Development of Pasta Production by Using of Hard and Soft Domestic Sorts of Wheat.

Zhilkaidarov AN[1]*, Iskakova GK[1], Chernyh VY[2], and Kizatova MZh[3].

[1]Almaty Technological University, Department "Technology of bakeries and processing manufacturing" 050012, Almaty, Tole bi str.100., Kazakhstan
[2]Federal state budget research institution "Research institute for baking industry"107553,Moscow, Cherkizovskaya str. 26A.,Russian Federation.

ABSTRACT

In work basing on the results of researched grain properties, quality of lour thereof, properties and dough of dough and quality of pasta, where also significant differences in physical and chemical, biochemical and pasta properties of new soft wheat sorts (Astana, Akmola 2) and hard whet sorts (Damsinskaya 90, Damsinskaya Yantarnaya) were found out. Comparison of pasta properties of sorts which were researched had shown that there are high flour quality indicators and indicators of dough properties and finished product are being observed in hard wheat sorts. Among hard wheat sorts the sort Damsinskaya 90 had demonstrated highest indicators.
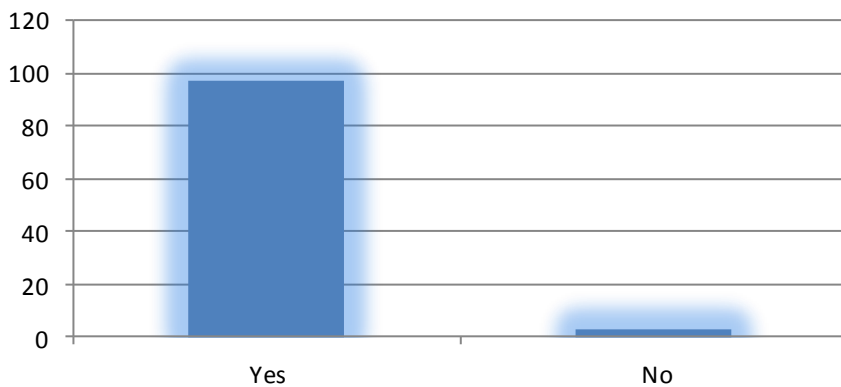**Keywords:** pasta, domestic sorts of wheat, hard and soft wheat.
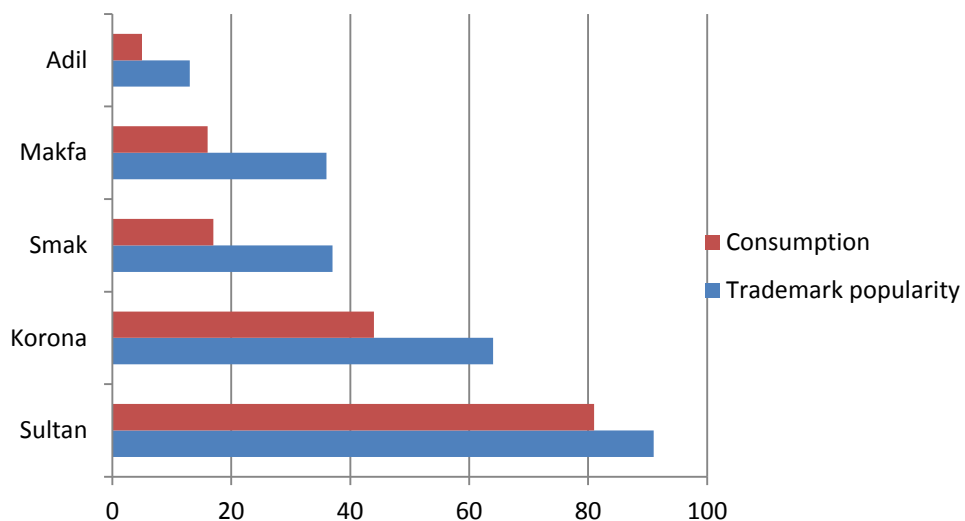
*Corresponding author

INTRODUCTION

High-qualified and not-expensive products of daily usage have a big demand on food products' market. And it's also about independent and irreplaceable product as pasta. Pasta is a product, which represents itself the conserved dough from wheat flour made through special milling process. A wide assortment of the product and its pleasant taste properties allow to use pasta products in very different combinations with other food products [1, 2].

Pasta industry of Kazakhstan has large perspectives of development. There are a lot of premises for it, which includes first of all an importance of pasta as a social product. Due to for its nutritional and energetically value pasta is the part of must have food. Besidesthat, the pastaproduction in Kazakhstan has traditional bases, and nowadays the market of this product develops rapidly as in quantity as well as in quality aspects. Moreover, one of the advantages of this branch is an economical aspect – pasta is the product of secondary processing, and therefore price for sailing is much higher as its own costs. In Kazakhstan, coming from results of Media Marketing Index conducted by TNS Gallup Media Asia, pasta is being consumed by 97% of our population(picture 1). Also statistics show, that most popular from them are spaghetti, horns, vermicelli, etc. [3, 4].

Picture 1: Pasta Consume, Kazakhstan, 2014

By analysing of known brands and trademarks of pasta, we can see that, as well known and well consumed pasta of domestic production is "Sultan". 91% of all consumers know that this trademark and 81% of them do use pasta of "Sultan" in nutrition. Top 5 producers are also includes such marks like "Korona", "Smak" etc. Trademark "Adil" is known for 13% of all pasta consumers and 5% of them do use this product (Picture 2)

Picture 2: Trademark popularity and its consumption %

In the Republic of Kazakhstan the maximal degree of pasta producing is about 132, 5 thousand tons. During last years the dynamic were better, but there are still some misses according to quality of the product, including for instance small factories, were instead of using of hard wheat sorts, they prefer to use an option which is cheaper – soft wheat which is normally not allowed on pasta production.

Potential possibilities could provide the pasta production for more than 1 million tons and the country could be in top 5 pasta producing countries in the world. A large part of pasta is being exported into: Russia, Kyrgyzstan, Belorussia, Ukraine, Tadzhikistan, Uzbekistan, Georgia, Turkmenistan, Afghanistan, and Mongolia[5].

The basic raw materials for pasta production are higher sorts milled hard wheat products. However, because of shortage of hard wheat, at least in our country, and due to its high prices, there is being used a soft mealy wheat sorts with a high vitrescence.

In this case, products of better quality which have amber-yellow or straw-yellow colour, will be produced from special flour for pasta of high quality(semolina), which was obtained through hard wheat or soft wheat (with higher vitrescence) milling process.

From macaronic flour (or flour for pasta production) of 1st sort it will be producedproducts with a brownish tint with more or less intensity. The bread flour of higher or 1st sort obtained through milling of soft wheat will be used in case of lack of the hard (macaronic) wheat.

The pasta made from premium bread baking flour, usually have a light cream colour, and the flour of 1st sort has a dark grey colour with a cream colour tint.In appearance, pasta groats has different sizes of fractions in compare with bread baking flour having a bit yellow tint as well. The half semolina consists from much smaller particles as a semolina, and therefore with a bit lighter tint (however, the pasta made from half semolina has a bit dark tint) [1].

Republic of Kazakhstan, occupying 2% of world territory, 3.3% of grain seeding area, having a 0.3% of world population, produces 1.5% of all grain types, and the wheat share is about 3.2% of world wheat harvest [6].

The increase of hard and soft wheat sorts with good technological properties of grain is a key factor of food security of the Republic. Trading value of grain batch depends on the quality of the grain. Quality could be depending on many indicators, including natural features, where the structure, grain shape, the linear dimensions, its chemical composition, physical and biochemical properties of the grain have a great importance. The study of the structural features of grain and its physical, biochemical properties are also very important – there will be established the potential for extracting the endosperm in the form of qualified flour with high macaronic properties.

In connection with the above, the research of pasta properties in flour produced from new perspective and domestic hard and soft wheat sorts has an important practical significance.

RESEARCH OBJECTIVES AND METHODS

As an object of research there were chosen soft (Astana, Akmola 2) and hard (Damsinskaya 90, Damsinskaya Yantarnaya) wheat samples of harvest 2014, and indicators describing their quality were also determined.

The grain humidity was determined using a State Standard 13586.5.-93.
The humidity was expressed in percentage.
The natural mass was defined through State Standard 10840-64 and expressed in g/l.
The general vitrescence was determined by State Standard 10987-76 and it was expressed in percentage.
The mass of the 1000 grain was found out by using a State Standard 10820-89 and shown in grams.
The quantity and quality of gluten grain determined in accordance with State Standard 13586.1-68.

Determination of infestation of grain was carried out according to the procedure described in the manual [7]. Depending on the percentage of impurities in the harvested grain it is divided into two groups: grains, matching to basic conditions and the grain, which has deviations in quality within the restrictive conditions.

The falling number was determined on the Hagberg – Perth equipment and expressed in seconds. The method for falling number define–is an international determination method of a-amylase in wheat, rye and flour. The method is based on the rapid gelation slurry of the flour or coarse flour in a boiling water bath, followed by a change in the flushing action of a-amylase on starch. The value of the falling number is inversely proportional to the amount of a-amylase in the sample [7].

To conduct laboratory experiments there were milled hard and soft wheat samples, using the in the mill installation MLU - 202. The finished flour was tested for its organoleptic (colour, smell, taste, crunch) and physic-chemical (humidity, amount and quality of gluten, fineness of grinding, ash content, metal impurities content, contamination of grain pests) indicators.

Smell, taste and crunch were determined according to State Standard GOST 27558-87. Humidity of the flour was determined by accelerated method in accordance with GOST 9404-88 and was expressed in percentage.

Wet gluten content and its quality controlled in accordance with GOST 27839-88 State Standard method.

To grind size to the requirements of GOST 27560-87 on hand sieving used laboratory sieves with a diameter of 20cm shells. Non sieves comply with GOST established for the investigated varieties of the flour. The residue on the sieve above and pass through the lower sieve weighed on technical scale and expressed as a percentage of the weight due to the sample taken.

Metallomagnetic impurities were measured with a magnet in the rigging of flour weighing 1kg (GOST 20239-74). All metallomagnetic particles were weighed and measured on a grid with 0.3 mm divisions.

Infestation by pests of grain reserves established in accordance with GOST 27559-87. Flour ash content determined according to GOST 27494-87 with the accelerator - nitric acid and expressed as a percentage.

The physical properties of the test were determined on Shopen Alveograph [7].

Organoleptic quality indicators, humidity, acidity and cooking properties (cooking time until it is ready, the amount of water absorbed during cooking products, the amount of solids passing into the cooking water, dimensional stability welded products) pasta according to State Standard GOST 14849-89.

RESULTS AND DISCUSSION

To conduct our research work there were chosen soft (Astana, Akmola 2) and hard (Damsinskaya 90, Damsinskaya Yantarnaya) wheat samples of harvest 2014, and indicators describing their physic-chemical and biochemical properties are represented on table 1.

Analysis of the collected data suggest that the physical (weight of 1000 grains, nature, vitreous) and biochemical (quantity and quality of gluten, ash content, falling number) indicators of the samples of the researched wheat fluctuates in a significant limit. The mass of 1000 grain–is one of the most important indicators characterizing the technological value of grain. It is believed the higher the weight of 1000 grains, the more valuable grain and has the better satisfied. At the same time, this indicator shows the grain density, with an equal amount of its high weight of 1000 grains suggests a large supply of grain nutrients. The results of evaluation of the quality of the samples showed that the mass of 1000 grains in durum ranges from 42.6 to 43.4 g, in the soft varieties - from 31.6 to 32.4, the maximum weight of 1000 grains of hard wheat had "Damsinskaya Yantarnaya" and the minimum was by soft wheat "Astana".

Table 1: Quality indicators of researched wheat sorts

Wheat sort	Humidity, %	Infestation, %		Nature, g/l	Mass of 1000 gran, g	Vitrescence, %	Gluten		Falling number, s	Ash content, %
		weed	cereal				%	Group		
Astana	12,0	1,10	2,74	797	31,6	59	29,1	I	301	1,92
Akmola 2	12,9	1,16	2,28	780	32,4	63	28,6	I	372	1,80
Damsinskaya 90	11,0	-	0,76	776	42,6	94	33,8	II	385	1,92
Damsinskaya Yantarnaya	12,3	0,18	3,96	777	43,4	96	31,0	II	412	1,95

The special attention deserves the nature of grain, which found a widespread use in the practice of domestic and international assessment of the trade grain. It considered as an indirect indicator of flour output for a long time.

The value of this indicator in hard wheat "Damsinskaya 90"was 776 g / l, "Damsinskaya Yantarnaya" - 777 g / l, and in the nature of soft wheat "Astana" was 797 g / l, Akmola 2 - 780 g / l.

The Vitrescence characterizes the texture of the endosperm of wheat and has a major impact on the conditions of preparation and processing of grain into flour, i.e. milling properties. It is believed that the vitreous grain has the highest strength and wheat flour is obtained crumbly, with a good sowing property. Vitrescence indicators of researched samples range from 59 to 96%. Total vitrescence is above 60% which were determined in samples of wheat "Akmola 2","Damsinskaya 90","Damsinskaya "Yantarnaya".

Studies of biochemical properties of the grain have demonstrated, that different researched wheat samples have different grain quality parameters (Table 1). Gluten content in wheat grain and flour is a very important indicator. High nutritional merits of flour could be explained by gluten content and its quality. The content of the wet gluten in hard wheat is more than in soft sorts of wheat. Thus, in hard wheat: "Damsinskaya 90" has a gluten content of 33.8%, in Damsinskaya Yantarnaya - 31.0%; in soft wheat: The soft wheat "Astana" had a gluten content of 29.1%, Akmola 2 - 28.6%.

Under words "quality of the gluten"mostly we do understand the totality of its physical properties: extensibility, flexibility, connectivity. The test on the quality of wheat gluten fall into two groups: the first and second.

The ash content of the grain is measured quite widely and depends on sort characteristics as well as on soil and climatic conditions of cultivation. Ash content of the grains influences the ballast group flour and its colour. According to Table 1 shows that the ash content in hard wheat "Damsinskaya 90" was 1.92 s, "Damsinskaya Yantarnaya" - 1.95 s., Astana - 1.92 s., "Akmola 2" had 1,80 seconds of falling.

The magnitude of the falling number of wheat sorts can be attributed to the grain with optimal amylase activity which has an excellent quality of falling number value between 200 and 300 s. Consequently, different wheat samples submitted for physical and biochemical properties and they do belong to different groups and classes.

To evaluate the macaronic properties of researched wheat sorts, therewere studied physical properties of the dough and quality indicators of the flour obtained by milling the soft t and hard wheat.

To conduct laboratory experiments there were milled hard and soft wheat samples, using the in the mill installation MLU - 202. The finished flour was tested for its organoleptic (colour, smell, taste, crunch) and

physic-chemical (humidity, amount and quality of gluten, fineness of grinding, ash content, metal impurities content, contamination of grain pests) indicators. The results of the study are given in Table 2.

Table 2: Flour quality indicators

Indicator	Flour from soft wheat		Flour from hard wheat	
	Astana	Akmola 2	Damsinskaya 90	Damsinskaya Yantarnaya
Organoleptic:				
Colour	white	white	cream with a yellow tinge	cream with a yellow tinge
Smell	characteristic of normal flour, no smell of mold, musty odors and other foreign smells			
Taste	Inherent for normal flour, without any sour, bitter or other taste			
Mineral admixture content	By chewing there was no crunch feeling			
Physic-chemical:				
humidity, %	12,24	12,62	12,84	12,56
Wet gluten content, %	30,8	30,4	35,4	32,8
Gluten quality by IGD-1 (indicator of gluten deformation), group	I	I	II	II
Milling fineness, %:				
Reside on sieve made from silk material	№43,6	№43,5	№190,3	№190,3
Pass through a sieve made from silk material	№35,3	№35,3	№43,40	№43,45
Ash content (calculated on dry substance), %	0,58	0,56	0,76	0,79
Metal impurities content mg / kg flour	-	-	-	-
Infestation by grain pests	No infestation was found			

Assessing the potential ability of wheat flour, first of all it important to determine the quantity and in the quality of the grain gluten. The quantity and quality of gluten flour depends on the quality of pasta. The content of gluten in the flour from the wheat: "Damsinskaya 90" is 35.4%, "Damsinskaya Yantarnaya" - 32.8%, "Astana" - 30.8%, "Akmola 2" - 30.4%. The collected data shows that the properties of gluten in hard wheat flour are much better as in soft wheat flour.

An important indicator of the flour is its ash content. The ash content of the flour and its colour will be influenced by the grain ash content. Table 2 shows that the investigated samples of grain during milling had different ash content and it was ranging from 0.56 to 0.79%.

Groats of the flour was evaluated by guests gathering / pass sieve №: flour from hard wheat - 190/43, flour from soft sorts - 43/35. The particles larger than 250 micrometres contained in flour from hard wheat and from 150 to 185 microns - flour from soft wheat sorts.

Table 3 shows the parameters characterizing the physical properties of the dough.

Table 3: Physical properties of the flour

Indicators	Astana	Akmola 2	Damsinskaya 90	Damsinskaya Yantarnaya
Dough elasticity, mm	108	99	112	105
Elasticity ratio to extensibility	1,02	0,93	1,12	1,08
Specific work of dough deformation, ea	305	300	331	310

The data presented in Table 3 shows that the physical properties of the dough on wheat sorts provided by an Alveograph vary very widely. Thus, the elasticity of the dough from wheat "Astana" was 108 mm, dough made from wheat "Akmola 2" - 99mm, dough from wheat "Damsinskaya 90" - 112mm. Hard wheat

"Damsinskaya Yantarnaya" - 105mm. Compressive deformation test and the ratio of elasticity to extensibility were respectively 305 and 1.02 ea; 300 ea and 0.93; 331 ea and 1.12; 310 and 1,08.

We have studied the quality of pasta from flour of hard and soft wheat (Table 4). The table shows that the pasta obtained from hard wheat has an amber-yellow colour, retains its shape good, does not clump together, fewer nutrients pass into the cooking water as compared with products made from soft wheat.

Humidity of pasta is an important indicator of trade quality, which determines the ability of products to long-term storage without deterioration. It is also a major factor in determining the value of the output of finished products, i.e. consumption of flour on the production of 1 ton of products. Humidity pasta from all sorts of wheat was not higher than 13%.

Table 4: Quality of Pasta from hard and soft wheat sorts

Indicators	Wheat sorts:			
	Astana	Akmola 2	Damsinskaya 90	Damsinskaya Yantarnaya
Organoleptic:				
- Surface condition	smooth	Smooth	smooth	smooth
- form	Corresponds to the type of the product			
- colour	white with a cream tinge		Cream with yellow tinge	
- taste	Inherent to products, without other taste			
- smell	Normal, without foreign smell			
Physic-chemical:				
- humidity, %	12,8	12,8	13,0	13,0
- acidity, degree	2,8	2,9	2,8	3,0
Cooking properties:				
- boiling watercondition	Clear			
- cooking time, minutes (boiling until readiness)	8	8	10	10
-increasing number of product mass (K_i)	1,84	1,76	2,28	2,15
- Dry substances, transferred into boiling water, %	8,0	8,6	5,0	5,5
- Form stability of cooked products	96	95	100	100

For all kinds of products, except tomato, pH must be no more than 4 degrees. Acidity - a measure of quality that characterizes the flavour and freshness of macaroni products. The acidity is determined primarily initial acidity flour. When carrying out the normal process the acidity of products compared to the initial acidity increased very slightly flour - no more than 10%. The acidity of pasta made from flour obtained by grinding wheat sorts"Astana", "Akmola 2","Damsinskaya 90" and "Damsinskaya Yantarnaya" was respectively, 2.8; 2.9; 2.8; 3.0 deg.

Cooking properties of pasta is determined by the following factors: the condition of the cooking water, boiling time until cooked/readiness, the increasing number of product mass, dry substances that have fallen into the cooking water, form stability of the cooked product. Boiling time until cooked in pasta from hard wheat flour "Damsinskaya 90" and "Damsinskaya Yantarnaya" was 10 minutes. This parameter for soft wheat flour pasta was approx.8minutes.

By cooking process, products after boilingincreased in mass in sorts "Astana" 1.84 times; "Akmola 2" - 1.76; "Damsinskaya 90" - 2.28; "Damsinskaya Yantarnaya" - 2.15 times. The amount of dry substances passing into the cooking water was, respectively, 8.0; 8.6; 5.0; 5.5%, and saving forms of the products - 96, 95, 100 and 100% respectively.

CONCLUSIONS

During these provided studies of the properties of grain, flour quality of it, the properties of dough and quality of pasta a significant differences of physical-chemical, biochemical, pasta properties of new and

promising domestic sorts of soft wheat ("Astana", "Akmola 2") and sorts of hard wheat ("Damsinskaya 90", "Damsinskaya Yantarnaya") of 2014 harvest were indicated and determined as well. . A comparison of the properties of the researched sorts of soft and hard wheat showed that, high values of quality flour properties of dough and finished products were founded during from a usage of hard wheat of Kazakhstan. Among hard sorts of wheat the highest quality indicators were shown by "Damsinskaya 90" sort.

REFERENGES

[1]   Medvedev GM Technology pasta izdeliy.- SPb .: GIORD, 2005;p312 .
[2]   Iskakova GK, Iztaev AI, Kulazhanov TK, Maemerov MM, BA Iztaev Technology of bread and pasta using ozonated water and ionoozonirovannoy (monograph). - Almaty: AW, 2011;p216.
[3]   Site Kazahzerno -http: // www. Kazakh-zerno.kz. publikatsiya- macaroni production Kazakhstan, 2011.
[4]   Site Kazakhstan Statistics Agency - http: // www. stat.kz.- Publications - Newsletters - Production.
[5]   Site Kazagromarketing - - http://www.kam.kz - Production - Macaroni industry.
[6]   Omarov TE Scientific and technological principles of export consignments of wheat: a monograph. - Almaty LLP "Publisher LEM», 2009. - 184s.
[7]   Ustimenko TV Practical evaluation of the quality of grain and grain products. Methodical instructions. - St. Petersburg: GIORD, 2007;p176 .