

RESEARCH OF FUNCTIONAL PROPERTIES OF MACARONI PRODUCTS ENRICHED WITH BERRIES RAW MATERIAL

Galina Voloshchuk¹, Tatjana Golikova²

¹ Institute of afterdiploma education of the National University of Food Technologies, Kyiv, Ukraine, e-mail: volog@ukr.net

² National University of Food Technologies, Kyiv, Ukraine, e-mail: tanyayev@ukr.net

Summary

The paper deals with functional properties of macaroni products enriched with berries raw materials – powders of wild ash, whortberry and strawberry puree. The effect of berry raw materials to the quality of macaroni products as well as nutritional value has been presented. Such macaroni have new colors – succinic, violet, – bettering structure and lower quantity of dry substances in cooking water. Addition of berry raw material to the recipe of macaroni promotes enriching of it with cellulose, pectin, especially mineral matters, vitamins and organic acids. It has been proven that macaroni products enriched with berry raw material have radioprotective properties that appear in definite decreasing of Cs-137 accumulating in organism.

Keywords: macaroni products, functional properties, wild ash, whortberry, strawberry.

Prevention of different diseases – oncological, atherosclerosis, anaemia, asthma, is partially possible by the enriching of nutrition by the biologically active substances of ingredients of herbal origin – creating of new assortment of daily products.

Macaroni products are a wide using and popular food products. In case of wheat flour processing it is a “rafinated” product with small content of biologically active substances – mineral matters, vitamins, proteins, food fibers.

For the widening of assortment and enriching of macaroni products that are processed with high temperature it is expedient to use berry powders – sources of food fibers, mineral matters, valuable carbohydrates, specific substances like a chlorophyll, phenol substance with P-vitamin activity [1, 2]. One of the perspective kinds of berry raw materials with researched preventive, functional properties and popular taste quality in Ukraine are the wild ash, strawberry [2, 3].

Chemical composition of red wild ash (aronia) differs in high content (6.5 % to the dry substances) of phenol substance with P-vitamin activity – anthocianins, leucoanthocianins, catechins, flavonols, fenoloksidants. Berries of red wild ash have the valuable mineral composition. It content 4...8 mg of ferrum, 0,3..0,8 mg of cuprum, till 3 mg of margan and till 0.11mg% of cobalt. Black wild ash has the near content of yodium as persimmon and feijoa. The content of organic acids, ascorbic and nicotinic, exceeds the quantity of these components in raspberries, redcurrants and strawberries. Fruits of black roman berries rich with tannic matters, food fibers, content till 1.5 % of pectin substances. Preparates made by black roman berries have the capillary stringing properties, and positive effect to the leaving of excessive cholesterol from human organism.

Fruits of whortberry content a lot of ferrum, it is useful in case of anemia. Ferrum of wild ash is better assimilated comparing to the medical preparations, because berries of wild ash content the ascorbic acid [3].

Using of whortberries betters circulation in retina of eye and intensifies a scotopia [4]. A wide spectrum of antocianins and phenols with strong antioxidant and anticarcinogenic properties are discovered in whortberries. Also was proven that these substances help to organism to resist the processes of senescence and formation of tumours [3].

Strawberry has a good balanced taste and smell resulting the moderate content of organic acid – 0,75..1,6 %. Strawberry is reached with ascorbic acids, vitamins B₁, B₂, B₆, PP, especially B₉ and vitamins of E group. Mineral composition of berries is differed in high content of magnesium, phosphorus, iron. Distinguishing feature of strawberry chemical composition is high content of cellulose – till 4 %, and content of pectin does not exceed 0.75 %.

In the National University of Food Technologies (Kyiv, Ukraine) under the direction of professor Yurchak V.G. the group of dessert macaroni products enriched with berries has been developed. New products with powders of black wild ash «Chornichniy aromat», with strawberry puree «Sunychni», with powder of rowan berries «Horobynka» and with whortberries powder «Chornychna kazka» got a high estimation on tastings and had a good cooking properties, by the taste and smell products were identify to the vareniks with berries. New colors in combination with original form of figured macaroni products were accepted positively by the consumers of child and youth segment of tasters.

Optimal quantity of new berries powder encouraged to the increasing of structure of macaroni products – durability, glassiness in a structure, form saving during cooking, decreasing of dry substances (not sugar) passed in cooking water (*table 1*). Bringing of stones with strawberry puree improves the organoleptical taste properties, but blocked positive effect of puree to the durability of products and saving of form during cooking.

Table 1 – Effect of berries raw materials to the quality of macaroni products

Quality indexes of macaroni products	Control samples (from wheat flour)	With powder of rowan berry «Chornichniy aromat »	With whortberry powder «Chornychna kazka»	With powder of wild ash «Horobynka»	With strawberry puree «Sunychnyi »
<i>Organoleptical properties</i>					
Color	white with grey shade	dark violet	violet	with saturated amber shade	grey with rose shade
State of surface	smooth, insignificantly rough		smooth		
Fracture	farinaceous	glassiness			
<i>Physical and chemical properties</i>					
Humidity, %	12,0±0,5	12,0±0,5	12,0±0,5	12,0±0,5	12,0±0,5
Acidity, degree	3,0±0,2	4,0±0,2	3,0±0,2	4,2±0,2	3,5±0,2
Durability, H	4,0±0,2	4,5±0,3	4,0±0,2	3,8±0,2	4,2±0,2
<i>Cooking properties:</i>					
Form	Partially does not save	save	save	save	Partially does not save
Taste, smell	characterized to the macaroni products	weak berry taste	weak whortberry	characterized to the macaroni products	strawberry
Coefficient of increase of mass	1.8±0,2	2.0±0,1	1.9±0,2	2.2±0,1	2.0±0,2
Coefficient of increase of volume	2.0±0,2	2.4±0,2	2.2±0,2	2.4±0,2	2.1±0,2
Dry substances, passed in cooking water, %	5.5±0,2	5.8±0,2	6.0±0,2	5.3±0,2	5.8±0,2

Changes in color of products let to use the wheat flour of premium class in producing the macaroni products with wild ash.

Berry puree and powders are the concentrates of initial raw materials. At practice it is possible the considerable rejections in content of nitrous matters, mineral components, food fibers, vitamins in products depending on parties of raw materials, class, conditions of growing of berries, technologies of preparing and producing of powder and puree. So, chemical composition was calculated at the base of reference data of chemical compound of wheat flour and berries.

Chemical composition and nutritional value of new kinds of macaroni products by the integral score were calculated by the technique of Union of R&D Institute of Bread Industry [5], results are shown in table 2.

Bringing of berry raw materials into the recipe of macaroni products encourages the enriching of it with cellulose, pectin, especially mineral matters, vitamins and organic acids. Integral score of organic acids exceeds 60 %, integral score of mineral matters and vitamins B group and PP increased insignificantly. In macaroni products «Chornychnyi aromat» integral score of flavonoids is more than 100 % from daily ration. Strawberry puree increases integral score of cellulose and pectin matters in macaroni products.

Bringing of wild ash powder in recommended dosage (6 % to the mass of flour) satisfies day's necessity in β -carotene on 10.8 % and to 4.6 % in vitamins C taking into account destruction of these vitamins in the cooking process.

The content of cellulose and carbohydrates increases in macaroni products «Chornychnyi aromat». But carbohydrates of whortberry are presented by mono- and disaccharides that are light mastering carbohydrates. As a result the energetic value of products decreases.

Table 2 – Effect of berry raw material to the nutritional value of macaroni products

Food nutrients	Day's norm of consumption	Integral score of macaroni products from wheat flour of premium and second class					
		Without additives, control samples		«Chornychnyi aromat»		«Sunychnyi»	
		premium	second	premium	second	premium	second
Proteins, g	40.0	23.5	26.6	23.5	26.4	23.7	26.7
Carbohydrates, g	450.0	15.1	14.4	15.1	14.4	15.1	14.4
-starch	425.0	14.6	13.5	14.3	13.3	14.5	13.7
-mono- and disaccharides	75.0	2.2	2.2	3.4	4.1	3.0	3.0
Fat (herbal), g	22.5	3.6	7.22	3.53	7.04	3.6	7.1
Food fibers, g							
-cellulose	23.0	0.4	2.3	1.86	3.8	2.2	4.0
-pectin	2.0	-	9.0	11.4	19.1	5.0	12.7
Organic acids, g	2.0	32.1	58.7	36.6	67.1	38.0	65.7
Mineral matters, mg							
-potassium	3250	3.4	6.9	3.6	7.1	3.8	7.3
-sodium	5000	0.9	0.3	0.2	0.3	0.2	0.4
-magnesium	4000	3.6	16.5	4.3	18.8	4.1	16.8
-calcium	900	1.8	3.2	1.9	3.3	2.2	3.6
-phosphorus	1250	6.2	13.3	6.4	13.2	6.4	13.3
-ferrum	15	7.2	19.9	14.0	25.5	7.3	20.5
Vitamins, mg							
-thiamin (B1)	1.75	8,8	19.1	8.3	18.7	8.8	18.6
-riboflavin (B2)	2.25	3,2	5.8	18.5	5.7	3.6	6.0
-Niacin (PP)	20.0	5,5	12.9	5.5	12.9	5.7	12.9
- β -carotene	5.0	-		3.9	3.9	0.7	6.0
-flavonoids	150.0	-		137.0	127.0	2.4	0,5
Mass of products, that	–	90,5	90.3	91.2	91.0	91.0	90.5

content 300 kcal, g						
---------------------	--	--	--	--	--	--

As known, majority of food fibers especially pectin have radioprotective, cation-exchanging properties to link ions of 2- and 3-valent hard metals with forming of not-soluble complex that are not sucked in organism and are not hatched from an it. Bioflavonoids effect to supporting of the state of blood vessels, organic acids especially vitamin C have capability to extinguish the chainlets of free-radical processes in irradiation of organism [5].

The researches of functional properties of macaroni products with berry raw materials were implemented in the laboratory of prevention of inner irradiation of the Ukrainian scientific center of radiation medicine. Experiment concerning researching of antiradation properties of products enriched with berry raw material to the metabolism of Cs-137 was implemented in radioisotope vivarium on the not thoroughbred females of white rats with mass 150...160 g approximately one age – 3 months for 10 animals in a group.

Part of the vivarium ration was changed into researched samples of macaroni products. Depending on the condition of research each group of animals used different macaroni products in quantity of 20.5 g per one animal. The macaroni products made from wheat flour of premium class and macaroni products enriched with pectin with calculation in 100 g of these macaroni – 50 % of day's prophylactic norm of radioprotectives consumption were used as control samples.

Accordingly: 1 group used macaroni products made from wheat flour of premium class, 2 group – macaroni products with 1 % of pectin; 3 group – macaroni products with powder of black wild ash; 4 group – macaroni products with strawberry puree.

Animals of control and experiment groups during 31 days got with the food indicative quantity (0.4 kBk) of solution Cs-137.

Content of radioisotope in the rat organism was measured on the next day after first receipt of isotope and then after each 2-3 days by the gamma-radiation of Cs-137 on the gamma-spectrophotometer «Adkam» with impulse analyzer on 4096 channels with detector NaJ. Measures were implemented in the geometry of plastic house that fixed the animal. Received results of researches were processed by means of variative statistics, authenticity of differences was determined by the Student's criteria.

Results of radiometric researches of cesium changes in the organism of rat were presented in the table 3 by the indexes of multipleness of radioisotope accumulating – ratio of radiocesium content in the organism of the animal at day of the measuring to the quantity of everyday receipt.

Table 3 – Dynamics of accumulating Cs-137 in the organism of rat under the influence of macaroni products with pectin and berry raw materials

Ration	Day measures Cs-137					% of reduction
	2	7	14	24	31	
Macaroni products without additives	0.72±0.10	3.01±0.16	5.03±0.21	8.19±0.28	9.17±0.29	–
With pectin	0.63±0.12	2.6±0.13	4.29±0.16	7.2±0.22	7.80±0.24	14.9
«Chornychnyi aromat»	0.64±0.11	2.64±0.12	4.43±0.17	7.18±0.21	8.04±0.24	12.3
«Sunychni»	0.61±0.11	2.62±0.12	4.33±0.17	7.11±0.23	8.01±0.25	12.7

The multipleness of radioisotope accumulation in the organism of first control group of the animals on 31 day was 9.17±0.29 kBk. Accumulation of radiocesium in the organism of animals that used products with pectin was on 14.9 % lower – 7.80±0.24 kBk. Animals used in the ration the macaroni products with berry raw materials accumulated Cs-137 on 12.3 %

and 12.7 % lower than animals used macaroni products without additives and approximately equivalent amount to the group used products with pectin. Such indexes are high for the natural products and allow to make a conclusion that macaroni products with berry additives have the antiradiation properties. These properties are shown up in a certain decline of Cs-137 accumulating in the animal organism.

Thus, creating of macaroni products enriched with berry additives – powders of black and red wild ash, whortberry and strawberry puree allows to widen the assortment of macaroni products made from inexpensive sort of wheat flour.

Products with berry raw materials are advantageously differ by new sensorial quality indexed, enriched textural properties, enhanceable content of flavonoids, mineral matters, vitamins of B group, PP, C and carotene as well as cellulose and pectin substances.

Functional, radioprotective properties of new macaroni products with powder of black wild ash and strawberry puree practically do not yield to the products with 50 % day's prophylactic norm of radioprotector – pectin.

References

1. Dotsenko I.I., Habovych R.D. Prophylaktychna medicina. Zagalna hihiena z osnovamy ekologii // Navch. Posibnyk. – K.: Zdorovia, 1999. – 643 s.
2. Dudchenko L.G., Kryvenko V.V. Plodovye I yagodnye rasteniya – tseliteli. – K.: Naukova dumka. – 1987. – 112 s.
3. Khalapsina S.V. Perspektyvy vykorystannia dykoroslykh yahid v ozdorovchomu kharcuvanni // Tezy dopovidey mizhnar. nauk. konf. molodykh uchenykh, aspirantiv I studentiv “Naukovi zdobutky molodi – vyrishennyi problem kharcuvannia ludstva u XXI stolitti”. – Ch. 1. – K., NUHT, 2013. – S. 9 – 10.
4. Bazarnova Yu. Dikorastushchie yagody v konditerskom proizvodstve // Khlibopekarska i kondyterska promyslovist Ukrainy. 2012. - №11. – S. 17 – 19.
5. Vremennoe metodicheskoe ukazanie po raschety khimicheskogo sostava khlebobulochnykh izdeliy . – M.: VNIHP, 1980. – 33 s.
6. Korzun V.N. Hihienicheskaya problema prophylaktyky vnutrennego obluchenia organizma pri dlitelnom alimentarnom postuplenii radionuklidov chezia i strontsia: Dis. Doktora med. nauk: 14.02.01 – K., 1995. – 300 s.