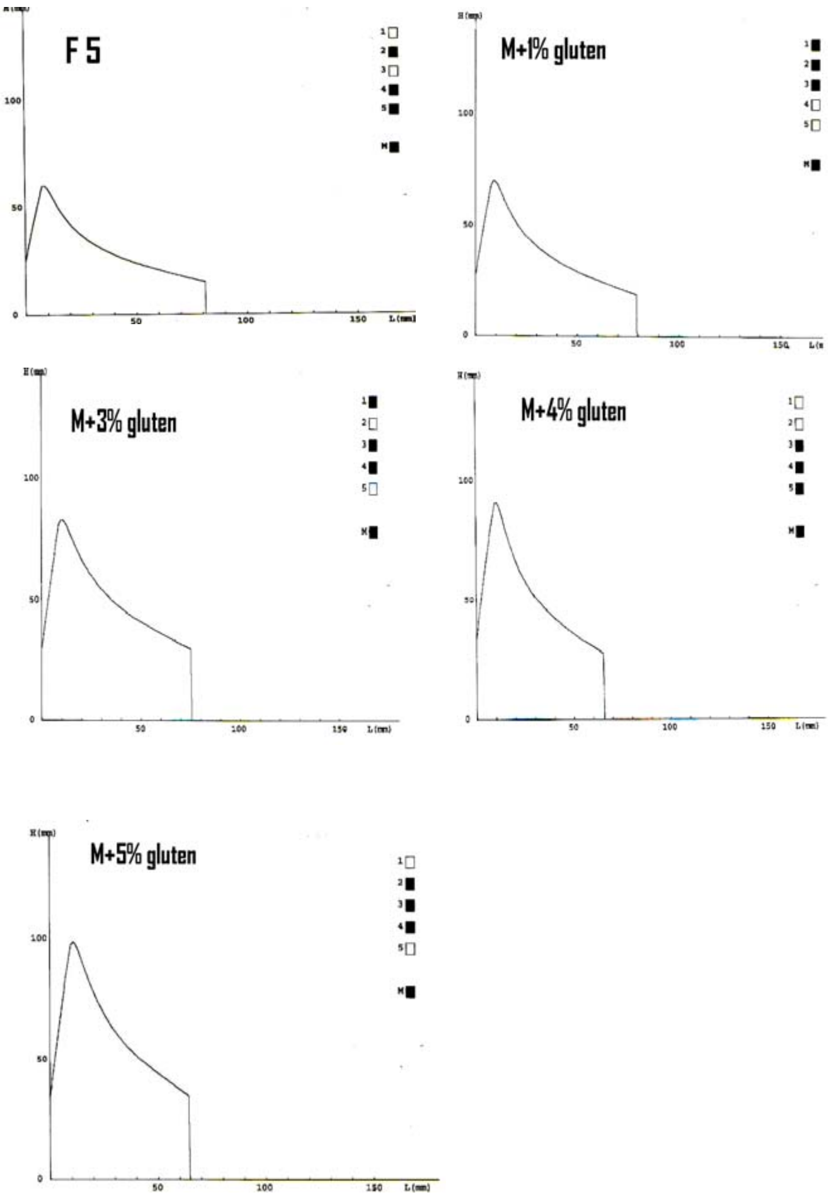

Figura 1 **Alveograms of analyzed samples**

A similar behaviour with the variation of the volume up to one point followed by a drop is also recorded for the other physical characteristics of the bread: porosity and elasticity, as shown in *fig. 2*.

The addition of vital gluten increases the quantity of gluten in the dough, forming a glutenic network much more arranged, which better holds all the other dough components. Because of this the CO_2 retention is improved and the bread has a higher porosity. The increased protein content makes the bread loaf more elastic.

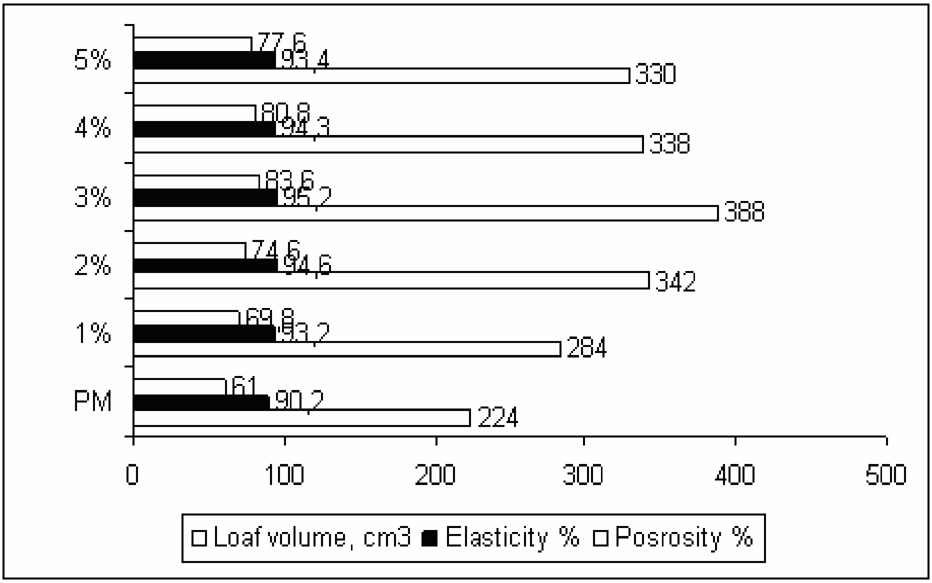

Figure 2 **Bread volume, porosity and elasticity variation, supplemented according to the added dose of gluten vital**

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CONCLUSIONS

Research has been conducted regarding the influence of polar and nonpolar lipid addition on the rheological and technological properties of doughs from low and medium quality flours. The rheological tests were carried out with the alveograph and the technological behavior was studied based on the baking tests results.

Vital gluten has the role of supporting the dough mass which translates in a stiffening of the glutenic network resulting in a higher resistance of the dough to strains and in a decrease in dough extensibility. From the alveographic point of view it has been shown that if the vital gluten doses are not in the right variation domain, taking into account the flour quality, the exogenous addition of proteic substance can lead to a worsening in dough's rheological behavior (as a result of excessive increase in tenacity or P/L ratio).

From the point of view of the finishes product – the bread, the addition of vital gluten promotes a significative improvement in the physical properties of the products, the maximum increase in volume being 73.2%.

All the results regarding the rheological aspect and the quality of the finished product have shown that for low quality flours the optimal dosage for the vital gluten is 3%, while higher doses lead to a worsening of the rheological properties of the dough and of the bread quality.

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