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## INFLUENCE OF VARIOUS FLOUR USED FOR PRODUCTION OF YEAST WHEAT BUNS AND CUPCAKES

Ingrida Kraujutienė\*, Dovilė Gailevičienė

Food Technology Department, Technology Faculty, Kaunas Kolegija, University of Applied Sciences,  
Pramonės pr. 22, LT-50387 Kaunas, Lithuania,

\*E-mail: ingrida.kraujutiene@go.kauko.lt

### Abstract

Flour technological characteristics are determined by the peculiarities of the grain structure. The chemical composition and nutritional value of each part of the grain is different. In terms of cereal (wheat, rye, etc.), about 80% of the total grain consists of endosperm (starch and protein source). In the production of flour production, endosperm is the most important part of the grain, which determines flour yield. In other words, the larger grains, the higher flour yield. According to many scientists, the protein content in wheat and flour produced from wheat is one of the main criteria for the quality of flour for baked products. Flour with a lower amount of gluten is used to prepare sponge (for sponge cakes or non-yeast cakes) or delicate dough and flour with a high amount of gluten - yeast and flaky pastry. In many cases, poor quality of confectionery products is determined to their preparation while selecting inappropriate gluten flour. Gluten is listed as one of allergenic substances. Persons who are on gluten-free diet, need to choose products without wheat, rye and barley, and replace the following products into buckwheat, rice, corn, oats, peas, etc.

To carry out technological research on cupcakes and buns production, taking into account the different technologies and types of flour, wheat flour (type 550D and Spelt) as well as gluten-free flour (peas and buckwheat), excluding an allergen such as gluten was selected. The research was carried out in the Food preparation laboratory, of the Faculty of Technologies at Kaunokolegija/University of Applied Sciences (Lithuania). The assessment to determine quality and sensorial analysis was carried after 24 hours. The results showed that cupcakes made using traditional 550D, Spelt type, pea and buckwheat flour were acceptable regarding organoleptic properties, in contrast to yeast products that were not acceptable due to gluten-free flour options. The baked production from buckwheat yeast dough were delicate, unsuitable due to consistency and non-merchantable appearance; baked production from pea flour - less crumble, yet it was hard.

**Keywords:** wheat, buckwheat, pea flour, spelt flour, yeast buns, cupcakes.

Received: 05.01.2017

Received in revised form: 06.03.2017

Accepted: 09.03.2017

## 1. INTRODUCTION

The quantity and quality of gluten found in flour determines dough and pastry-making technology. Gluten is particularly important in manufacture of wheat bakery products hence it influences the structure of dough. Gliadin determines viscoelastic properties of the dough such as tenacity and extensibility, whereas glutenin - elasticity and dough resistance to stretching. Furthermore, baking properties of flour depend on the quantity and quality of gluten. (Zhang et al., 2007). The higher gluten content or the stronger gluten is, the longer it is possible to knead the dough. A significant impact of the rheological properties of dough is made due to the use of additives and manufacturing technology. Dough and higher humidity promotes the formation of gluten network, whereas fat additives inhibit that

process. The more friable and delicate structure of baking products is determined by the use of fat, water quantity and dough kneading intensity. Fat and type of flour contribute significantly to the more friable and delicate structure of baked products. Flour with a higher amount of gluten downgrade the quality of baked products.

One of the most urgent problems of today is wheat protein-induced allergic reactions for group of people of higher risk who can not eat products consisting wheat (Wang et al., 2010; Stenman et al., 2008; Hartmann at Meisel, 2007; Pastorello at al., 2007).

Celiac disease (celiac enteropathy) is a chronic disease of the small intestine, which is characterised by the wheat protein gluten or similar to barley and rye protein decisive mucosal damage and impaired nutrient absorption for people with a genetic

predisposition(Munera-Picazo et al. 2014)The only treatment option of celiac disease is special gluten-free diet.

The best allergy treatment and prevention is avoidance of contact with the allergen. But in case of wheat-induced allergy, it is not very simple due to wheat is widely used in the food industry. At present, it has been the biggest concern for many specialists. More efforts are put to draw the attention of the public. There has been a significant increase in labelling food and warning customers about the presence of wheat or protein gluten, and nutritionists can help create a special diet, which is wheat-free. Another method that might be available to everyone, is the replacement of traditional wheat flour with gluten-free flour. It might be flour of buckwheat, peas, rice and other.

Scientists claim that it is useful to involve products made of Spelt(*Triticum spelta*) flour into people's diet due the flour is characterised by a specific fiber composition, abundant health promoting e.g. phenolic compounds that have the oxidation inhibitor characteristics (Verma et al., 2008; Escarnot et al., 2010; Wilson et al., 2008).

There have been very controversial opinions regarding the allergic effects induced by Spelt flour on human health. (Pitchford, 2002). The scientific literature suggests that gluten found in Spelt flour has a different structure and products of the Spelt flour are suitable for people intolerant to gluten. (Pitchford, 2002). According to other authors, the Spelt flour has the same amount of gluten as any other wheat flour (Dumke, 2007).

Regarding the nutritional value of pea and buckwheat flour, it is not significant. Peas are a real source of energy due to they contain protein, carbohydrates and the amount of fat is low, whereas Buckwheat contain 72 % of carbohydrates and 10 % of proteins. These proteins are well absorbed even up to 78 %, they rich in amino acids-lysine and triptophan.

*Aim of research:* Using non-traditional grain flour for production of confectionery products to assess their impact on the quality of baked products.

## 2. MATERIAL AND METHODS

As a high-gluten flour should be chosen to bake yeast dough, and low-gluten flour for delicate dough, there have been applied two technologies to prepare different doughs for production of sample products.

In order to assess the influence of flour proteins on quality of the baked products, there have been produced sample baked products of yeast and delicate doughs using conventional wheat flour as control indicator to compare with gluten-free flour of peas and buckwheat. Spelt flour was used to enrich products with fibre stuff.

Yeast dough was prepared applying a single-phase method: all ingredients were mixed at once accordingly the recipe below (Table 1).

**Table 1. Recipe of yeast buns**

Ingredients	Amount, g
Wheat flour	520
Sugar	60
Compressed yeast	35
Salt	3
Water	Accordingly calculations

The dough was mixed for 15 min., then was fermented for 2 hrs at 30°C temperature. Then the fermented dough was kneaded once again and was divided into 70 g round-shaped pieces which were left for 5 min for panning. After panning the dough is shaped and left for proofing and developing in a closet for 20 min. at 30° C up to 75 % moisture. After that the ready to bake products are baked for 15 min. at 220°C temperature.

Cupcakes were made from delicate dough. The recipe is given in Table 2.

**Table 2. Recipe of cupcakes**

Ingredients	Amount, g
Wheat flour	320
Butter	220
Sugar	200
Eggs	160
Baking powder	6

Dough for cupcakes have been prepared battering fat and sugar until fluffy mass, gradually adding eggs. After the mixture doubled, flour was added. 60 g dough pieces were baked for 17 min. at 220 °C temperature. Quality of products was evaluated by their organoleptic properties applying standard requirements (LST 1809:2003 Flour confectionery. General requirements). All organoleptic indexes such as appearance, taste, smell, view of crumb were evaluated according to a 5 mark scale (the best-5, the worst-1). 7 trained experts participated in the conduction of the research. The evaluators received a special training in compliance of standard LST ISO 8586-11.

### 3. RESULTS AND DISCUSSION

In comparison to unconventional grain flour, wheat flour is considered as the flour of lower biological value due to the low amount of mineral content, improper balance of the proteins regarding the amount of essential amino acids (Гейдари et al., 2008; Brindzová et al., 2009).

Biological value of the wheat flour can be improved mixing it with another grain flour such as peas, buckwheat and other cultures (Гейдари et al., 2008; Brindzová et al., 2009). By adding this flour in recipes for pastries, it is possible to provide unusual sensory properties, as well as enriching with essential amino acids, minerals, vitamins and other functional materials (Гейдари et al., 2008; Gambus et al., 2009). As Bonafaccia et al. (1994) state, flour mix consisting of 30 % buckwheat and 70 % wheat flour is often used in production. Adding 15 % of buckwheat flour (comparing to whole wheat flour mass) baked products are enriched with better antioxidant features (Li-Yun L. et al., 2009; Kreft I. et al., 2008).

Yet, baked products containing gluten are not suitable for people which are allergic to wheat proteins. Considering that fact, wheat flour was completely replaced with flour from unconventional grain and legumes such as buckwheat and peas.

Taking into account the findings of scientists that gluten available in Spelt flour has a different structure and products of the flour are suitable for people intolerant to gluten, Spelt flour was used for the research. Delicate and yeast doughs from different flour types were used (peas, buckwheat, Spelt and wheat) to bake some samples.

For the assessment of the different types of flour and yeast dough products (buns and cupcakes) quality, 24 hours after baking, the appearance of products and the section of the buns or cupcakes was observed.

The results showed that using a gluten-free flour (pea and buckwheat flour) unlike from wheat and Spelt flour containing gluten, the yeast dough was less elastic. Yeast dough of buckwheat flour crumbled during formation and was elastic and had a good consistency as other flour (pea, Spelt and wheat flour) was used.

Although yeast pea dough was of a proper consistency, while shaping it crumbled, and the buns were dry and hard.

The results of organoleptic analysis are given in Table 3.

As Sevastita et al. (2008) state the bread made of Spelt flour, is characterised by specific sensorial properties: has a unique piquant nutty flavour, that bread maintains freshness for a longer time and a relative size of the final product is bigger, and rheological features are perfect. The bread of such flour is easy to bake, bread crumb is of a lighter colour.

The porosity of buns produced of Spelt flour is more even in comparison to buns of conventional wheat flour (Table 3).

Samples (buns and cupcakes) of yeast dough containing Spelt flour had specific nutty flavour, fibres were sensed when chewing. The same results obtained using shortbread (buns and cupcakes) (Table 3).

Unlike products of yeast dough, shortbread-cakes produced of wheat flour were crumbly, had a good marketable appearance, were easy to cut and had an even porosity. The same features were identified in shortbread of gluten-free flour (buckwheat and pea flour).

**Table 3. The results of organoleptic analysis**

Flour	Quality index evaluation (1–5)	Comment	
<i>Yeast loaves</i>			
Wheat	Shape, appearance	5	
	Surface and crust features	5	
	Crumb view, porosity	5	
	Structure, elasticity	5	
	Taste, odour	5	
Spelt	Shape, appearance	5	Fibres sensed and nutty flavour
	Surface and crust features	5	
	Crumb view, porosity	5	
	Structure, elasticity	5	
	Taste, odour	5	
Pea	Shape, appearance	5	Crumb has a greenish tint. Peas flavour
	Surface and crust features	5	
	Crumb view, porosity	4	
	Structure, elasticity	3	
	Taste, odour	3	
Buckwheat	Shape, appearance	1	Completely inadequate
	Surface and crust features	1	
	Crumb view, porosity	1	
	Structure, elasticity	1	
	Taste, odour	1	
<i>Cakes</i>			
Wheat	Shape, appearance	5	
	Surface and crust features	5	
	Crumb view, porosity	5	
	Structure, elasticity	5	
	Taste, odour	5	
„Spelt“	Shape, appearance	5	Fibres sensed and nut flavour
	Surface and crust features	5	
	Crumb view, porosity	5	
	Structure, elasticity	5	
	Taste, odour	5	
Pea	Shape, appearance	5	Crumb has a greenish tint.
	Surface and crust features	5	
	Crumb view, porosity	4	
	Structure, elasticity	5	
	Taste, odour	5	
Buckwheat	Shape, appearance	3	Crust inclined to char. Crumb isof dark colour. Specific buckwheat flavour being
	Surface and crust features	3	
	Crumb view, porosity	4	
	Structure, elasticity	4	
	Taste, odour	3	

Baking features are more influenced by polymeric proteins (glutenins). They suspend the air which is necessary to prepare the dough with good rheological features (crumbly and elastic) (Sluimer, 2007). Therefore, the appropriate selection of flour containing a high gluten amount when preparing yeast dough is important. Gluten-free flour is not suitable for yeast dough preparation. Preparing delicate dough, wheat flour can be replaced with pea or buckwheat flour.

#### 4. CONCLUSIONS

1. The analysis of literary sources and experimental research suggest that baking shortbread dough, wheat flour can be replaced with gluten-free flour.
2. Shortbread of gluten-free unconventional flour has a good structure and appearance, is tasty. Unlike products of yeast dough prepared of gluten-free unconventional flour is not

rising, hard, crumbly and of unmarketable appearance.

3. Unlike preparing the yeast dough flour of peas and buckwheat is perfect to prepare delicate dough.

4. Yeast dough samples of buckwheat flour were crumbly, had no suitable consistency and marketable appearance. Samples of yeast dough prepared of pea flour were less crumble, but hard.

#### 4. REFERENCES

- [1] Bonafaccia G., Kreep I. (1994) Technological and qualitative characteristics of food product made with buckwheat. *Fagopyrum*, No. 14, p. 35–42.
- [2] Brindzová L., Takáčsová M., Mikušová L., Zalibera M. (2009) Antioxidant capacity and sensory evaluation of wheat bakery products supplemented with buckwheat and oat flour and barley  $\beta$ -d-glucan. *European Journal of Plant Science and Biotechnology*, Vol. 3 (1), p. 56–61.
- [3] Dumke N. M. (2007). *Allergy cooking with ease*. Digital Book format: PDF (Adobe DRM). 214 p.
- [4] Escarnot E., Agneessens R., Wathelet B., Paquot M. (2010) Quantitative and qualitative study of spelt and wheat fibres in varying milling fractions. *Food Chemistry*, Vol. 122, p. 857–863.
- [5] Gambus H., Gambus F., Pastuszka D., Wrona P., Ziobro R., Sabat R., Mickowska B., Notowna A., Sikora M. (2009) Quality of gluten-free supplemented cakes and biscuits. *International Journal of Food and Nutrition*, Vol. 60 (4). p. 31–50.
- [6] Hartmann R., Meisel H. (2007) Food-derived peptides with biological activity: from research to food applications. *Plant biotechnology. Food biotechnology*, Vol. 18. p. 163–169.
- [7] ISO 8586-2:2008. Sensory analysis. General guidance for the selection, training and monitoring of assessors. Part 2: Expert sensory assessors
- [8] Kreft I., Germ M. (2008). Organically grown buckwheat as a healthy food and a source of natural antioxidant. *Agronomski Glasnik*, No. 4. p. 397–406.
- [9] Li-Yun L., Hsiu-Man L., Ya-Wen Y., ShengDunL., Jeng-Leun M. (2009) Quality and antioxidant property of buckwheat enhanced wheat bread. *Food Chemistry*, Vol. 112 (4), p. 987–991.
- [10] Munera-Picazo S., Ramirez-Gandolfo A., Burlo F., Carbonell-Barrachina A. A. (2014) Inorganic and Total Arsenic Contents in Rice-Based Foods for Children with Ceiac Disease. *Journal of Food Science*, Vol. 79 (1), p. 122–128.
- [11] Pastorello E.A., Farioli L., Conti A., Pravettoni V., Bonomi S., Iametti S., Fortunato D., Scibilia J., Bindslev – Jensen C., Ballmer – Weber B., Robino A.M., Ortolani C. (2007) Wheat IgE –Mediated Food Allergy in European Patients:  $\alpha$  – Amylase Inhibitors, Lipid Transfer Proteins and Low – Molecular Weight Glutenins Allergenic Molecules Recognized by Double – Blind Placebo – Controlled. Food Challenge. *Int Arch Allergy Immunol*, Vol. 144, p. 10–22.
- [12] Pitchford P. (2002) *Healing with whole foods*. North Atlantic Books. 487 p.
- [13] Sevastita M., Tofana M., Motoran C., Museran C., Marta G. Studies about the main quality parameters of the Spelta wheat. *Bulletin UASVM, Agriculture. Animal Science and Biotechnologies*. Vol. 2. 2008.
- [14] Sluimer P. (2007) *Principles of breadmaking*. Amer Assn of Cereal Chemists. 182 p.
- [15] Sotkovsky P., Hubalek M., Hernychova L., Novak P., Havranova M., Setinova I. (2008) Proteomic analysis of wheat proteins recognized by IgE antibodies of allergic patients. *Journal of Proteomics*, Vol. 8, p. 1677–1691.
- [16] Verma B., Hucl P., Chibbar R.N. (2008) Phenolic Content and Antioxidant Properties of Bran in 51 Wheat Cultivars. *Cereal chemistry*, Vol. 85, p. 544–549.
- [17] Wang J.R., Wei Y.M., Fedak G., Liu Z.G., Jiang Q.T., Pu Z.E., Zheng Y.L. (2010) Molecular Characterization of Major Allergens Associated with Baker's Asthma in Wheat Flour Food. *Science and Technology Research*, Vol. 16, p. 341–346.
- [18] Zhang X., Do M.D., Bilyk A. (2007) Chemical Modification of Wheat – Protein – Based Natural Polymers: Formation of Polymer Networks with Alkoxysilanes To Modify Molecular Motions and Enhance the Material Performance. *Biomacromolecules*, Vol. 8 (6), p. 1881–1889.
- [19] Гейдари М. И., Назарян А. Н. (2008) Технология производства мучных кондитерских изделий с использованием ингредиентов с высоким содержанием пищевых волокон. *Хранение и переработка зерна*, № 5. p. 46–48.