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STUDY CONCERNING THE USE OF GERMINATED OAT FLOUR IN OBTAINING DIETARY BREAD

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Abstract

The flour obtained from sprouted grains is successfully used in the composition of functional and dietetic foods. Due to the high content of active ingredients and good bioavailability of their nutritional compounds, the products made from sprouted grain flour have a higher quality in comparison with classic foods. By using white wheat flour and flour from germinated oats in different percentages (5%, 10% and 15%), we obtained a bakery product: bread with sprouted oats, which has been characterized in term of physical-chemical parameters. The addition of germinated oat flour in raw material diminishes gluten content and enhances the ability of flour hydration, which increases the elastic properties of the product and its storage life. Sprouted oat bread is distinguished by a high content of minerals(15% sprouted germinated oat flour added). The amount of carbohydrates is reduced to20% in bread with 15% sprouted germinated oat flour and this product is recommended in the hypoglycemicdiet.

Key words*: bread, sprouted germinated oat flour.*

INTRODUCTION

Production and consumption of functional foods is a strong current trend in healthy eating. These foods have an important biological role in all metabolic processes of the body. These ensure the health, promote the growth and development of the organism and optimize metabolic processes, physiological activity of the organs, the immune system, cognitive performance and the defense against oxidative stress (Alexa 2010; Hurgoiu, 2004).Known as protective food, functional food can be used for a long time without causing adverse side effects, cytoprotective and restorative effects, increasing the body's natural immunity (Zielińska-Dawidziak et al., 2014).

Cereals are the first vegetable matrices used as functional foods. It is known the role of dietary fiber from cereals in ensuring a healthy diet (Finney, 1982; Alexa, 2009). Germination, as process of grain processing, lead to a significant increase in the content of bioactive compounds (vitamins, bioelements, enzymes) of a product, making it the product of functional food (Alexa et al., 2009; Botau et al., 2015). Germinated grain flours have a higher bioavailability of nutritional compounds and permit the production of functional food. Germinated oat is the ideal food for a perfectly healthy diet. Given the large number of nutrients that are found in oat germ, they bring a multitude of benefits to our health, being an important source of protein, unsaturated fats, fiber, vitamins A, B1, B2, B6, D, E and K, iron, phosphorus, magnesium and zinc. Germinated oat are recommended in treating anemia, but also helps to strengthen the immune system, protects the muscles, circulatory system, lungs and improves visual acuity. Being very rich in antioxidants, they protect our cells against free radical damage. Treatment with oat germ is indicated for strengthening immunity being recommended for older people and children. The chemical composition of germinated cereals and their positive effect on organism have been reported in previous studies. (Hidalgo et al., 2013; De Vasconcelos et al., 2013; Marton, 2010; Pandhre et al., 2011).

The research aim was the obtaining a product from white wheat flour with added germinated oat flour in different percentages, which was analyzed in term of physical-chemical parameters. The association of germinated grain in bakery matrix is an innovative solution for obtaining functional foods.

MATERIALS AND METHODS

The characteristics of germinated oat flour

The study of physical-chemical proprieties aimed the determination of content in gluten,

hydration capacity (CH) and acidity of flour samples studied. For the samples of bread, was analyzed ash content, the height to diameter (H / D) and humidity. The gluten content, the ability of moisture, ash content and humidity were expressed as a percentage, acidity was expressed in degrees of acidity, and the ratio of height to diameter (H / D) was obtained by dividing the height of the samples of bread to the diameter of these samples.

Obtaining of germinated oat flour

Germinated oat was obtained in USAMVB laboratory and included: oat washing, seeds germination in Petri dishes under optimal conditions, germs harvesting, drying, grinding and obtaining of dry germ germinated oat flour which is stored until use in obtaining of bread with sprouted oats.

Oats were germinated for 7 days at 20-24^{o}C , after a pre- soaking for 40 hours. Green malt obtained was dried at temperature below 65^{o}C until the moisture below 6% .

Phisical-chemical characterisation of flours

White flour and germinated oat flour were analyzed in term of wet gluten content (G), hydration capacity (CH) and acidity (A) accordingSTAS 90/1988.

Obtaining of bread with germinated oat flour

The bread was made by the direct method for the preparation of the dough.The bread was obtained using white wheat flour and flour from germinated oats in different percentages (5%, 10% and 15%). Dosage of raw materials was done by weighing or measuring according to technological recipes. To obtain bread with 10% germinated oat flour we use 300 g white wheat flour type 480, 180 g Water, 3 g yeast, 30 g oat flour, 4.5 g salt. All materials were homogenized on high speed of mixer for 10 minutes, to obtain the dough. The fermentation was done 40 minutes at 35^{o}C and then the dough was divided and shaped in round forms. The dough was baked 20 minutes at 220 ° C (Moldoveanu, 1992).

Physical-chemical characterisation of bread with germinated oat flour

Regarding sensorial properties it was analysed the product shape, appearance and color of the shell, core sectional appearance, consistency, smell and taste. The main physical-chemical parameters of bread: ration between bread height and diameter (H/D), ash and bread humidity were determined according STAS 91/1983 - "Bread, bakery products and bakery specialties. Methods of Analysis".

Statistical analysis

To determine the significance of differences between flours and breads, data processing was performed by analysis of variance and t-test (Ciulca, 2006). The basic principle of biplot method developed by Gabriel *et al.* 1971 was also used.

RESULTS AND DISCUSSIONS

There were obtained three types of bread containing oat germ meal of 5%, 10% and 15% added to wheat flour, which were characterized in term of physical and chemical parameters. The sensorial properties shown that bread with 5% and 10% oats germ meal was well increased, with well-developed core, uniform porosity, darker compared to the control and pleasant taste. Bread with added 15% oats germ meal was less high, with well-developed core, uniform porosity, but less elastic than the5% and 10% germinated oat flour added. The color was darker than the sample with 10% germinated oat flour added and slightly astringent taste (Table 1).

Table 1. Results on sensorial examination of bread with oat germs flour

Sensorial	Bread with 5% oats germ meal	Bread with 10% oats germ meal	Bread with 15% oats germ meal
Product form	Oval shape, very well brought	Oval shape, well brought	Oval shape, less high
Shell:Skin, color	Color close to the witness, without cracks	Darker compared to the control, without cracks	Darker than the other samples, cracks
Core: Sectional appearance, color, consistency	The corevery well developed,uniform porosity	The core well developed, uniform porosity	The core well developed, uniform, elastic smaller, darker
Smell	Pleasant	Pleasant	Pleasant
Taste	Very pleasant	Pleasant	Slightly astringent taste

The addition of germinated oat flour in wheat flour causes the decrease of the gluten content in bread (Table 2). Gluten content was 26% for bread flour with addition of 5%, 22% for the bread with 10% flour and 20% for the bread with 15% added oat germ meal.

In the study made by MacArtur and D'Appolonia (1984), the values of wet gluten in the samples of flour obtained from wheat varietes Waldron (41.6%), Olaf (36.1%) and Experimental (38.3%) were significantly superior to those established by us. These authors reported a maximum value of the wet gluten content at 41.6% and in our study, there was obtained the value of 26%. This difference was influenced by the type of flour and the genotype used. In our researches was analysed a mixture made from wheat flour and germ germinated oat flour (variety Lovrin 1) and in the study mentioned above was determined wet gluten in the flour varieties of wheat Waldron, Olaf and Experimental without being mixed with flour germinated grain. Therefore, it appears that increasing the quantity of flour from germinated oats determines an significant decrease in wet gluten content in the dough, which is of great practical importance to obtain dietary products.

The white flours hydration capacity (CH) augments with increased addition of germinated oat flour, as showed by the results presented in Table 2.

From the technological point of view this is very important because a higher hydration capacity increases elastic properties of the product and increases the duration of storage. By sprouting, hydrolytic enzymes release chemical compounds that increase the absorption of water and ensure their solubility.

In other studies (Camire and Flint, 1992) was determined hydration capacity of germinated oat flour and cornmeal, settling lower values than those obtained by us. Also, Bhatty (1986) established a capacity of hydration much lower then our results at flours made from oat varieties Scout and Tupper.

The acidity of samples arises once the addition of germinated oat flour, mostly due to higher enzyme activity is flour made from sprouted grains compared to white wheat flour made from the grain endosperm lacking the enzyme equipment In other studies, the maximum degree of acidity found in wheat flour was at the value 3 (Moldoveanu, 1992), higher than the values determined by us.

The ratio between height and diameter (H/D) does not vary in the case of addition of 5% and respectively 10% oat flour. Significant changes in this parameter is recorded in the case of addition 15% germinated oat flour (Table 2).

Values of the first two breads analyzed indicates a ratio H / D balanced while the low value for bread with added 15% germinated oat flour is due to a height lower sample analyzed and a larger diameter, providing an indication that the bread has a lower quality.

Moisture content of bread samples with addition of germinated germinated oat flour does not vary within wide limits. There is a small increase once with augmentation of germinated oat flour percentage added to the sample (Table 2).

Humidity values were within the limits imposed by STAS 878/68 for white bread weighing up to 1 kg (up 43.5%). Moisture core, expressed as a percentage, was between 43 and 43.5% in some samples of white bread (Moldoveanu, 1992), standing out higher values than those obtained in our measurements.

The ash content, that shows the contribution of mineral substances in bread, increases with the addition of germinated oat flour, being at maximum in case of 15% bread with oat flour germinated, enhancing food value product (Table 2).

The values of ash obtained in the study of Maleki et al. (1980) were between 0.41% and 0.43%. Measurements were made at certain flours obtained from several varieties of wheat, such as Eagle, Omaha, Aurora, etc. It appears that these values are significantly lower than those achieved by us, which shows that our product has a high food value due by the use of germinated oat flours.

In Table 2 is presented the statistical analysis of the values obtained regarding flour samples and bread with germinated oat added. Statistical analysis of the values obtained shows that raw material (white flour) with addition of 5% germinated oat flour was significantly superior to other types of gluten analyzed. The hydration capacity (CH) and acidity showed values significantly higher at 15% flour with added sprouted germinated oat flour. Bread with

added 15% germinated barley flour presented values of total ash and moisture significantly superior to other varieties while bread with added 5% and 10% germinated oat flour have identical values, which is significantly superior to other assortment analyzed.

Raw material with addition of 5% germinated barley flour showed significantly superior values towards to the average of gluten, while with the addition of 15% oat flour germ, gluten had significantly lower value.

The capacity hydration and acidity of raw materials with 15% germinated oat showed significantly superior values to the average, while 5% germinated oat showed values significantly below the average. Assortment of bread with 15% added flour from germinated oats had significantly superior values to the average of moisture and ash, while the values significantly lower than the average of those traits were recorded at bread with added 5% flour from germinated oats. The proportion height-diameter (H/D) presented values signifycantly superior to the average at assortments of bread with added 5% and 10% germ germinated oat flour and bread with added 15% germinated oat flour presented value significantly lower than the average.

Table 2. Statistical analysis of flour samples and bread with germinated oat added

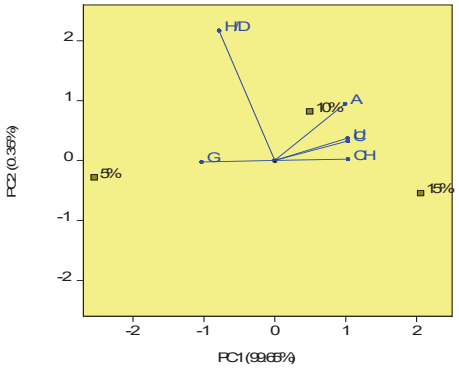
Analyzed sample	Wheat flour with germinated oat flour			Bread		
	Gluten (%)	CH(%)	Acidity(degrees)	Ash(%)	ProportionH/D	Humidity (%)
5% germinated oat	**26a**	60b	1.44b	2.60b	**0.45a**	36.20b
10% germinated oat	22ab	62ab	2.72a	2.90ab	**0.45a**	36.62ab
15% germinated oat	20b	**63a**	**2.80a**	**3.00a**	0.42a	**36.75a**
Average	**22.67±1.76**	**61.67±0.88**	**2.32±0.44**	**2.83±0.12**	**0.44±0.01**	**36.52±0.17**
Dl 5%	4.81	2.40	1.20	0.33	0.04	0.45
Dl 1%	7.54	3.77	1.88	0.51	0.06	0.71
Dl 0,1%	12.85	6.43	3.21	0.88	0.10	1.21

They are considered significant differences between genotypes lettered differently

In the Figure 1 is presented the bread obtained with different percentages of germinated oat flour germs.

Figure 1. Bread with germinated oat flour

The two dimensional biplot representation for physical-chemical proprieties of flour and bread with added germinated oat flour samples (Figure 2) shows that wheat flour with the addition of 15% germinated oat flour associate with highest values for capacity hydration and acidity.



G - gluten, CH – hydration capacity, A – acidity, C – ash, H/D – ratio H/D, U – humidity

Figure 2. Biplot analysis for physical-chemical properties of flour samples and bread with germinated oat added

The highest content of gluten is present in the flour with the addition of 5% germinated oat flour that dropped with increasing amounts of sprout germinated oat flour. Regarding the

bread, the highest values for the amount of ash and moisture is associated with bread with added 15% germinated oat flour. The values of height-to-diameter ratio (H/D) shows the same values for bread with added 5% and 10% germinated oat flour (0.45), which is higher than bread with added 15% of germinated oat flour (0.42).

CONCLUSIONS

The addition of germinated oat flour germ in wheat flour causes the decrease of the gluten content. By addition of 10% oat flour, the hydration capacity increases at 62% and respectivelyat 63% in the case of the addition of 15% oat flour.

The acidity of the samples augments with the addition of germinated oat flour germ flour, this fact is due to higher enzyme activity of germinated oat flour.

The sensorial properties of samples shown that bread with 5% and 10% oats germ meal was well increased, with well-developed core, uniform porosity, darker compared to the control and pleasant taste. Bread with added 15% oats germ meal was less high, with well-developed core, uniform porosity, but less elastic than the 5% and 10% germinated oat flour added.

The contribution of mineral substances in bread arises with the addition of germinated oat flour, being the maximum at the bread with 15% germinated oat flour, which increases the nutritional value of the product.

Two-dimensional diagram for physical-chemical properties of the types of bread tested shows that the wheat flour with the addition of 15% germinated oat flour associate the highest values for hydration capacity and acidity.

The addition of germinated oat flour germ flour in bread recipe increases the nutritional value and dietary potential of bread.

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