

## STUDY THE INFLUENCE OF DRY GLUTEN UPON THE QUALITY OF BARLEY FLOUR BREAD

\*Chochkov Rosen, Karadzhov Grozdan

University for Food Technologies – Plovdiv, Bulgaria

\*Chochkov Rosen, [rosen404kov@abv.bg](mailto:rosen404kov@abv.bg)

**Abstract:** The effect of dry gluten on quality of bread with barley flour was studied. All samples with dry gluten have a high ratio H/ D compared to that of the control bread. With increasing of dry gluten quantity the both volume at formed and bottom bread increase. Dry gluten also increase the specific volume of the samples at all levels. The results of sensory analysis using hedonic rating showed that with addition of 10 and 15 % dry gluten the disadvantages of gluten free bread is reduced to an acceptable level. Increasing the quantity of dry gluten causes an increase bread volume, and the bread specific volume.

**Keywords:** barley flour, bread, dry gluten, quality

### 1. Introduction:

In breadmaking barley flour is used in small quantities (10 %) to wheat flour without any significant negative influence on bread quality [6, 7]. According to some authors, the bread volume with wheat and barley flour (with the addition of 5 % barley flour) is higher than the volume of wheat bread [11]. Mihalkova [2, 3] found that the addition of barley bran reduce the volume of wheat bread, index H/ D and change the crumb structure. After modifying the method of kneading the authors received bread with the addition of 15 % barley bran containing  $\beta$ -glucans from 1.6 to 1.8 %, which is with relatively good quality.

According to Rurhann, Marjorie and Penfield [12] the addition of 20 % barley flour decreased 5-6 % specific volume of wheat bread. The bread quality is lower than the control sample. Other authors [8, 10] also found that the volume of wheat bread reduced by the addition of barley bran. The results from another research are similar. The addition of barley flour up to 15 % wheat flour leads to improved bread chemical composition, fiber content, essential amino acids. In particular the quantity of lysine is increased to 3.10 g/ 100 g [5]. As the results of the studies the authors found that bread volume is low and the quality is unacceptable. Some authors [13] replaced 20 and 30 % of wheat flour with barley flour. The results show that the barley flour has a positive effect on most of dough properties. The authors propose 20 % addition of barley flour to wheat, but the bread quality is low. In literature it's not found studies for bread prepared from barley flour entirely. The purpose of the present investigation was to establish an objective influence of dry gluten on the quality of bread from barley flour.

### 2. Materials and Methods:

#### 2.1. Raw materials:

Barley flour with ash content - 1.93 % (d.b.), protein (N x 5.7) – 10.50 %; Water potable; Dry vital gluten with 94 % (d.b.) and water absorption – 120 %.

#### 2.2. Methods:

2.2.1. **Substitution of dry gluten** – by submitting to the barley flour of certain quantities (5, 10, 15 and 20 %) to obtain 100 % combination of barley flour and dry gluten;

2.2.2. **Baking method** – by methodology prepared in UFT - Plovdiv. The dough temperature is 29 - 30 °C, resting time – 20 min, bread formation, final fermentation (35 °C) for 40 - 45 min, baking temperature 220 - 240 °C [1];

2.2.3. **Masse (g), volume (cc)** – according BSS 3412 – 79;

2.2.4. **Index (H/D)** – the ratio of height to diameter of bread [1];

2.2.5. **Specific volume, cc/ g** – the ration of volume to masse of bread [1];

2.2.6. **Sensory analysis** – the evaluation was made according to ISO 8586-2:2008 with the next indicators: volume, odor, crust color, crumb color, mastication, porosity, atypical flavor, residual flavor (fig. 1). Before the analysis the degustators were prepared by the test procedure. Each degustator applied to the tasting map (scale for the intensity of index) the values characterizing the strength of perceptions of each property. The arithmetic results are graphically shape on coordinate system. Each property receives a value, which forms the sensory evaluation of bread [9].

24 students selected and trained according to ISO 8586-1 (third year students of Faculty of Food Technology of UFT), participated in the evaluation of bread samples. The students received encoded samples and questionnaires as well as instructions for the evaluation of the samples.

№	INDEX	INDEX INTENSITY								
	Volume									
	Odor									
	Crust color									
	Crumb color									
	Mastication									
	Porosity									
	Atypical flavor									
	Residual flavor									

Fig 1. Tasting card for index intensity of barley flour bread

The information contained on the sensory performa was indicated as:

**Legend:**

- |                                      |                      |
|--------------------------------------|----------------------|
| 1 – extremely dislike;               | 6 – slightly like;   |
| 2 – very much dislike;               | 7 – moderately like; |
| 3 – moderately dislike;              | 8 – very much like;  |
| 4 – slightly dislike;                | 9 – extremely like.  |
| <b>5 – neither like nor dislike;</b> |                      |

**3. Results:**

**3.1. Physico-chemical characteristics of bread with barley flour**

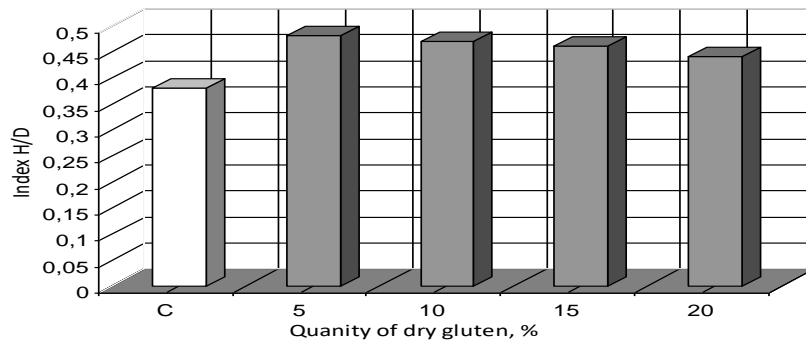
After previous studies it was establish that the volume of bottom and formed bread with barley flour is low. These values define the flour as a very low. By the reason of absence of gluten in barley flour it can not be expected to use it alone for bread making. To improve the barley flour baking straight it was introduced different quantity of dry gluten - 5, 10, 15, 20 %. The results of determining the characteristics of barley flour bread with dry gluten are presents on Table 1.

The bread quantitative indicators are almost constants - significant changes in mass of bread, were not established. The masse of bottom bread is 193-194 g and masse of formed bread is 392-394 g. With increasing of dry gluten quantity the both volume at

formed and bottom bread increase. The highest volume with an addition of 20 % dry gluten is 626 cc. The difference between the volume of the control sample and those of formed bread with 20 % dry gluten expressed as a percentage is 24.9.

**Table 1.** Characteristics of barley flour bread with dry gluten

SAMPLES	Masse, g		Volume, cc	
	Bread (on the floor)	Tin bread	Bread (on the floor)	Tin bread
Barley flour (C)	193	393	280	470
Barley flour 95 % + 5 % dry gluten	193	392	305	490
Barley flour 90 % + 10 % dry gluten	194	394	310	495
Barley flour 85 % + 15 % dry gluten	194	392	315	600
Barley flour 80 % + 20 % dry gluten	193	393	321	626



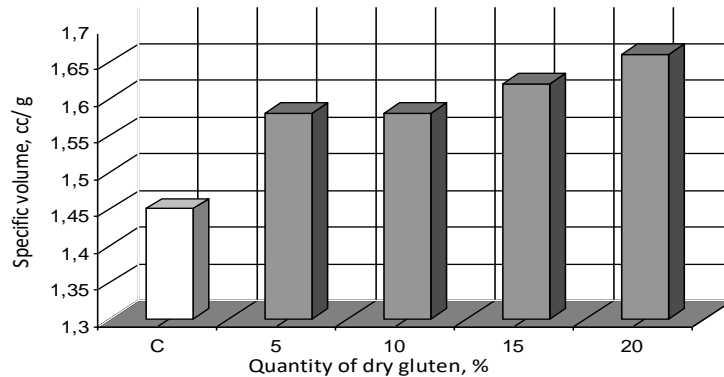
**Fig. 2.** Influence of dry gluten on index H/D of barley flour bread

Figure 2 shows the change of indicator (H/ D) of bread with barley flour and dry gluten. Bread with 5 % dry gluten has highest indicator H/ D - 0.48. On the other hand the higher quantity of dry gluten decreased the indicator H/ D. The index variation is 0.03 units, which is practically insignificant.

Despite of the reduction, all the fourth variety with dry gluten showed a high index H/ D compared to the control sample. The results of the statistical analysing show that the standard deviation of the samples is  $\pm 0.03$  with a level  $\alpha = 0.05$  [14].

The results of studies of the samples specific volume are presented in figure 3. It was found that the specific volume with higher values more in addition of 5 % dry gluten. A tendence is similar with higher quantity of dry gluten (10, 15 and 20 %). The highest specific volume is obtained with an addition of 20 % dry gluten respectively 1.66 cc/ g.

The difference between the control sample volume and those with 20 % dry gluten, in percentage is 12.65. This indicates that the dry gluten increases the specific volume of the samples at all levels of its addition, whence it follows that the bread quality improves. In a statistical treatment of data showed that the sample standard deviation is  $\pm 0.078$ .

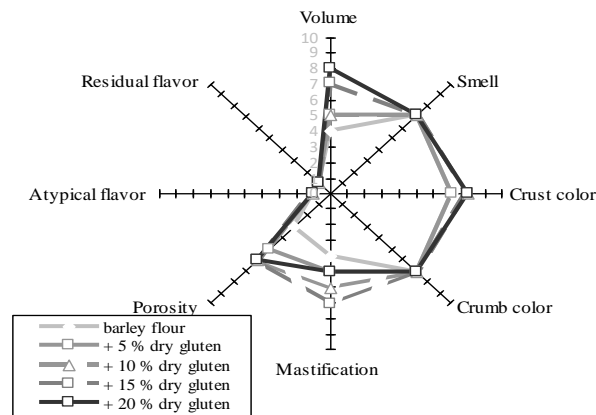


**Fig. 3.** Influence of dry gluten on specific volume of barley flour bread

### 3.2. Sensory evaluation of bread with barley flour and dry gluten

Results of sensory evaluation of bread samples containing different level of dry gluten substitution as compared to the control is shown in figure 4. It is found that the bread formed shape is specific with visible light cracks in the crust. The crust color of both bread is intensely colored. The color is dark practically identical to that of control sample.

High quality of the samples at all levels of incorporation of dry gluten is established in the porosity. The crumb is perceived as more developed. The difference between the samples is achieved 3 units.



**Fig. 4.** Sensory analysis of barley flour bread and dry gluten

The taste of bread is pronounced identical to this of bread from barley flour because of the rich, and specific smell of barley flour. Bread crumb is very moist. This is due to high relative water absorption of barley flour (72 %). By increasing the quantity of gluten bread masticates is improved. The best results were obtained with 10 and 15 % dry gluten. Bread has an atypical flavor and residual flavor. The biggest difference between the samples is found in the volume. 4 points is for control sample, 8 points is with 20 % dry gluten. This is a significant increase in this indicator. The higher volume is likely due to the improved elasticity and gas retention properties of barley dough with dry gluten.

#### 4. Conclusion:

The results from experiments indicated that all the samples with dry gluten have a high ratio H/ D compared to that of the control bread. The dry gluten increases the specific volume of the samples at all levels of its submission. The results of sensory analysis using hedonic rating showed that addition of 10 and 15 % dry gluten disadvantages of gluten free bread is reduced to an acceptable level. Increasing the quantity of dry gluten causes an increase in volume, in consequence, and a bread specific volume. In sensory analysis made to establish that the quality of the samples at all levels of the addition of dry gluten is accounted for porosity index – crumb is perceived as being more developed.

#### 5. References:

1. Вангелов А, Гр. Караджов (1993), – “Технология на хляба и тестените изделия “, ръководство за лабораторни упражнения, Земиздат, София.
2. Михалкова Н., Г. Маринова (2011), Изследване влиянието на функционални добавки от ечемик и овес върху качествените показатели на хляба. *Н. Тр. УХТ – Пловдив, LVIII, св 1*, стр.439-444.
3. Михалкова Н., Г. Стефанов, В. Бъчваров, Г. Маринова, Ж. Найденова (2010), Получаване на обогатено на  $\beta$ -глюкани брашно от голозърнест овес. *Н. Тр. УХТ – Пловдив, LVII, св 1*, стр.183-188.
4. Наредба № 9 на МЗ от 16.03.2001 г. за качеството на водата предназначена за питейно-битови нужди (ДВ бр. 30 от 2001 г.).
5. Alu'datt M. H., T. Rababah, K. Ereifej, I. Alli, M. A. Alrababah, A. Almajwal, N. Masadeh and M. N. Alhamad (2011), Effects of barley flour and barley protein isolate on chemical, functional, nutritional and biological properties of Pita bread, *Journal of Food Science and Technology, Article in Press*.
6. Bjorklund M van R.A., et al. (2005), Changes in serum lipids and postprandial glucose and insulin concentrations after consumption of beverages with beta-glucans from oats or barley: a randomized dose-controlled trial. *Eur. Journal Clin Nutr* p. 1272-81.
7. Choi I., [Mi-Ja Lee](#), [Jae-Sung Choi](#), [Jong-Nae Hyun](#), [Ki-Hoon Park](#) and [Kee-Jong Kim](#) (2011), Bread quality by substituting normal and waxy hull-less barley (*Hordeum Vulgare* L.) flours, *Food Science and Biotechnology*, **Vol. 20**, Number 3, p. 671-678.
8. Gill S., T. Vasanthan, B. Ooraikul, B. Rossnagel (2002), Wheat bread quality as influenced by the substitution of waxy and regular barley flours in their native and extruded forms, *Journal of Cereal Science* **Vol. 36** (2): 219 – 237.
9. ISO 6658-85, Sensory analysis – Methodology – General guidance;
10. Izydorczyk M. S., J. E. Dexter (2008), Barley  $\beta$ -glucans and arabinoxylans: Molecular structure, physicochemical properties, and uses in food products: *Food Research International* **41** (9), p. 850-868.
11. Karolini-Skaradzinska Z., H. Subda, A. Czubaszek (2006), Influence of addition of barley flour on properties of dough and bread obtained from flours of spring and winter wheat's, *YWNO. Nauka. Technologia. Jako*, 2 (**47**), p. 124 – 132.
12. Ruthann B. Sw. Marjorie, P. Penfield (1988), Barley flour level and salt level selection for a whole-grain bread formula, *Journal of Food science*, **Vol. 53, Issue 3**, pages 896–901.
13. Shouk A.A., S.Y. El-Faham (2005), Effect of fat replacers and hull-less barley flour on croissant quality, *Polish Journal of Food and Nutrition Sciences* **vol: 14/55**, number: 3, pages: 287-292.
14. Sigma Plot 11, exact Graphs and Data Analysis.