STUDY OF RHEOLOGICAL PROPERTIES OF GLUTEN-FREE FLOURS WITH THE CHOPIN MIXOLAB

Eng.drd. Anca IANCU
Mechanical Engineering Faculty „Politehnica"University of Timişoara
Romania

Ph.D.eng.Dumitru ŢUCU
Mechanical Engineering Faculty „Politehnica"University of Timişoara.- Romania

Eng.drd. Gabriel DĂMĂCUŞ
Mechanical Engineering Faculty „Politehnica"University of Timşoara.- Romania

REZUMAT. Interacţiunea dintre alimentaţie şi sănătate, natura patologică indusă de produse alimentare în sau pe corp, este una din problemele cele mai actuale. Pastele fără gluten sunt alimente fără risc pentru viaţa cotidiană pentru persoane alergice la gluten, diagnosticate cu boala celiacă, cea mai frecventă boală genetică în Europa.

Cuvinte cheie: boala celiac, fara gluten, amilasa, amidon,

ABSTRACT. Interaction between diet and health, the possible pathological nature of food on the body is one of the most actual problems nowadays. Gluten-free pasta is foods without risk of everyday life for people allergic to gluten, diagnosed with celiac disease, the most common genetic disease in Europe.

Keywords: celiac disease, gluten-free, amylase, starch,rheology.

1. INTRODUCTION

Many peoples fear the limitations and restrictions imposed by the diet. Even if it means following certain rules, life with celiac disease can be lived with intensity and joy, because gluten-free food provided by food in quantities of increasingly larger. Gluten-free pasta making experimental research stems from the fact that raw materials are used as a gluten-free rice flour, corn flour, buckwheat, soy, eggs enhanced with carrot juice, cranberry juice, tomato and spinach. Special emphasis is placed on quality characteristics, which should be close to those of wheat flour pasta, the boiling behavior and the increase in volume.

2. MATERIALS AND METHODS

Gluten-free pasta is an alternative to wheat pasta; it is made from raw materials such as gluten, rice flour, buckwheat flour and soy flour.

It seems that, **Buckwheat** has been "domesticated" and cultivated for the first time, in Southeast Asia, now approx. 8000 years and the cultivated area of 1mil. Ha, is mainly concentrated in Europe (Russia), Canada (25 000 ha), France (2500 ha), Poland and USA.

Buckwheat is composed of many nutrients, such as protein, sucrose and dextrose, vitamin P, B1, B2, B3, B5, E, minerals (calcium, magnesium, potassium, iron, selenium), amino acids and routine, a substance very valuable for the health of capillaries and 70 ÷ 80% of the fruits of buckwheat represents the starch, in which 25% is amylase and 75% amylopectin.

Buckwheat flour is obtained by grinding whole buckwheat grain moisture; it has 14% humidity, grey colour, matter flour and characteristic taste.

Rice is the symbol of wealth in Chinese culture and also the protection of grain. It symbolizes and fertility of earth, the power of gods and its properties are known and used for 5,000 years, being the most popular in the world.

Cultivated area is 150 million hectares; growing large countries are located in Asia. Major world importers are Indonesia, Iran, Nigeria, Saudi Arabia, Philippines and CE.

Rice contains a large amount of starch (75%), but the endosperm is almost completely devoid of vitamins, low in fat (0.4%) and a positive relation between sodium and potassium, which has made rice, an important element for controlling blood pressure, 7.5% protein, niacin 1.5%, fibber 0.9%, 0.8% iron. Rice flour is obtained by grinding long grain rice; husked rice is 12.13% moisture, acidity 0.4 degrees.

Soy is a vegetable from China and Japan, widespread in the U.S. and many European countries, including Germany and France and continues to surprise with its therapeutic virtues.

Defatted soy flour is made from soy, mainly by partial or complete degreasing by solvent extraction. Defatted soy flour has the following quality indicators: protein 40%, 2% fat, lecithin 2.5%, 5.5% minerals, fibbers 2.5%, carbohydrate 23.5%.

To obtain gluten-free pasta were subjected to rheological tests following gluten-free flour blends:

- 50% rice flour and buckwheat flour 50% - sample 1;
- 75% rice flour and soy flour 25% - sample 2.

Rheological studies were performed to determine the parameters of mixing and determining allowable deviation values for approval or for mixtures of flour. Experiments were performed on the Chopin Mixolab.

The principle of the method

To determine the hydration of the flour, kneading the dough behaviour (time for forming, stability and softening); behaviour for heat, when there is increased enzyme activity, clotting proteins and starch gelatinization.

These changes are determined based on using a sensor measurement of the opposite moment when the dough is kneading. The information obtained is transmitted to a computer for processing and calculations. For each gluten-free mixture were obtained graphic profiles shown in Figure 1 and Figure 2, distinguished by the 5 areas of the curve (C1, C2, C3, C4 and C5).

Figure 1. *Graphic profile rice flour and buckwheat flour*

3. RESULTS AND DISCUSSIONS

Dough development, coincides with the water absorption of flour, followed by the dough formation (C1) and the capacity to hydration of sample 1 (48.9%) compared sample 2 (52.20%).

Softening protein, corresponds to the first stage of heating the dough at a temperature of 58 °C; now the thermal clotting of the protein occurs (C2) for sample 1, compared with sample 2 which occurs at 86.2 °C, followed by the release of a small part of water connected to the kneading which emphasizes the dough softening.

Starch gelatinization, corresponds to the second stage of heating of the dough at a temperature of 70.5 °C for sample 1 and 67.3 °C for sample 2; the starch gelatinization start (C3), which leads to dough increase consistency.

Enzymatic activity, takes place at high temperature of dough and constant heating of the mixer (second set), located within the temperature's limits of α-amylase activity (C4) and its duration of action on starch which is greater than 30 minutes to sample 1 and 40.43 minutes for sample 2. As a result the dough consistency will fall more for sample 2.

Starch retrogradation takes place under cooling dough, when gelling and the retrogradation of starch begins (C5), a phenomenon that produces increased consistency at a temperature of 55.8 ºC for sample 1 and 59 ºC for sample 2.

Figure 2. *Graphic profile of rice flour and soy flour*

Mixolab Profiler converts the standard curve obtained in six visible indices expressed on a scale from 0 to 9 (Mixolab Index) for a complete characterization of flour (water absorption, behavior during malaxării protein / gluten strength, viscosity, hot work amylase and relegation index).

With this system can determine whether a flour meets specifications also sets the limits of acceptability depending on the desired profile, flour and flour if a profile does not meet the parameters set, mixolabul suggest changes.

Target profiles were experienced with Chinese Ravioli profile and have obtained the following sections for gluten-free mixtures.

Viscosity is another parameter used in determining the rheological properties of flour and amylase activity and quality due to starch. The viscosity of

the analyzed samples is 0, which indicates that the pasta dough has a viscosity (consistency) than is presented as powdery.

Behavior is due to starch retrogradation during cooling (ie crystallization of amylopectin). The index is higher the less shelf life. Index of relegation is a sample 1 which is a great shelf life, compared to 5 for sample 2 which has a lower shelf.

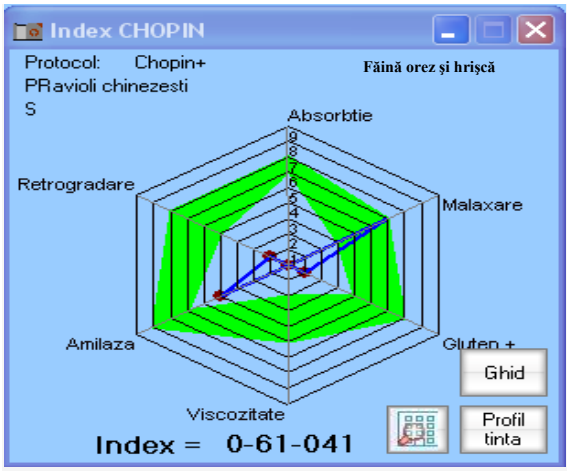

Figure 3. *Rice and buckwheat flour profile*

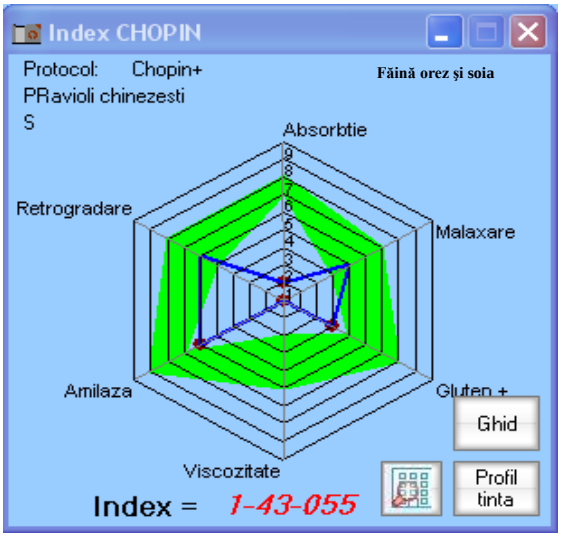

Figure 4. *Profile rice flour and soy*

4. CONCLUSIONS

The test mixtures of gluten-free flour are suitable to obtain gluten-free pasta. Absorption and the time of kneading is bigger for sample 2 then for sample 1.

Speed of wetting for proteins under the effect of heating is higher for sample 1, α = -0.044 Nm/min for 16.68 min., then for α = -0.162 to Nm/min of sample 2 for 34.65 min.; we can remark the standing durability to the processing of dough made from rice flour and soy.

Pasting speed is higher for sample 2 where β = 0.092 Nm/min, compared to that of sample 1 with β = 0.080 Nm/min. Enzymatic hydrolysis rate is γ = -0.018 Nm/min for sample 2 and γ = 0.000 Nm/min., in case of sample 1.

From the two samples the best behave to obtain gluten-free pasta mixture was sample 2, because the dough has achieved greater stability of the starch gel formed; the starch gelatinization starts faster than in sample 1, also the enzymatic activity is longer and starch retrogradation is slower.

Pasta made from this mixture maintains shape after boiling, are easy sticky, the volume increases 3 times and the sediment is 0.4 cm; compared with the pasta obtained from sample 1 where the form shatters at boiling, are sticky, the volume grows 2.5 times and the sediment is 3.5 cm.

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