

METHOD FOR OBTAINING GLUTEN FREE HIGH PROTEIN BISCUITS

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Abstract

The purpose of the study is to select suitable flours according to its mineral composition to obtain gluten-free high protein biscuits.

From the study it was found that when glues of whole grain rice flour, walnut flour and freeze-dried raspberries flour are put in suitable proportions, gluten-free biscuits are with good technological parameters can be obtained.

The biscuits are with high protein and fats. They are with low carbohydrates composition. The new products are without GMO, artificial colors and flavors. They are with Fe, Zn, Ca.

Key words: rice flour, gluten-free, high protein, biscuits, walnut flour, freeze-dried raspberries, butter, lecithin.

INTRODUCTION

Recently, demand for gluten-free products has increased, due to the increased consumer awareness. People suffering from gluten intolerance need to eat gluten-free foods. In order to produce such foods, it is necessary to study the gluten-free flours and to put them in the appropriate proportions (Laguerre et al., 2007; Andon & Anderson, 2008; Mc Afee et al., 2010; Pieretti & Meineri, 2011; Arendt, 2012). Celiac disease is an autoimmune disease of the small intestine, which leads to the malabsorption of several important nutrients, finding a lack of iron, folic acid, calcium and fat-soluble vitamins. Anemia, mouth ulcers, diarrhea or constipation, abdominal pain, bloating, fatigue, osteoporosis, infertility, cancer, anxiety and depression are the most important symptoms associated with this disease (Koinov & Radkov, 1981; Sikorski & Kolodziejska, 1986; Vangelov, 1999; Ordinance No. 8, 2002; Lim et al., 2009). Studies have shown that the disease affects about 1% of the population. Throughout their lives, patients with this disease have an intolerance to the prolamine fraction of wheat (gliadins), rye (chakras) and barley (chordines). Celiac disease is a global phenomenon and its prevalence is greatly increased due to improved diagnostic procedures (Genadiev et al., 1968;

Torbica, 2010; Toldra & Reig, 2011; Borisova, 2015; Borisova, 2016). Omega-6 fatty acids have a high value due to the high content of linoleic acid in cereals at the expense of shorter and medium-chain fatty acids that are m (FAO/WHO, 1991; Reg. 1924, 2006; Laguerre et al., 2007; Torbica et al., 2010; Kotsev, 2012; Reg. 432, 2012).

MATERIALS AND METHODS

Analytical methods used

Organoleptic assessment

- BDS 15612-83, Organoleptic evaluation of the raw materials - appearance, color, taste, aroma (BDS 15612-83).
- The breads developed were organoleptically evaluated on the 9th Bald Hedonic Scale (Lim et al., 2009).
- BDS 1671-89, Determination of total protein content - Kendal's method) (BDS 1671-89).

BDS 1671-89, Determination of total fat content - Soxtec device (BDS 1671-89) ISO 2171:1999, Determination of total ash content (BDS ISO 2171:1999) BDS ISO 5498:1999, Determination of total fiber content) (BDS ISO 5498:1999).

Macro and trace-elements are determined on an atomic emission photometer - AES-ICP "Varian- Liberty II".

RESULTS AND DISCUSSIONS

Were used mixes of flours - rice, walnut and freeze-dried raspberries to produce gluten-free

high protein biscuits. In addition to the main flours, butter, egg mélange, stevia, vanilla and lecithin are incorporated as auxiliary raw materials (Table 1).

Table 1. Physicochemical analysis on the flours (%) (n = 10)

Type of analysis	Whole grain rice flour	Walnut flour	Freeze-dried raspberries flour
Moisture, % (x±sd)	10.50±0.02	11.25±0.01	0.75±0.02
Protein, % (x±sd)	16.12±0.01	13.05±0.02	4.40±0.02
Acidity, °H (x±sd)	3.12±0.01	1.70±0.01	2.80±0.01
Fat, % (x±sd)	4.04±0.01	51.40±0.02	1.20±0.02
Carbohydrates, % (x±sd)	44.94±0.02	24.96±0.02	14.80±0.02
Ash, % (x±sd)	1.12±0.01	0.80±0.01	1.00±0.01
Fiber, % (x±sd)	13.12±0.01	10.12±0.01	3.42±0.01
Energy value, kcal/100 g product	219	214	200

P<0.005

Flours need to be tempered at room temperature as they are stored in a dry and cool place. Of all the raw materials it is necessary to dispense the necessary quantities according to the gluten-free high protein biscuits formula. Mix the dough by the single-phase method.

Table 1 shows physicochemical analysis on the flours. In terms of moisture, protein and carbohydrates whole grain rice flour has the highest content (10.50%; 16.12%; 44.94%), and freeze-dried raspberries flour has the lowest content (0.75%; 4.40%; 14.80%), respectively. In terms of fats walnut flour has the highest content (51.40%), and freeze-dried raspberries flour has the lowest content, respectively (1.20%). The walnut flour is rich on fats and proteins. The whole grain rice flour is rich on proteins. The high protein and gluten free flours are appropriate for biscuits.

In terms of Ca, whole grain rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively. In

terms of K, whole grain rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively.

In terms of Mg, whole grain rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively. Regarding Na, whole grain rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively (Table 2).

Description of the technological process: preparation of the raw materials, kneading the dough, shaping the dough - rolling, baking, analysis and quality of the finished product, tasting.

In terms of Fe, whole grain rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively. In terms of Mn, walnut rice flour has the highest content, and freeze-dried raspberries flour has the lowest content, respectively. In terms of Zn, whole grain rice flour has the highest content, and walnut flour has the lowest content, respectively (Table 3).

Table 2. Microelements in the flours (mg/kg) (n = 10)

Microelements	Whole grain rice flour	Walnut flour	Freeze-dried raspberries flour
Ca, mg/kg (x±sd)	2310.50±0.02	511.25±0.01	76.75±0.02
K, mg/kg (x±sd)	2916.12±0.01	513.05±0.02	84.40±0.02
Mg, mg/kg (x±sd)	1934.04±0.01	651.40±0.02	91.20±0.02
Na, mg/kg (x±sd)	1144.94±0.02	724.96±0.02	74.80±0.02

P<0.005

Table 3. Trace-elements in the flours (mg/kg) (n = 10)

Trace-elements	Whole grain rice flour	Walnut flour	Freeze-dried raspberries flour
Fe, mg/kg (x±sd)	5670.50±0.02	6542.51±0.01	567.5±0.02
Mn, mg/kg (x±sd)	456.81±0.01	654.99±0.02	346.40±0.02
Zn, mg/kg (x±sd)	768.04±0.01	467.9±0.02	456.20±0.02

P<0.005

Table 4. Physicochemical analysis on the biscuits (%) (n = 10)

Type of analysis	Biscuits Mix 1	Biscuits Mix 2	Biscuits Mix 3
Moisture, % (x±sd)	11.50±0.02	12.25±0.01	1.25±0.02
Protein, % (x±sd)	16.12±0.01	13.05±0.02	4.40±0.02
Acidity, °H (x±sd)	3.12±0.01	1.70±0.01	2.80±0.01
Fat, % (x±sd)	4.04±0.01	51.40±0.02	1.20±0.02
Carbohydrates, % (x±sd)	44.94±0.02	24.96±0.02	14.80±0.02
Ash, % (x±sd)	1.94±0.02	1.24±0.02	1.54±0.02
Fiber, % (x±sd)	16.94±0.02	13.94±0.02	10.94±0.02
Energy value, kcal/ 100 g product	219	214	200

P<0.005

Mix 1 is rice flour 70%, walnut flour 10% and other raw materials.

Mix 2 is rice flour 60%, walnut flour 20% and other raw materials.

Mix 3 is rice flour 50%, walnut flour 30% and other raw materials.

Table 4 shows physicochemical analysis on the biscuits. In terms of moisture, protein and carbohydrates mix 1 has the highest content (11.50%; 16.12%; 44.94%), and mix 3 has the lowest content (1.25%; 4.40%; 14.80%), respectively. In terms of fiber mix 1 has the highest content (16.94%), and mix 3 has the lowest content, respectively (10.94%). The biscuits of mix 1, mix 2 and mix 3 are rich on fats and proteins. They are rich on proteins.

Technological preparation

A preliminary preparation was made butter has a temperature of 45°C. Knead the dough from the flour and the other components using the one-phase mixing method.

The resulting dough is rolled out to a thickness of 5 mm.

Biscuits were baked for 20 minutes at 200°C with a fan.

They are intended for people with specific health needs/type 2 diabetes, cardiovascular diseases, gastroenterological diseases/, as well as for the general consumer.

The technology, characterized by the fact that the baking time is reduced to 20 minutes, and the traditional one is up to 35 minutes, depending on the input raw materials, which saves energy consumption. The innovative approach in the baking process is with a fan, which shortens the product's readiness time.

Composition of biscuits, characterized by the fact that whole-grain high-protein flours are used as an additive to rice to achieve a high energy value based on protein content, at the expense of the carbohydrate component.

In terms of Ca, mix 1 has the highest content, and mix 3 has the lowest content, respectively. In terms of K, mix 1 has the highest content, and mix 3 has the lowest content, respectively. In terms of Mg, mix 1 has the highest content, and mix 3 has the lowest content, respectively. Regarding Na, mix 1 has the highest content, and mix 2 has the lowest content, respectively (Table 5).

Table 5. Microelements in the biscuits (mg/kg) (n = 10)

Microelements	Biscuits Mix 1	Biscuits Mix 2	Biscuits Mix 3
Ca, mg/kg (x±sd)	641.50±0.02	631.25±0.01	101.75±0.02
K, mg/kg (x±sd)	3016.12±0.01	1673.05±0.02	1184.40±0.02
Mg, mg/kg (x±sd)	2134.04±0.01	1181.40±0.02	1131.20±0.02
Na, mg/kg (x±sd)	1234.94±0.02	934.96±0.02	967.80±0.02

P<0.005

Description of the technological process: preparation of the raw materials, kneading the dough, shaping the dough - rolling, baking, analysis and quality of the finished product, tasting. In terms of Fe, mix 2 has the highest content, and mix 3 has the lowest content,

respectively. In terms of Mn, mix 2 has the highest content, and mix 3 has the lowest content, respectively. In terms of Zn, mix 1 has the highest content, and mix 3 has the lowest content, respectively (Table 6).

Table 6. Trace-elements in the biscuits (mg/kg) (n = 10)

Trace-elements	Biscuits Mix 1	Biscuits Mix 2	Biscuits Mix 3
Fe, mg/kg (x±sd)	5670.50±0.02	6542.51±0.01	567.5±0.02
Mn, mg/kg (x±sd)	456.81±0.01	654.99±0.02	346.40±0.02
Zn, mg/kg (x±sd)	768.04±0.01	467.9±0.02	456.20±0.02

P<0.005

Characteristic and sensory evaluation of biscuits

Mix 1 - round biscuits with regular shape and cracking of the upper bark. The color of the bark is a golden to a reddish tinge of normal thickness. The color of the medium is creamy. The porosity is small, in places with large single blasts. The taste is sweet. The flavor is typical of this type of biscuits.

Mix 2 - round biscuits roll with a regular shape and tearing the top surface. The top bark is golden to reddish, with normal thickness, no burns. The color of the medium is creamy. The medium is well baked under pressure to restore its original volume. The porosity is thick-walled with big balls, more developed than mix 1 and mix 3. The taste is sweet. The aroma is typical and typical of the composition of the biscuits.

Mix 3 - round biscuits with correct shape. The top bark is golden, with normal thickness, no burns. The color of the medium is creamy. The medium is under developed, under pressure it is difficult to restore its original volume. The porosity is thick, compact. The taste is sweet,

without flavor, when chewing gums. The fragrance is pleasant and characteristic of the composition of the biscuits.



Figure 1. High protein gluten free biscuits

Figure 2 shows rheological properties of dough on the biscuits mix 1. The dough is gluten free, without resistance and stretch.

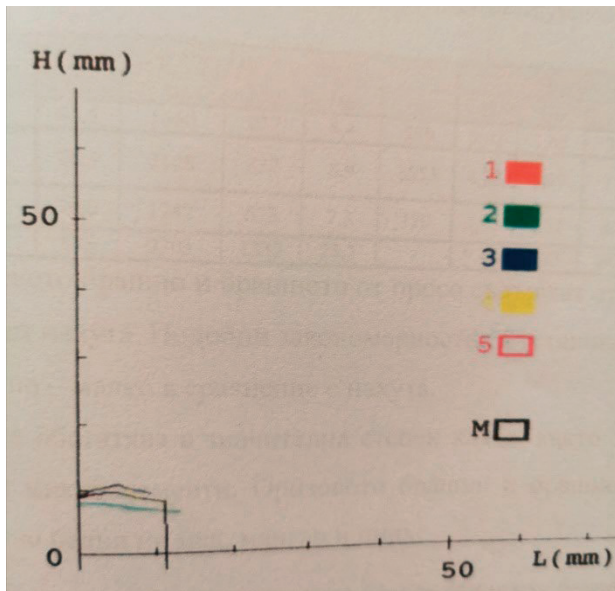


Figure 2. Rheological properties of dough
 1. stretch; 2. Resistance;
 3. bubble formation; 4. elasticity;
 5. dough formation;
 M. gluten formation

Figure 3 shows rheological properties of dough on the biscuits mix 2. The dough is gluten free, without resistance and stretch.

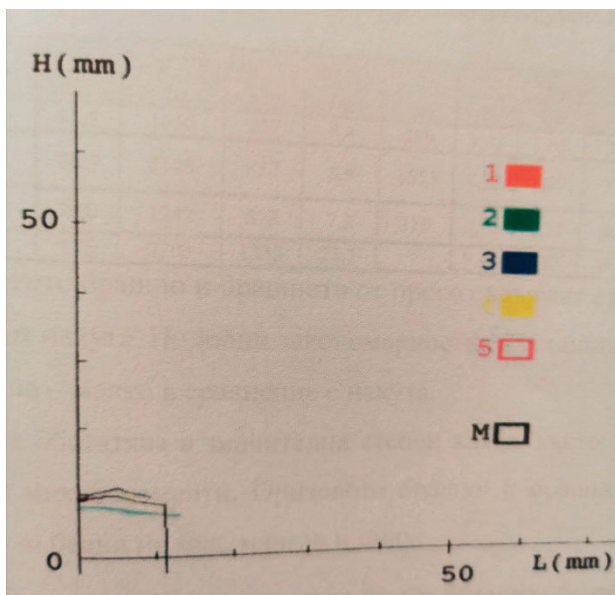


Figure 3. Rheological properties of dough
 1. stretch; 2. resistance;
 3. bubble formation; 4. elasticity;
 5. dough formation;
 M. gluten formation

Figure 4 shows rheological properties of dough on the biscuits mix 3. The dough is gluten free, without resistance and stretch.

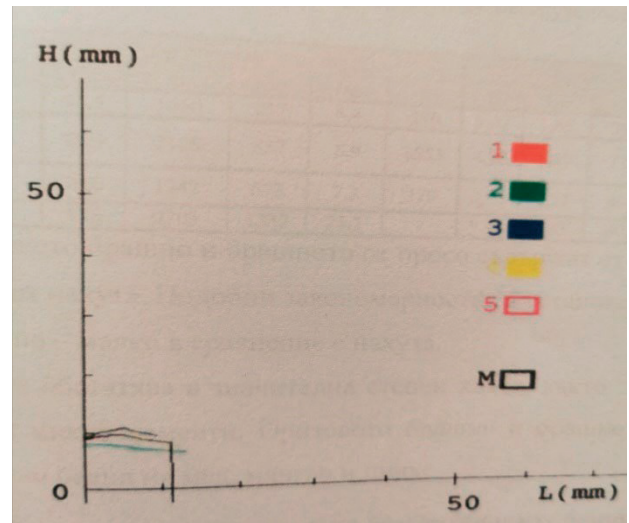


Figure 4. Rheological properties of dough
 1. stretch; 2. resistance;
 3. bubble formation; 4. elasticity;
 5. dough formation;
 M. gluten formation

CONCLUSIONS

Flour from rice, walnut and raspberries are extremely suitable for the production of gluten-free high protein biscuits. They are with good technological parameters can be obtained.

The biscuits are with high protein and fats. They are with low carbohydrates composition. The new products are without GMO, artificial colors and flavors. They are with Fe, Zn, Ca. They are intended for people with specific health needs/type 2 diabetes, cardiovascular diseases, gastroenterological diseases/, as well as for the general consumer.

Composition of biscuits, characterized by the fact that whole-grain high-protein flours are used as an additive to rice to achieve a high energy value based on protein content, at the expense of the carbohydrate component.

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