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Development Recipe of Dry Porridge for School Food.

**Amirkhanov Kumarbek, Assenova Bahytkul, Smolnikova Farida*,
Nurgazezova Almagul, Nurymkhan Gulnur, Kasymov Samat, and Igenbayev Aidyn.**

Department of Food and Light Industry Production Engineering, Faculty of Engineering and Technology, Shakarim State University of Semey, 071400 Semey, 20^a Glinka str., Kazakhstan.

ABSTRACT

The cereal products are one of the most important foods. The cereal products are the main supplier of digestible carbohydrates – the main energy component of food. Rational nutrition in childhood and adolescence contributes to the harmonious physical and mental development, high performance and achievement of the schoolchild. The cereal products occupy a worthy place in the human diet and are found at the base of the food pyramid a healthy diet. The aim of the research was to create rational formulations of dry cereal grain intended for school meals. The experimental formulation of dry cereal was developed. The composition of porridge was included groats millet and rice, dried vegetables and fruits. The results of this study are the prerequisite for the creation of the production technology of dry porridges to school food. According to the results of the work developed company standard – ST RSE 30958956 – 01 – 2014, technological instruction. Conducted industrial testing of technology of cereal production conditions in SP "Nedoshitko M. I." cafe "Semol" Semey. Received a positive decision on issuance of innovative patent for invention "Method of obtaining dry nutritional mixture on grain basis" No. 1 2014/1881 from 20 December 2014.

Keywords: grain, porridge, technology scheme, ecology, recipe

**Corresponding author*

INTRODUCTION

The substances polluting the natural environment is very diverse. Depending on their nature, concentration, time of action on the human body they can cause various adverse effects. The body's reaction to pollution depends on individual characteristics: age, gender, health status. As a rule, more vulnerable children, the elderly and elderly sick people [1].

The systematic or periodic flow of the body relatively small amounts of toxic substances cause chronic poisoning [2].

In areas exposed to radioactive contamination, in particular in the city of Semey, East Kazakhstan region, Republic Kazakhstan, the incidence among the population especially children, has increased many times. To improve the condition of health is possible used biomedical means, physical education, organization of rational balanced nutrition [3].

For normal human activity organism needs not only the supply of adequate (according to the needs of the organism) the amount of energy and nutrients, but also certain relationships between numerous dietary factors, each of them has a specific role in metabolism. A food, characterized by an optimal ratio of nutrients is called balanced. The food factor plays an important role not only in prevention but also in treatment of many diseases [4].

Rational nutrition in childhood and adolescence contributes to the harmonious physical and mental development, high performance and achievement of the schoolchild. Therefore, the level of health of schoolchildren and their coverage of hot nutritious meals are included as indicators in the rating of activity of bodies of Executive power [5,6].

Most of the regions, implementing the state social policy of protecting the health of children and adolescents, much attention is paid to the organization of an effective system of school meals, providing students with physiologically adequate nutrition.

In the Republic of hot meals covered 79% (1 929 785 people), children 6183 (84%) at the secondary schools of the Republic, 21 % of cafeteria food. At the figure of 2 provides information about the coverage of hot meals.

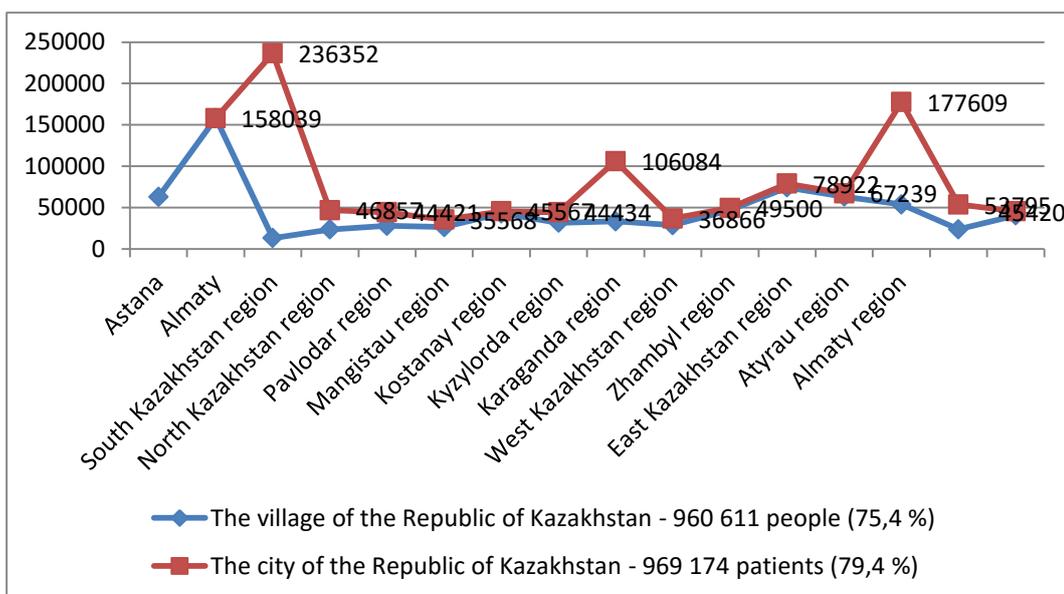


Figure 1: The information about the coverage of hot meals to children in regions by type of area (city, village)

Free hot meals provided 99% of children from socially unprotected layers of the population.

Full coverage (100%) of students from low-income families a free hot meal is provided in the Atyrau, Zhambyl, Karaganda, Kostanay, Kyzylorda, Mangistau, Pavlodar, North Kazakhstan, South Kazakhstan regions and Astana.

It is known that the risk factors contributing to the emergence and development of all chronic diseases begin to form in childhood and adolescence and to 20 to 29 years the prevalence is significantly increased [7].

Over the past five years, the incidence of pupils increased by 22 %, including: anemia by 2.5 times, respiratory diseases by 1.5 times, endocrine diseases and nutritional disorders by 1.4 times, diseases of the nervous system by 1.5 times, injuries, poisoning, accidents by 1,2 times .

The key to solving the issue of filling in missing body of essential macro and micronutrients to optimize diets is a regular inclusion in the diets of children and adolescents of specialized food products enriched with vital nutrients, which are based on natural raw materials. Detoxification, therapy, individual correction of the nutritional status of patients will allow to extend life expectancy. In the diet of healthy young people living in a temperate climate not engaged in physical labor, proteins should be 13%, fat - 33%, and carbohydrates - 54% of the daily energy content of the diet, taken as 100%. The approximate proportion of carbohydrates in the diet: starch - 75-80%, digestible carbohydrates, 15-20%, cellulose and pectin - 5%. The ratio of essential vitamins is based на1000 kcal (4,184 MJ) diet: vitamin C - 25 mg, B1 – 0,6 mg, B2 – 0,7 mg, B6 -0,7 mg, PP and 6,6 mg. Ratio of calcium, phosphorus and magnesium, which provides better absorption by the body, is 1:1,5:0,5 [8].

Cereal products occupy a worthy place in the human diet and are found at the base of the food pyramid a healthy diet. They accompany man from a very early age (four to five months, as cereals are one of the first products of the feeding up of the child). And today, considering this group of foods from the modern point of view, it is necessary to underline once again their undeniable advantages:

- Diverse range;
- -Accessibility to various segments of consumers;
- -High quality and nutritional value;
- -Security;
- -The ability to create on their basis products with specified composition and properties.

The cereals in the human diet ranges from 8 to 13% of total cereal consumption. The cereals are among the most important food products and have a high nutritional value [9,10,11].

The cereals is an important food with high nutritional value. In croup contains essential amino acids, vitamins, mineral salts. The cereals are widely used in cooking for preparation of various first and second dishes, and in the food industry for the production of canned food and food concentrates [12,13,14].

The use of cereals in the diet of children aged 6 to 13 years of age has important organizational values in the school meals. Typically, in the school feeding is used monocomponent milk porridge - rice, buckwheat, millet, wheat, barley that require additional enrich them in protein, vitamins and minerals [15,16].

The aim of the research was to create rational formulation of dry porridge intended for school meals.

MATERIAL AND METHODS

For the research were chosen different types of cereals: rice, millet, wheat, buckwheat, barley. In accordance with the purposes of scientific work, the tasks were set:

- study of chemical composition of different cereals, selection of grain ingredients for the formulation of porridges;
- the study of the chemical composition of the fruit preparation;
- the composing formulation of dry porridges;

- the study the nutritional value of dry porridges .

The organoleptic indicators and chemical composition of different types of cereals were investigated in the laboratories of the Department "Technology of food products and consumer industry products". Researches of microelement composition of cereals by liquid chromatography, and quantitative and qualitative analysis of chemical elements using mass spectrometry study of the topography and microstructure of the surface of various samples was carried out in the regional laboratory Test engineering profile "Scientific center of radioecological researches" of Shakarim state University of Semey.

For research dry cereal were used the following methods: in the study of the organoleptic quality of cereals the following methods were used: sampling - according to the State Standard -26312.1- 84. Determination of color, smell, taste and crunch according to the State Standard 26312.2 -84.

In the study of physico-chemical characteristics of cereal groats used the following methodology:

- The determination of moisture — according to State Standard 26312.7-88.
- The determination of total ash — according to State Standard 26312.5.84.
- -The definition of size according to State Standard 26312.4-84.
- The determination of metallic impurities according to State Standard 20239-74.
- The definition of infestation and contamination by pests of grain stocks — according to State Standard 26312.3-84.

RESULTS

The results showed, that in the composition of porridge include of different trace elements, data summarized in table 1.

Table 1: The microelement composition of cereals – rice, millet, buckwheat, barley, wheat, per 100 g of product in mg/kg

Elements	Buckwheat groats	Rice cereal	Millet groats	Fine-ground barley	Wheat groats
Mg	40.7	4.85	13	23.4	8.47
Si	58.5	8.08	5.22	22.2	4.55
P	29.7	9.89	11.4	19.8	22.2
Cl	13.5	12.05	11,05	16.5	5.46
K	61	18.2	11.9	12.5	19.6
Ca	2.8	1.51	3.21	6.16	5.56
Fe	0.7	0.1	0.3	0.3	0.4
Na	tracks	78.6	21.9	40.3	8.27
S	tracks	28.05	40.9	21.1	20.2
Al	tracks	5.3	tracks	tracks	4.03
Cr	tracks	tracks	tracks	tracks	11.4

For the school feeding is very important to the flow of such elements as potassium, phosphorus, calcium, magnesium, iron. Analysis of the data shows that the greatest value of these elements found in buckwheat: Mg – 40.7 mg/kg, P – 29.7 mg/kg, potassium – 61 mg/kg , calcium is most found in barley cereal – 6.16 mg/kg, the iron content in buckwheat.

Next we studied the microstructure of grain cereals, to determine their porosity. The results are shown in figures 2,3,4,5,6.

For the school feeding is very important such elements as potassium, phosphorus, calcium, magnesium, iron. Analysis of the data shows that the greatest value of these elements found in the buckwheat groats: Mg – 40.7 mg/kg, P – 29.7 mg/kg, potassium – 61 mg/kg , most of the calcium in barley groats– 6.16 mg/kg, contains a lot of iron buckwheat groats.

Next we studied the microstructure of grain cereals, to determine porosity. The results are shown in figures 2,3,4,5,6.

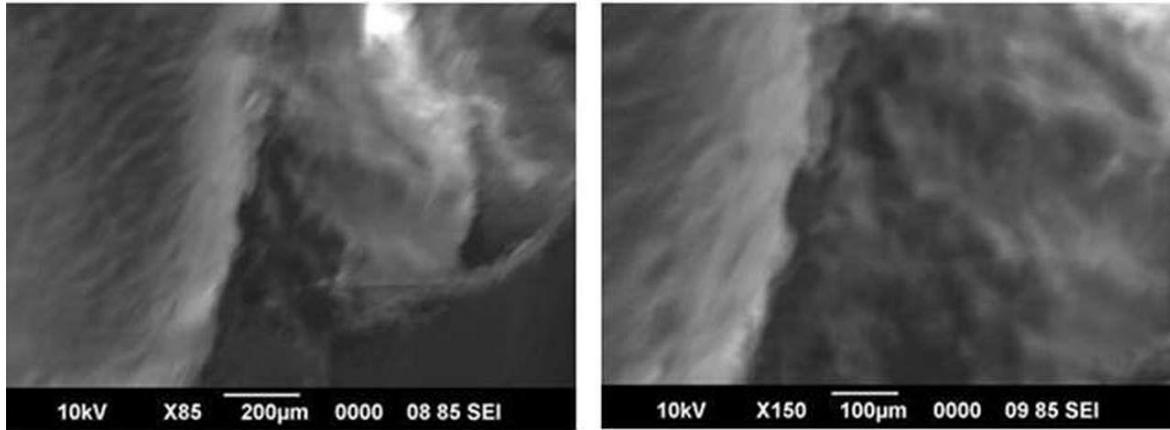


Figure 2: The microstructure of the buckwheat groats

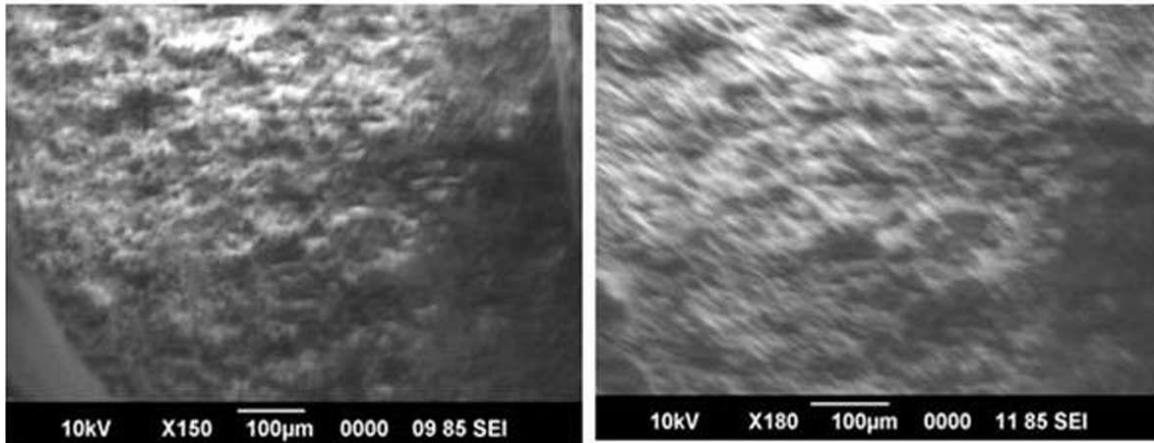
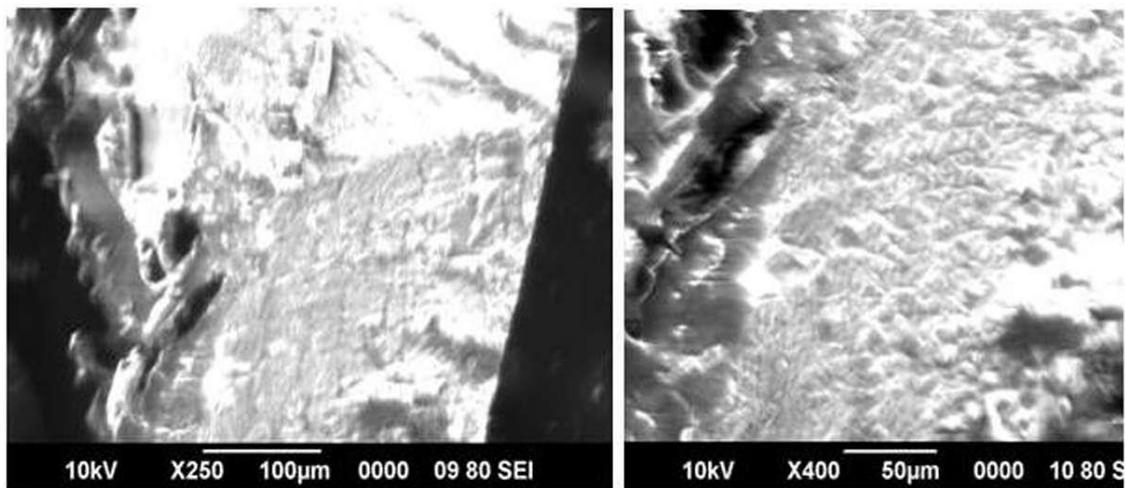


Figure 3: The microstructure of the fine-ground barley



Figures 4: The microstructure of the rice groats

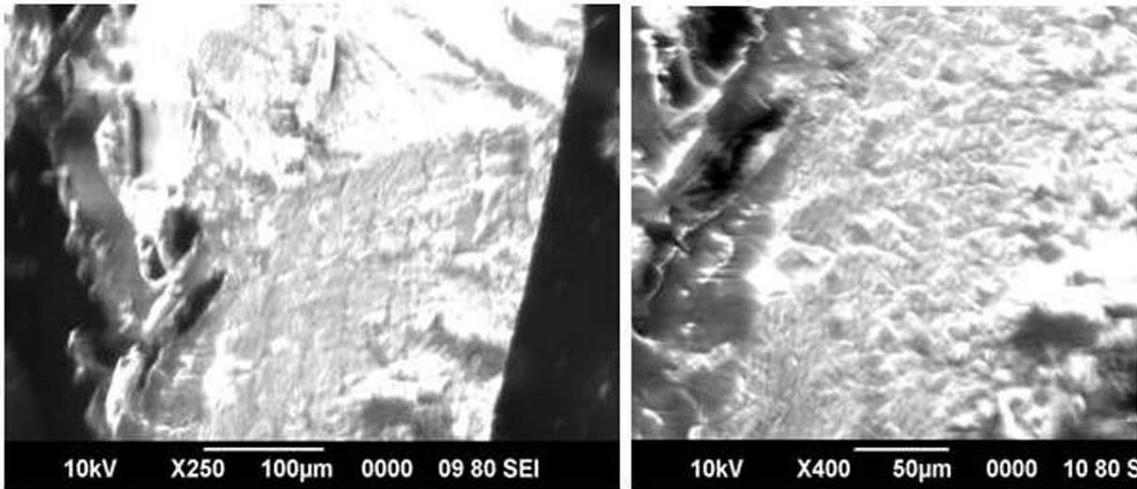
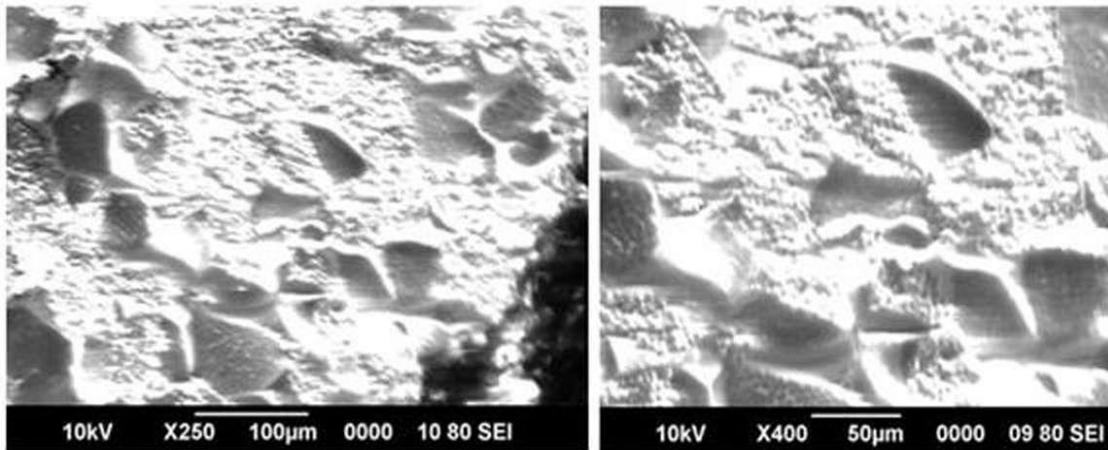


Figure 5: The microstructure of the wheat groats



Figures 6: The microstructure of the millet groats

Analyzing the obtained data it can be noted that buckwheat groats has a dense structure, the pores in the monitored field is small, fine-ground barley is a dense structure, the pores are barely noticeable, rice cereal has a dense protein-starch complex, large pores. Wheat has a dense structure with small pores. Millet has different pores, large and medium-sized, protein-starch complex dense.

Studying the structure of grain-growing groats, it is possible to draw conclusion, that quickly is boiling millet groats.

Further, cereal grains have been investigated for chemical composition. The chemical composition of cereals is shown in table 2.

Table 2: The chemical composition of cereals and norms content, g per 100 g of product

Indicators	Buckwheat groats	Rice groats	Millet groats	Fine-ground barley	Wheat groats
Water	14.0	14.0	14.0	14.0	14.0
Protein	12.3	6.9	11.7	10.1	12.4
Fat	2.3	0.4	2.5	1.1	0.9
Carbohydrates	67.5	76.2	69.2	71.3	70.1
Ash	1.2	0.68	1.1	1.1	0.9

After analyzing the data, it can be noted that the greatest amount of protein contained in buckwheat groats 12.3% and in the wheat groats is 12.4 %. The least amount of fat in rice groats of 0.4 percent, the largest amount of carbohydrates in rice groats 76.2 %.

The buckwheat groats is most contained of the ash, it is 1.2 %.

The study of chemical composition and microelement composition showed that the rich chemical composition in buckwheat groats.

In the preparation of the formulation took into account the following factors:

- -food combinatorics, organoleptic indicators - the consumer properties of cereals;
- preferences of schoolchildren when choosing cereals in the diet;
- consumer properties of cereals.

A preliminary survey of schoolchildren aged 7 to 13 years old showed that they prefer to eat rice porridge.

The millet groats is quickly cooked, rice cereal contains a significant amount of carbs compared to other cereals, so it can be used as a source of energy, it is used in diets with diseases of the gastrointestinal tract. Organoleptical properties of these grains are well blended. Experimentally, studying the chemical composition and organoleptic indicators were selected proportions of rice and millet grains at a ratio of 35:65.

For filling in of lack of mineral substances and vitamins in dry mixture of groats were added dry fruit and vegetables : pumpkin, apple, pear, carrot.

The experimental compounding of dry porridge were developed, composition of compounding is driven to the table 3.

Table 3: Recipe of dry porridge

Name	Amount, gramm
Millet groats	55
Rice groats	30
Carrots dried	5
Apple dried	4
Pumpkin dried	3
Dried pears	3
Total	100

To assess the nutritional value of dry cereal were investigated three types of cereals that are sold in shopping centers of the city Semey, and made a comparative analysis of the chemical composition. Were chosen: experiment 1 - porridge "King" (ingredients: cereal 5 cereals (oats, wheat, barley, rye, corn), dried grapes, dried cherries, dried cranberries; Experience 2 - Cereal "Bystrov" (ingredients: oat groats, dried blueberries), Experience 3 - porridge "Buckwheat groats" (ingredients: buckwheat groats). The chemical composition of test samples are shown in table 4. According to the results of tables built chart – figure 7.

Table 4: The chemical composition of different types of porridge

Indicators	Experience 1	Experience 2	Experience 3	Experimental model
Proteins, g	7.5	6.2	7.5	8.8
Fats, g	1.1	0.8	1.3	1.2
Carbohydrates, g	57.0	47.6	41.0	64.2
Ash, g	0.56	0.42	0.6	0.9
Energy value, kcal	257	255	270	276

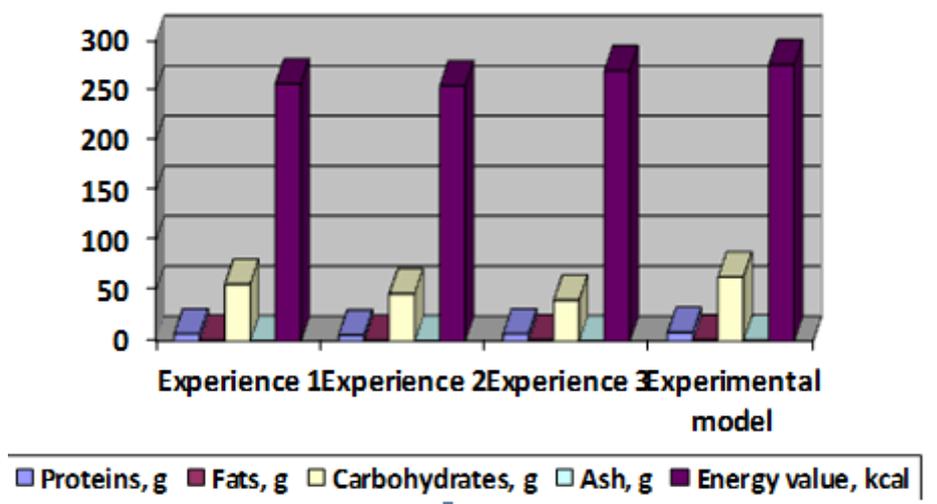


Figure 7: The chart of the chemical composition of cereals

As we can see, in this diagram the composition of dry cereal superior in protein content, carbohydrates, ash, other prototypes (experience 1, experience2, experience 3), also has enough high energy value. In the test samples was studied vitamin and mineral composition data presented in tables 5, 6.

Table 5: The amount of vitamins in porridges, mg /%

Name of vitamins	Porridge «King»	Porridge «Bistrov»	Porridge «Buckwheat groats»	Experimental model of dry porridge with vegetable and fruit fillings
E, mg	0.000081	0.00051	0.000129	0.007318
B1, mg	0.00233	0.00105	0.00425	0.02598
B2, mg	0.00435	0.00089	0.01231	0.05112
B6, mg	0.02363	0.00021	0.01256	0.04311

Table 6: The amount of microelements in porridges

Elements	Unit of measure	Porridge «King»	Porridge «Bistrov»	Porridge «Buckwheat»	A experimental model of dry porridge with vegetable and fruit fillings
Sodium	mg/kg	574.2	879	125.2	874.2
Magnesium	mg/kg	19.87	232	1322.4	93.987
Aluminum	mg/kg	95.1	65.1	98.6	12
Phosphorus	mg/kg	1241.1	650	1233.1	1534.2
Potassium	mg/kg	100.02	198.01	100.58	128.76
Calcium	mg/kg	120.54	120	128.72	145.32
Strontium	mg/kg	3.49	0.01	3.2	1.9
Arsenic	mg/kg	0.02	0.2	0.07	0.01
Manganese	mg/kg	30.6	8.2	32.1	29.1
Cobalt	mg/kg	0.45	2.46	0.32	0.46
Cadmium	mg/kg	0.12	2.05	0.03	0.05
Nickel	mg/kg	18.4	16.2	15.4	22.3
Copper	mg/kg	14.5	10.4	12.6	23.6
Zinc	mg/kg	65.4	12.5	33.4	76.8
Lead	mg/kg	1.4	0.5	1.8	1.0
Selenium	mg/kg	0.15	0.01	0.15	0.05
Rubidium	mg/kg	5.1	2.5	6.9	4.7
Barium	mg/kg	0.78	0.01	1.0	0.4
Iron	mg/kg	106.4	23.1	423.4	167.4
Silver	mg/kg	0.094	0.051	0.105	0.015
Chrome	mg/kg	26.1	50.6	45.3	50.6

On the values of tables 5,6 evidently, that a experimental model of dry porridge excels other types of dry porridges, that is contains the complex of mineral substances and vitamins.

DISCUSSION

The results of this study are the prerequisite for the creation of the production technology of dry cereal to school meals. The dry mixture of cereal produced according to the technological scheme. The technological process of dry cereal shown at the figure 8.

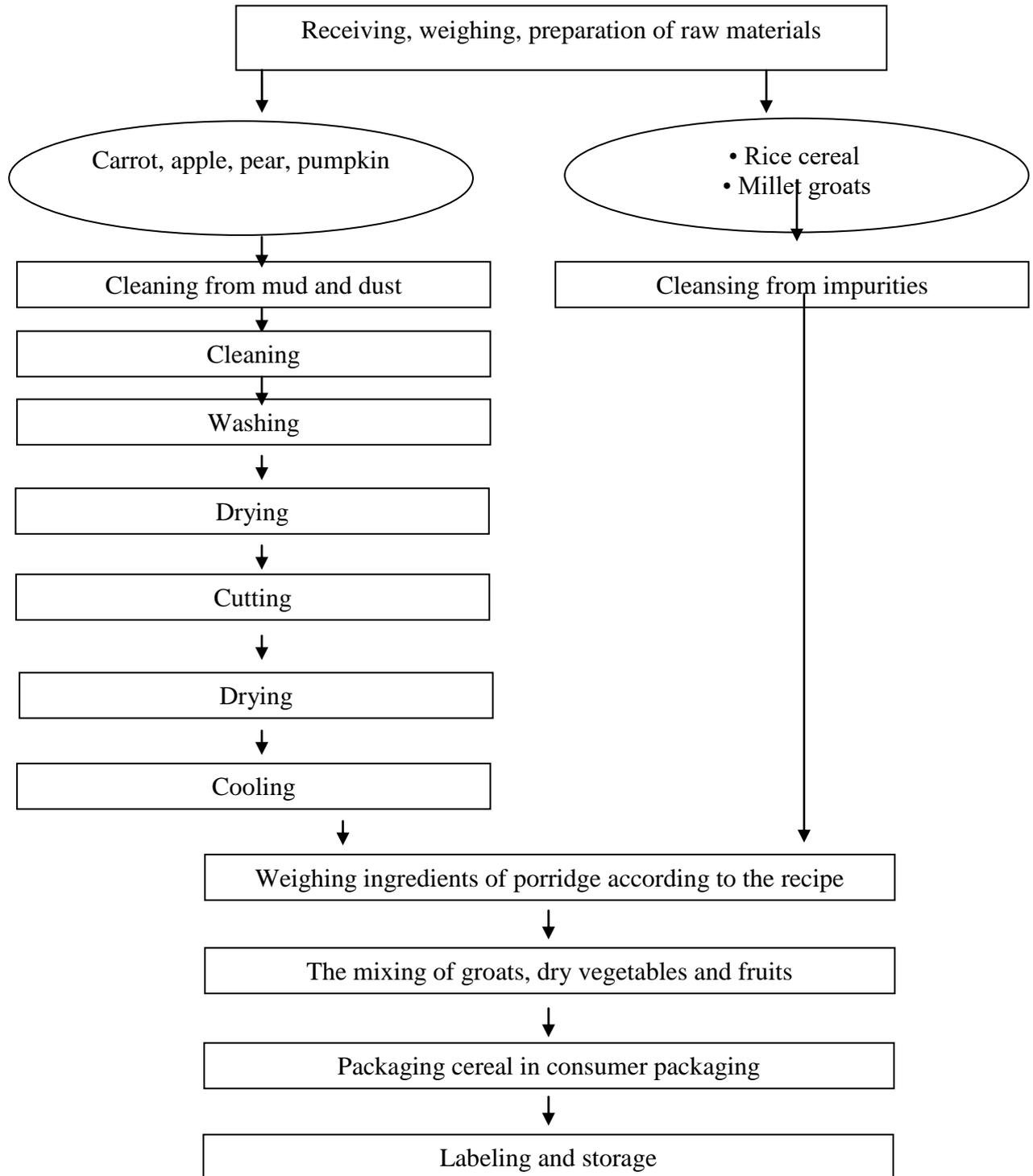


Figure 8: The technological scheme of production dry porridge

For the production of dry porridge used crushed rice, crushed millet, dry fruits and vegetables. The rice and millet must be checked for infectiousness and purity.

As fillers use fruits apples according to STATE STANDARD 21122-75 - fresh Apples of late ripening, pear to STATE STANDARD 21713-76 - fresh Pears of late ripening. Technical condition.

As a vegetable filler use pumpkin to according the STATE STANDARD 7975-68. Pumpkin fresh food. Technical condition. Carrots to according the STATE STANDARD 28275-94. Carrots fresh dining. Guide to storage.

The vegetables and fruits take in measured amounts, wash away dust and dirt in running water at a temperature of 15-20 °C.

The vegetables like pumpkin and carrots cleaned, peeled, fruit – apples and pears cleaned from the core.

The vegetables and fruits washed with running water 15-20 °C. The washed vegetables and fruits are placed on tables for drying at the temperature of 18-20 °C (at room temperature). The dried vegetables and fruits cut into squares measuring 10×10 mm.

The sliced fruits and vegetables are dried at the drying box according to STATE STANDARD R 54970-2012.

The technological requirements of drying: t - air temperature, ϕ - relative humidity, τ - the drying time:

(for carrot) $t=35$ °C, $\phi= 8$ % $\tau= 36$ hours
(for pumpkin) $t= 35$ °C, $\phi= 8$ %, $\tau= 28$ hours
(for Apple) $t=35$ °C, $\phi= 10$ %, $\tau = 36$ hour
(for pear) $t= 35$ °C, $\phi= 12$ %, $\tau = 28$ hours

The dried fruits and vegetables are cooled to the temperature of 12 °C.

The rice and millet groats, dry carrot, dry pumpkin, dry apple, dry pear weighed on the scale according to the recipe according to STATE STANDARD 11761-66. The prepared ingredients are mixed.

The finished product is Packed in cellophane, then in a cardboard box. Net weight is 400 grams. All boxes are marked. The box is must be packed in a corrugated fibreboard box according to the state standard 13511-06. Total weight of box with products should not exceed 10 kg.

The finished product is stored at a temperature of 18-20 ° C, relative humidity $\phi=70$ %, storage period is 6 months.

CONCLUSION

According to the results, was developed by company Standard– 30958956 – 01 – 2014 and technological instruction. Conducted industrial testing of technology of production of dry cereal in the enterprise "Nedoshitko". Received a positive decision on issuance of innovative patent for invention "method of obtaining dry nutrient mixture on grain-based" No. 1 2014/1881 from 20 December 2014.

The results showed that a mixture consisting of rice and millet groats, dry vegetable and fruits have a higher nutritional value than single-label cereal; a new product is harmless and can be used for school meals. The work on improvement of the formulation of dry grain mixture continues. In particular, to increase the amount of protein, vitamins of group B, mineral substances in the product is scheduled to enter a ground meal from the germ of wheat, which has a number of useful properties.

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