Analysis of The Properties of Bread From Local Rye and Wheat For Sustainable Production of Bread

Muhammad Zaxiriddin Zaynobiddinov[1], *Qo'chqor* Dodayev[2], *Suvonqul* Ravshanov[2], *Dilrabo* Maksumova[2], *Kasun* Dissanayake[2], *Hisanithy* Parasuraman[3] and *Mohamed* Rifky[3,4*]

[1]Andijan Institute of Agriculture and Agricultural Technologies, Andijan, 71,000, Uzbekistan
[2]Tashkent Institute of Chemical Technology, Tashkent, 100,000, Uzbekistan
[3]Eastern University, Sri Lanka, Chenkalady, 30350, Sri Lanka
[4]Naveen Jindal Young Global Research Fellowship, O.P. Jindal Global University, India

Abstract. This article analyze the properties of bread from local Rye and Wheat. An analysis of the properties of flour prepared from rye grain "Vakhshskaya 116" and wheat "Davr" grown in the Andijan region of the Republic of Uzbekistan is presented. The main raw material for these products is wheat flour, and the main problem is that rye, triticale, oats, barley, peas and other sources are used very little or not at all. In this regard, everyone knows that there is an urgent issue of expanding the general list of assortments with products made from rye grain and triticale**.** The chemical composition of bread, defects and diseases are studied, and a comparative analysis of the indicators of grain and bread is carried out.

1 Introduction

It has been established that 60% of the biologically active substances, proteins, carbohydrates, fats, macro and micro-elements, vitamins needed by the human body, as well as the bulk of organic acids, are obtained from consumed cereals and grain products. The main cereal products consumed in the Republic of Uzbekistan are made from wheat flour, most of which are bread and bakery products. The second part of the problem is that the main raw material for these products is wheat flour, and the main problem is that rye, triticale, oats, barley, peas and other sources are used very little or not at all.

In this regard, everyone knows that there is an urgent issue of expanding the general list of assortments with products made from rye grain and triticale. Using local raw materials to solve a problem is also a solution to the problem of localizing raw materials, which are always in demand. One of the main tasks is to further analyse the technology for the production of bakery products specially bread from local rye and triticale flour, their beneficial properties and expand the range of flour products [1-3].

Today, research institutes and production companies in developed countries: Russia, Belarus, Poland, Germany, Denmark, Latvia, Italy, England, USA, Canada are conducting

* Corresponding author: rifkyalm@esn.ac.lk

scientific research on the enrichment of various grain products with bioactive substances and other food products [4,5].

Widespread research on moisture-thermal processing of grain-bread was done to examine how different techniques of preparing wheat grain for grinding affected the production of flour and the quality of baked bread. Our research is aimed at studying the amino acid composition of rye flour protein and the content of vitamins, which provide excellent properties of bread. When preparing bread products from a mixture of wheat flour and the flour obtained from Rye, the bread is enriched with a large number of macro- and microelements, vitamins, dietary fiber, and acquires low-starch dietary properties.

It has been established that bread made from bran and low-grade flour has the highest mineral content. According to SanRandN "Sanitary Rules and Norms", the average daily physiological human need for minerals in consumer products is: Potassium (K-3500 mg); Sodium (Na-2400 mg); Phosphorus (P-1000 mg); Calcium (Ca-1000 mg); Iron (Fe-400 mg) and Magnesium (Na-400 mg) [6-8].

The nutritional value of bread products is determined by their chemical composition; it has been studied that the composition of the main and additional ingredients in the recipe depends on changes in its composition during the bread production process. Safety of the bakery products are the main concern in the production of bread. It is necessary to study the safety of bread with rye flour, as well as bread products made from various raw materials.

Chalk disease (Mycotoxinos) occurs as a result of the development of the fungi *Endomyces fibuligera* and *Monilia variabilis* in the crust or pulp of bread. This disease is caused by mycotoxins produced by fungi. Mycotoxins may be in the form of a hard coating (the mushroom itself or a coating in the flour). They can also develop in intact breadcrumbs containing flour.

Spots or chalky white coating is a joint-like coating formed by fungi on slices of bread which is a risk to humans. This disease does not pose a threat to humans, but eating contaminated bread may pose a risk of food poisoning due to exposure to certain types of mycotoxins. It is not allowed to process spoiled bread and feed it to livestock.

Bloody bread disease is caused by the activity of the bacterium *Serratia marcescens* or "wonderful stick". It enters bread from the external environment and develops well in it at a temperature of 25-30°C. This releases the red pigment prodigiosin, which forms bright red spots on white bread that look like blood. As a result of eating such bread, the body is poisoned, sometimes fatal. Bread infected with this disease is destroyed totally to prevent contamination to human. Potato bread disease is caused by the bacteria *Bacillus subtilis*.

The optimal conditions for the development of these bacterial spores are at the temperature of 40°C, humidity, the presence of nutrients and a slightly acidic environment. The spores can withstand temperatures of 120°C for an hour. Under the influence of proteolytic enzymes of potato sticks, the protein is broken down, and the resulting product will be having a sharp, characteristic odour [9-12].

Potato bread disease causes bread to become sticky, slimy, and thread-like structure. It is strictly forbidden to process such bread. After being examined by experts, bread contaminated by this illness will be kept in a different room and destroyed to avaoid contaminations. Available mold, fungus and their spores will develop on the baked bread at high relative humidity and temperatures ranging from 5 to 50°C. These conditions promote the creation and accumulation of mycotoxins, also known as aflatoxins, which are harmful to people. Therefore this research is done to analysis of the properties of bread from local rye and wheat for sustainable production of bread.

2 Methods

Inductively coupled plasma mass spectrometry (ICP-MS) was performed to determine macro and microelements available in the grains. The elements calcium, phosphorus, magnesium, iron, and iodine were identified in food products using this method. This was accomplished by measuring 0.0500-0.500 g of the test material using an analytical balance, then filling a Teflon container in an autoclave with the proper quantity of purified condensed mineral acids (hydrogen peroxide and nitric acid).

After being sealed, the autoclave was placed inside a Bergh of programmed microwave digester (MWS-3+). The right program was chosen based on the kind of material being tested in the research. Following the autoclave process, the materials were transferred to 50 or 100 ml volumetric flasks and adjusted to the necessary level using 0.5% nitric acid.

An ISPMS spectrometer or a comparable emission spectrometer with inductively coupled argon plasma was used to determine the chemicals available in the grains. For the aforementioned analysis, the following tools were utilized. Flasks of various sizes, ISPMS NEXION-2000 or comparable mass spectrometer, German microwave separators, or comparable Teflon autoclave. Multi-element standard No. 3 (29 elements for MS) was the set of chemicals utilized. Mercury, hydrogen peroxide, nitric acid, bi-distilled water, and argon (gas purity 99, 99.5%) were used as the standards.

3 Results and Discussion

Macro and microelements contained in bread are substances that are of great for the structure and health of food. These elements provide the chemical structure of food and are necessary for the human body to perform necessary functions. The plasma inductance of macro- and microelements was determined by mass spectrometry (ISP-MS), the results are presented in table 1.

Table 1 shows the comparative analysis of the composition of the macro and microelements in rye grain (Vakhshskaya 116), wheat grain (Davr), and the breads were made of these grains. The analysis of the data reveals that there were large changes in elemental concentrations due to the baking process and processing stages involved in the manufacture of bread.

Column 5 of Table 1 shows the amount of minerals in rye bread. The content of lithium, beryllium, boron, aluminum, silicon, calcium, titanium, chromium, copper, germanium, zirconium, molybdenum, silver, potassium, antimony, cesium, barium, tungsten, lead, bismuth is less than the amount in the original grain.

Table 1. Micro- and macroelement composition of rye grain “Vakhshskaya 116”, wheat “Davr” and bread made from them

Macro- and microelements		Corn		Bread		The difference between grain and bread		MPS
		Rye grain, mg/l	wheat grain, mg/l	Rye bread, mg/l	Wheat bread, *mg/l*	Rye, mg/l	Wheat , mg/l	
Lithium	Li	0.019	0.018	0.016	0.033	-0.003	0.015	0.030 mg/kg

Berellium	Be	0.048	0.054	0.011	0.008	-0.037	-0.046	-
Bor	B	2.643	2.144	0.956	0.964	-1.687	-1.18	0.500 mg/kg
Sodium	Na	271.528	241.167	2987.773	2896.765	2716.245	2655.598	-
Magnesium	Mg	407.928	341.434	551.016	575.67	143.088	234.236	-
Aluminum	Al	14.006	7.37	7.956	18.076	-6.05	10.706	0.500 mg/kg
Silicon	Si	319.379	330.917	134.262	276.198	-185.117	-54.719	100.000 mg/kg
Phosphorus	P	587.461	608.576	677.437	771.942	89.976	163.366	-
Sulfur	S	472.074	490.193	517.881	420.362	45.807	-69.831	160 mg/kg
Potassium	K	1853.51	1284.603	2797.79	2193.67	944.28	909.067	360 mg/kg
Calcium	Ca	1212	1298.923	487.536	454.22	-724.464	-844.703	-
Titanium	Ti	0.362	0.164	0.266	0.254	-0.096	0.09	0.100 mg/kg
Vanadium	V	0.024	0.023	0.033	0.041	0.009	0.018	150 mg/kg
Chromium	Cr	0.358	0.386	0.287	0.255	-0.071	-0.131	6.0 mg/kg
Manganese	Mn	2.401	2.58	2.736	3.657	0.335	1.077	1000 mg/kg
Iron	Fe	11.671	13.642	32.666	28.974	20.995	15.332	-
Cobalt	Co	0.014	0.008	0.022	0.021	0.008	0.013	5.0 mg/kg
Nickel	Ni	0.061	0.062	0.093	0.082	0.032	0.02	4.0 mg/kg
Copper	Cu	0.673	0.685	0.624	0.449	-0.049	-0.236	10 mg/kg
Zinc	Zn	3.902	2.642	4.753	4.099	0.851	1.457	50 mg/kg
Galium	Ga	0.045	0.03	0.058	0.09	0.013	0.06	-
Germanium	Ge	0.001	0.001	0	0	-0.001	-0.001	-
Arsenic	As	0.003	0.003	0.006	0.01	0.003	0.007	0.2 mg/kg
Selenium	Se	-0.029	-0.042	0.182	0.242	0.211	0.284	-
Rubidium	Rb	0.381	0.43	0.443	0.527	0.062	0.097	-
Strontium	Sr	0.516	0.288	0.539	0.502	0.023	0.214	11
Zirconium	Zr	0.07	0.006	0.024	0.025	-0.046	0.019	-
Nobiy	Nb	0	0	0	0	0	0	-
Molybdenum	Mo	0.125	0.068	0.074	-0.003	-0.051	-0.071	-
Serebno	Ag	0.002	0.001	0	0	-0.002	-0.001	-
Cadmium	Cd	0	0	0.001	0.001	0.001	0.001	0.1 mg/kg
Indium	In	0	0	0	0	0	0	-
Tin	Sn	1.823	1.863	1.01	1.189	-0.813	-0.674	-
Antimony	Sb	0.002	0.002	0.001	0.001	-0.001	-0.001	4.5 mg/kg
Cesium	Cs	0.001	0.001	0	0.001	-0.001	0	60 mg/kg,
Barium	Ba	0.384	0.384	0.312	0.473	-0.072	0.089	0,100 mg/L
Tantalus	Ta	0	0	0	0	0	0	-
Tungsten	W	0.001	0.001	-0.001	-0.001	-0.002	-0.002	-
Rhenium	Re	0	0	0	0	0	0	-
Mercury	Hg	-0.284	-0.555	0.001	0.001	0.285	0.556	0,03 mg/kg
Tellurium	Tl	0.001	0.001	0.004	-0.005	0.003	-0.006	-
Lead	Pb	0.004	0.009	-0.01	-0.003	-0.014	-0.012	0,50 mg/kg
Bismuth	Bi	0	0.001	-0.002	-0.002	-0.002	-0.003	-
Uranus	U	0.002	0.003	0.015	0.003	0.013	0	-

The content of boron, aluminum, silicon, sulfur, potassium, titanium and barium in rye bread exceeds the MAC. Bread made with rye flour can be deemed safe because it contains 0.006, MAC 0.2 mg/kg of arsenic, 0.001–MAC 0.1 mg/kg of cadmium, and 0.001–MAC 0.03 mg/kg of mercury. Column 6 "Wheat bread" of Table 1 indicates the amount of elements contained in wheat bread in mg/kg.

Baking significantly alters the elemental composition of grains. The amount of sodium is significantly raised with salt addition and other elements such as boron, silicon, and beryllium are reduced by thermal degradation or leaching. The nutritional value of the final product is maintained because of the essential minerals like magnesium that do not change significantly or are slightly changed. Nonetheless, the high concentration of aluminum in the wheat bread can be a sign to suggest that there is a contamination vulnerability that has to be monitored and regulated.

4 Conclusion

Bread made with rye flour can be deemed safe because it contains 0.006, MAC 0.2 mg/kg of arsenic, 0.001–MAC 0.1 mg/kg of cadmium, and 0.001–MAC 0.03 mg/kg of mercury. Local rye and wheat suitable for sustainable bread, bread safe, nutritionally enriched, Rye bread provides dietary diversity, supports food security and health goals.

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