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Effect on Quality of Pasta Adding of Finely Dispersed Amaranth Flour.

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ABSTRACT

The studies of particle size distribution, the color characteristics of flour whiteness, strength and quality of the cooked pasta are established that to obtain pasta from aestivum wheat flour extra class with good physico-chemical and organoleptic parameters in the formula is allowed adding no more than 7.5% and for pasta from the durum wheat flour no more than 10.0% of finely dispersed amaranth flour, further increasing dosages of fine amaranth flour deteriorate technological properties of pasta. The use of fine flour amaranth it is advisable to enrich the pasta with valuable food components.

Keywords: pasta, aestivum wheat flour extra class, durum wheat flour, finely dispersed amaranth flour, grain size, color characteristics flour, strength of pasta.

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INTRODUCTION

One of the problems of modern humanity - the creation of useful food for human health. The deficit in the body of protein, dietary fiber, vitamins, macro- and microelements is a threat to health and requires urgent revision of approaches to processing of vegetable raw materials.

Traditional types of pasta have insufficient nutritional value, imbalance of essential nutrients of protein and carbohydrates. At present, the pasta industry set targets to improve the range, improve product quality, expanding production of products enriched with protein, vitamins and other components of high nutritional and biological value. The most promising way to solve this problem - the manufacture of products enriched with biologically valuable additives, obtained by processing vegetable raw materials that will improve the quality of food, to meet the demand for dietary and medical products of domestic production [1-3].

In recent years, the global market has a new source of raw materials for the food industry - amaranth grain and its products. Amaranth has the highest unpretentious, it can grow on saline and alkaline soils, resistant to drought. Milled grain amaranth contains about 16% protein, 6.5% fat, most of which comprise the unsaturated fatty acid, 50% starch, minerals, pectin, lysine. By quantity of lysine in amaranth exceeds many of the products. This amino acid is very important and indispensable, as involved in the production of antibodies, tissues, hormones, enzymes, and collagen. Amaranth also contain vitamins A, B6, C and K, folic acid, riboflavin, calcium, potassium, iron, copper, magnesium, phosphorus [4-6].

Grain amaranth contains squalene, which is indispensable for the synthesis of vitamin D in the human body. The seeds are also rich in dietary fibers that clean the intestines of toxins and improve digestion. Potassium, calcium, iron and magnesium in the composition amaranth seed strengthen cardiovascular system. Protein and nutrients tend to give a feeling of fullness very quickly, thereby reducing the risk of overeating. Amaranth - is a real dietary product. Regular consumption of oil and amaranth seed is a good prevention eye disease, senile dementia, tumors, insomnia.

In view of the above research aimed at improving the food and biological value of pasta, to improve their organoleptic and physico-chemical parameters on the basis of the use of amaranth flour are relevant.

MATERIALS AND METHODS

For experimental studies used aestivum wheat flour extra class, durum wheat flour (semolina), the fine amaranth flour and applied methods to control particle size distribution, brightness and color characteristics of aestivum wheat, durum wheat and amaranth flour. Was studied the effect of amaranth flour on the strength and quality of the pasta.

Size distribution of the different flour samples were determined using information-measuring system (IIS) based on the "GIU-1" device.

The principle of operation of an optical granulometer "GIU-1", created on the base of the microscope, "Biolam- I" is based on an analysis of the electron microscopy images of the sample flour, applied on a glass slide. The specialized software allows you to search and count the particles, measured light transmission of particles, their size, elongation, and the smoothness of the area. [7] The range of measured particle size of 1-250 microns. Processing time frame of 0.4 s and time to obtain statistically reliable results (10,000 particles) for each sample – 10 min.

Whiteness of flour whiteness was determined by Blik-R3. The spectral region of whiteness Blik-R3 is within 540±50 nm range of the measured reflection coefficients – from 45 to 90 %, the standard deviation of measurements of the reflection coefficients - 0.3 %, the basic absolute measurement error - 1.0% and the number of automatically measuring fields on the preparation of samples 10 pcs. Time determination of brightness of one sample not more than 60 seconds. Color characteristics were determined using flour device Chromameter Cr-410. The operating principle of the three-position of the colorimeter based on the measurement of the reflection coefficient of light waves from the test sample. The instrument produces three measurements at different wavelengths on the basis of the results of color coordinate which are calculated in two different systems, as well as yellowness [8].

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Durability pasta determined on the device "Structuremeter ST-2 ', designed to determine the rheological and strength properties of raw materials, semi-finished and finished food products. Determination of rheological properties of food environments on the basis of kinetic analysis (load changes over time) and dynamics (measurement of mechanical stress on the penetration depth of the indenter) loading force measured by the strain gage (resistive-strain transducer) when moving to join him different indenters vertical for a given speed law [9].

Organoleptic (color, surface condition, shape, smell and taste), physico-chemical (moisture, acidity) quality indicators and cooking properties of durum wheat were determined according to the manual [10].

Cooking pasta properties are characterized by keeping the shape, duration of cooking until tender, magnification mass products (Km), the amount of solids that have passed into the cooking water, the state of the cooking water.

To determine the status of products after cooking 50 - 100 g pastas placed in a ten-fold amount by weight of boiling water and cooked until tender. After cooking the pasta was transferred to a sieve, drain the water and given by the external examination the dimensional stability of products and their adhesion to each other.

The duration of cooking until cooked defined period of time by immersing articles into the boiling water until the disappearance of powdery layer of lack of fusion. When cooking pasta periodically removed a small segment of products, placed it between two bits of glass and squeezed. The disappearance of undercooked mealy "wick" shows the willingness of welded products.

Magnification weight product during cooking was calculated by the formula

$$K = M_2 - M_1/M_1$$

where: M_2 - mass of cooked products, g (determined after draining the cooking liquid); M_1 - the mass of dry products.

The amount of solids that have passed into the cooking water, determined by accelerated method and expressed as a percentage of the dry mass of products made at the brew. The amount of solids which have passed into the cooking water P (in%) was calculated by the formula:

$$P=(b - a)\cdot V/G\cdot 50\bullet(100)$$

Where: b - the mass of the cup with a dry residue, g; a - the mass of an empty bowl, g;

RESULTS AND DISCUSSION

Studied particle size distribution of aestivum wheat flour extra class durum wheat flour (semolina) and a finely dispersed amaranth flour.

The results of particle size distribution of the flour are shown in Table 1 and Figure 1, and color characteristics in Table 2.

Table 1 - Dispersibility of different types of flour and morphological features of its particles

Raw materials	D in eq.	Smoothness	Elongation	Light transmission
Aestivum wheat flour extra class	107 microns	2	1,66	0,86
Durum wheat flour	210 microns	2,15	1,63	0,91
Finely dispersed Amaranth flour	69 microns	2,19	1,81	0,78

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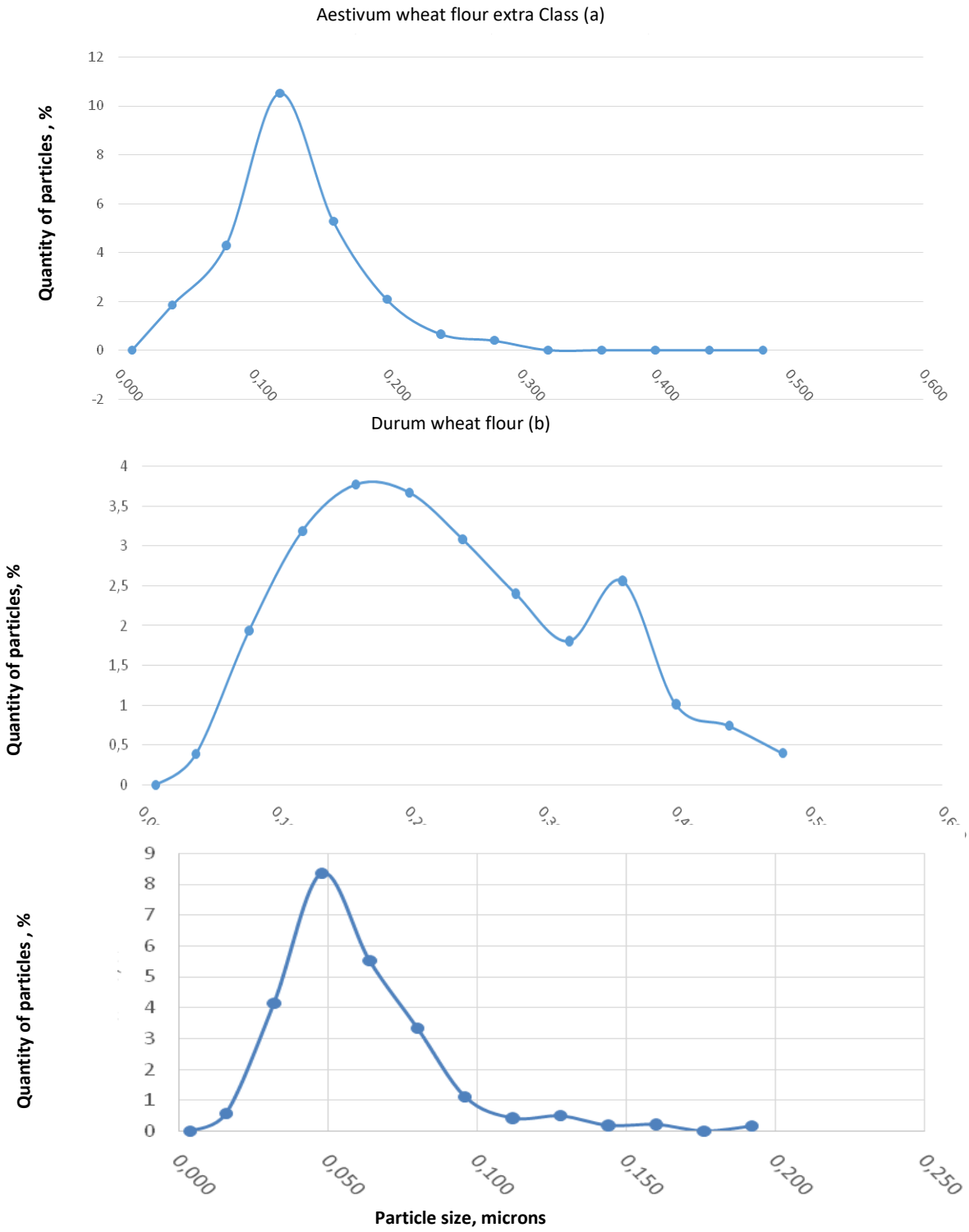

Figure 1 – particle size distribution of aestivum wheat flour extra class (a), durum wheat flour (b), finely dispersed amaranth flour (c)

From figure 1. size of particle distribution higher in durum wheat and lower in amaranth flour. Table 1 shows the values of the average equivalent particle size of dispersed systems and analyzed the parameters of their morphological features.

Color of flours was evaluated using Japanese colorimeter Chromameter Cr-410 whiteness was determined on apparatus white flour Blik -R3. The color of the objects evaluated at the three-dimensional color model in the Lab coordinate system. The results are shown in Table 2.

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Table 2 - The color characteristics of disperse systems, controlled by a Cr-410 devices and Blik-R3

Type of flour	Cr-410				Blik-R3
	L	a	B	yellowness	Whiteness cond., unit.
Aestivum wheat flour extra class	92,99	0,425	9,345	0,101	56,4
Durum wheat flour	87,935	1,39	23,745	0,270	16,5
Finely dispersed amaranth flour	82,46	1,2	12,51	0,152	26,2

Analysis of the data in Table 2 showed that durum wheat semolina and a finely dispersed amaranth flour yellowness index has a higher performance than aestivum wheat flour extra class.

The color of products may vary from the color of the primary and secondary raw materials and conditions of the technological process of production. Products made from durum wheat flour durum wheat will have a yellow color. White or slightly off-white color characteristic of products made of baking flour. Adding additives, for example, finely dispersed amaranth flour, makes obtaining the necessary presentation to the functional pasta.

In order to determine the possible dosages of finely dispersed amaranth flour in the recipe Pasta produced in the laboratory for formulation and process parameters set forth in the user manual [10].

Pasta was made from aestivum wheat flour extra class and durum wheat flour with finely dispersed amaranth flour in dosages of 5; 7.5; 10; 12.5; 15; 17.5; 20.0% by weight. We assessed the organoleptic, physical and chemical indicators of quality pasta. The controls were samples of pasta from the aestivum wheat flour extra class and durum wheat flour, cooked without adding finely dispersed amaranth flour. The results are shown in Tables 3 and 4.

In accordance to the organoleptic characteristics from results on tables 3 and 4 were better pasta from aestivum wheat flour extra class and durum wheat with adding 7.5 and 10.0% a finely dispersed amaranth flour, respectively: they have the right shape, do not stick together, color products was solid. There were no significant differences with the controls. However, a further increase in dosage a finely dispersed amaranth flour deteriorated organoleptic properties of the product.

Analysis of the results showed that the increase in supplements contributes to poor product quality. Thus, with increasing dosages of finely dispersed amaranth flour from 5 to 20% of the acidity of the product of aestivum wheat flour extra class increased from 2.8 to 4.2 degrees, from durum wheat flour - from 2.5 to 4.0 degrees, the control in this case is respectively 2.6 and 2.5 degrees. From Tables 3 and 4 shows that increasing the content a finely dispersed amaranth flour with 5% to 20 until ready cooking time increases, respectively, 0 - 3 and 0 - 4 min compared to the control. increase product weight coefficient decreases, respectively, from 1.78 to 1.38 and from 1.80 to 1.38.

Closely related with these figures is the main indicator of the cooking properties of the pasta - the amount of dry matter passed into the cooking water. Thus, with increasing content of finely dispersed amaranth flour with 5 to 20% by weight of aestivum wheat flour extra class this indicator is increased by 0,03-3,86 % durum wheat flour – from 0 to 2,85% compared to controls. As the content of amaranth flour a finely dispersed dimensional stability of welded products is deteriorating, resulting in coalescence of welded products.

Thus, studies have shown that the most positive impact on the quality of the cooked pasta had finely dispersed additives amaranth flour in an amount of 7.5% by weight of aestivum wheat flour extra class and 10.0% by weight of durum wheat flour (semolina).

Durability is an important indicator of the quality of pasta, which is of great value during storage and transportation. The strength of the pasta was evaluated on the device Structuremeter - ST 2.

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Table 3 - Effect of a finely dispersed amaranth flour on the quality of pasta from aestivum wheat flour extra class

Name of indicator	Control	The content of amaranth flour, %						
		5	7,5	10	12,5	15	17,5	20
Organoleptic characteristics:								
- Surface condition	smooth	smooth						
- The form	inherent to this type of	inherent						
- Colour	light cream	cream with a grayish shade		cream with a grayish shade				
- Taste	inherent products, without foreign taste	inherent products, without foreign taste						
- Smell	inherent products., without foreign smell	inherent characteristic	inherent, with a barely noticeable odor amaranth flour				inherent, with a barely noticeable odor amaranth flour	
Physical and chemical parameters:								
- Humidity%	12,8	13,0	13,0	13,0	13,0	13,2	13,0	13,0
- Acidity, degrees	2,6	2,8	2,8	3,0	3,2	3,6	4,0	4,2
Melting properties:	not deformed do not stick together	not deformed do not stick together			not deformed do not stick together			
- Dimensional stability	1,80	1,78	1,75	1,63	1,51	1,49	1,43	1,38
- Weight increase ratio of products (km)	8,24	8,21	8,51	9,50	9,97	10,96	11,76	12,1
- The amount of solids which have passed into the cooking water,%	transparent	transparent		Not transparent				
- Duration of cooking until tender, min	7	7	7	8	9	9	10	10

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Table 4 - Effect of a finely dispersed amaranth flour on the quality of pasta from durum wheat flour

Name of indicator	Control	The content of amaranth flour, %						
		5	7,5	10	12,5	15	17,5	20
Organoleptic characteristics:								
- Surface condition	smooth	smooth						
- The form	inherent to this type of	inherent						
- Colour	amber	Amber with a grayish shade		amber with gray shade				
- Taste	inherent products, without foreign taste	inherent products, without foreign taste						
- Smell	inherent products., without foreign smell	inherent characteristic	inherent, with a barely noticeable odor amaranth flour				inherent, with a barely noticeable odor amaranth flour	
Physical and chemical parameters:								
- Humidity%	12,7	9,2	9,2	9,5	9,5	9,6	9,8	10
- Acidity, degrees	2,5	2,5	2,6	3,0	3,2	3,6	3,6	4,0
Melting properties:	not deformed do not stick together	not deformed do not stick together					not deformed do not stick together	
- Dimensional stability	1,83	1,80	1,79	1,75	1,59	1,49	1,43	1,38
- Weight increase ratio of products (km)	6,25	6,20	8,31	6,63	7,77	8,36	8,76	9,1
- The amount of solids which have passed into the cooking water,%	transparent	transparent				Not transparent		
- Duration of cooking until tender, min	10	10	10	10	11	12	14	14

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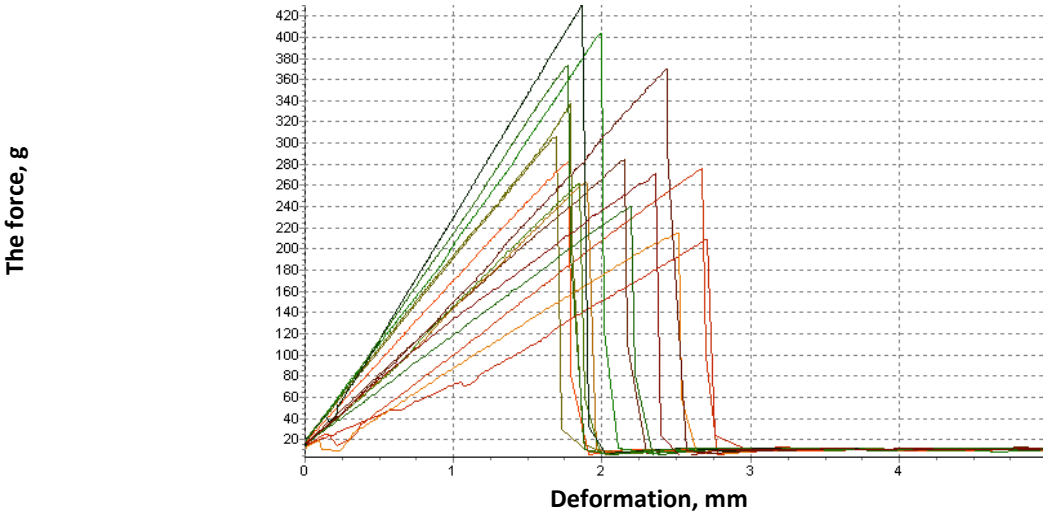
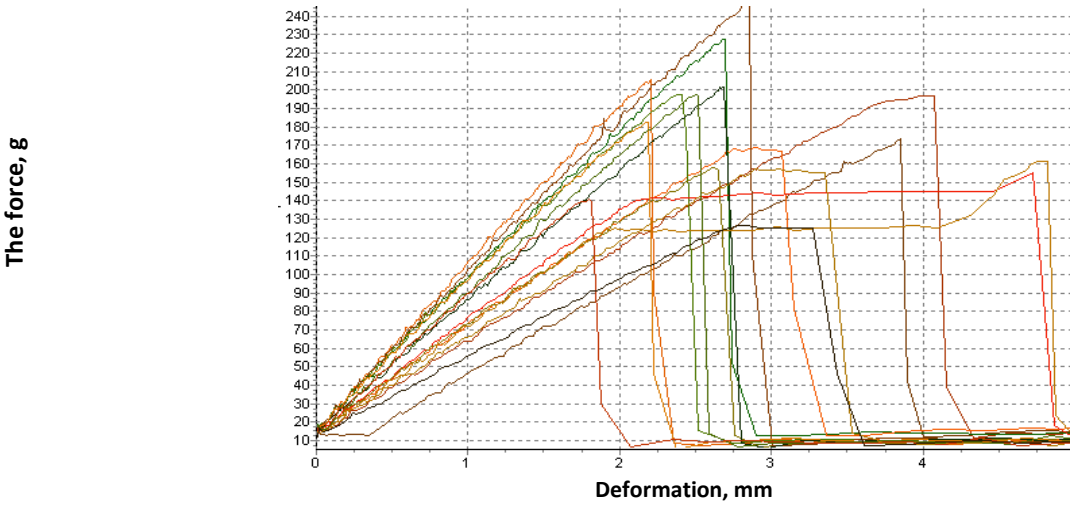
A method for determining the dry pasta strength based on the measurement of the load limit force and limit the deformation due to the installation of the span table due to an external diameter of analyzed products and setting the loading rate of the indenter applied to the pasta of 10 ± 1 g / s. Calculation of rheological characteristics, namely the tensile strength and modulus of elasticity of dried pasta made with regard to their load limiting force limiting deformation of the span table and values of the inner and outer diameters. The results are shown in Figure 2 and Table 5.



The strength of the pasta from aestivum wheat flour extra class



The strength of the pasta from aestivum wheat flour extra class with finely dispersed amaranth flour

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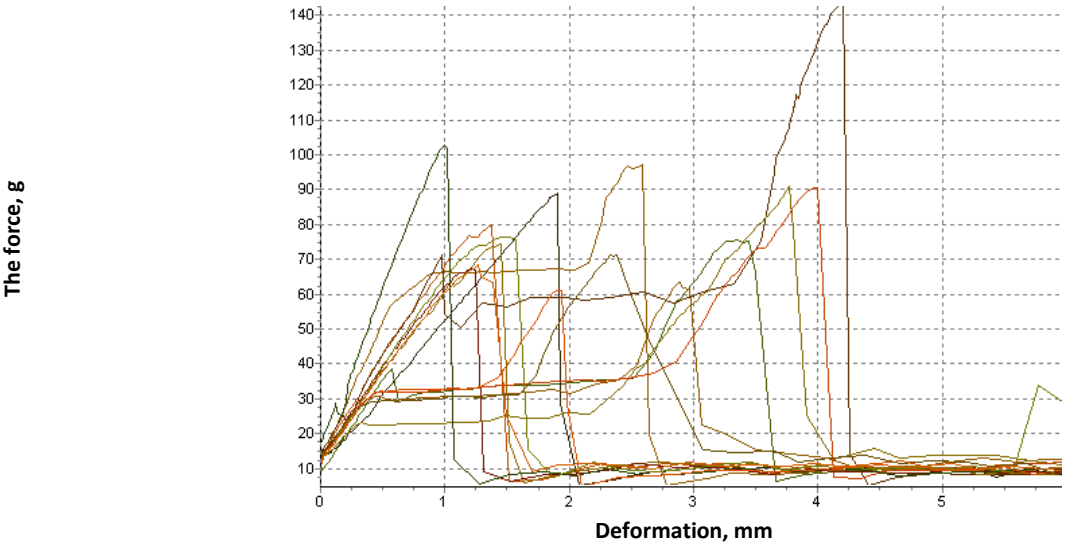
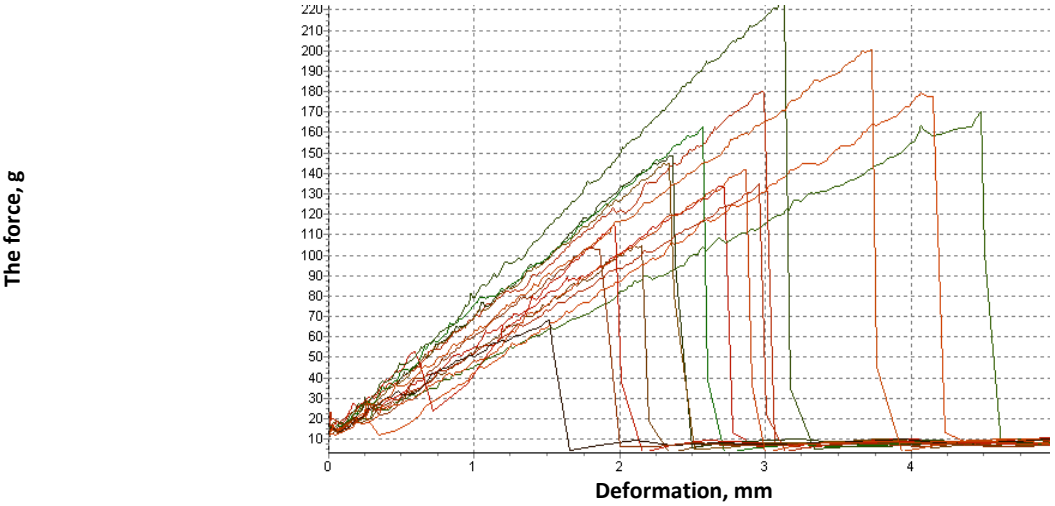


The strength of the pasta from durum wheat flour



The strength of the pasta of durum wheat flour with finely dispersed amaranth flour

Figure 4 - Unit Results Structuremeter ST-2

Table 5 - Indicators structuremeter for pasta from the aestivum wheat flour extra class and durum wheat flour with amaranth flour a finely dispersed

Characteristic	Pasta			
	From aestivum wheat flour extra class	From aestivum wheat flour extra class with finely dispersed amaranth flour	From durum wheat flour	From durum wheat flour with finely dispersed amaranth flour
Average value $f_{\text{limit effort}}$, g	301,77	182,48	83,85	145,08
The coefficient of variation, g	21,52%	17%	24,36%	20%

As indicated in table 5 limit the force loading the pasta from the aestivum wheat flour extra class r is 301.77 g, pasta of durum wheat semolina - 83.85, at the pasta from the aestivum wheat flour extra class with finely dispersed amaranth flour - 182.48 g, pasta from durum wheat flour with finely dispersed amaranth flour - 145.08 As a result of studies found that products with finely dispersed amaranth flour stronger than pasta without additives.

Thus, studies have shown that the most positive impact on the quality of the cooked pasta had a a finely dispersed additives amaranth flour in an amount of 7.5% by weight of aestivum wheat flour extra class and 10.0% by weight of durum wheat flour (semolina).

CONCLUSION

The studies particle size distribution, the color characteristics of flour whiteness, strength and quality of the cooked pasta is established that to obtain pasta of baking flour with good physico-chemical and organoleptic parameters in the formula is allowed adding no more than 7.5% durum wheat flour semolina - no more than 10.0% of finely disperseed amaranth flour, further increasing dosages of finely dispersed amaranth flour leads to deterioration of the technological properties of the finished product.

Thus, according to the analysis of the data presented, the use of finely dispersed amaranth flour is suitable for enrichment of pasta valuable food components.

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