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NATURAL FIBER - POLYSACCHARIDE FOOD SUPPLEMENT OF ANTIOTOXIC ACTION

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НАТУРАЛЬНОЕ ВОЛОКНО - ПОЛИСАХАРИДНОЕ ПИЩЕВАЯ ДОБАВКА АНТИТОКСИЧЕСКОГО ДЕЙСТВИЯ

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Abstract. The toxicological assessment of meat raw materials on the consumer market in Imereti region was conducted in Georgia. In 45% of the samples, the content of the lead has been estimated at 2.5–3 times more than 0.1 mg/kg. In modern ecological conditions, the natural fibrous polysaccharide composition of antioxidant action has been worked out to increase the toxicological safety of food raw materials in the modern ecological conditions — the ratio of active wheat bran, high molecular pectin and low molecular pectin 15:3:2. The lead sorption ability has been studied by the composition. The technological properties of the supplement are studied. Based on the obtained results, techniques for functional purpose meat products have been developed for children and diabetes patients using these additives.

Аннотация. Проведена токсикологическая оценка мясного сырья потребительского рынка Имеретинского региона Грузии. В исследуемых образцах установлено высокое содержание (в 2,5–3 раза больше нормы — 0,1 мг/кг) железа. С целью повышения токсикологической безопасности пищевого сырья разработана технология натурального полисахаридного комплекса антитоксического действия на основе пшеничных отрубей, высокомолекулярного пектина и низкомолекулярного пектина в соотношении 15:3:2. Изучены сорбционная способность и технологические свойства полученного комплекса. Использование пищевой добавки антитоксического действия дает возможность разработать технологию мясных продуктов для детей и диабетиков.

Keywords: fibre-polysaccharide complex, food supplement, diabetic products.

Ключевые слова: волоконно-полисахаридный комплекс, пищевая добавка, диабетические продукты.

In the modern era, environmental pollution by heavy metals is considered one of the biggest problems of human health [1]. On Approval of the Technical Regulation on the Maximum Permissible Limit of Some Pollutants in the Food and Nutrition Code of Georgia (16.08.2001, Tbilisi) and no. 567 “On Approval of Sanitary Rules and Standards of Quality and Safety of Food Raw Materials and Food Products” (9.11.2015 Tbilisi) — foods from 40 heavy metals harmful to the human organism are regulated only in lead, arsenic, cadmium, mercury, copper and zinc content, which is due to their broad, almost universal distribution in the environment, with strong toxicity, the ability to accumulate in human and animal organisms.

We have analyzed toxicology and radiation safety analysis of 20 samples of various kinds of meat (beef, pork and poultry) in the Imereti region consumer market in Georgia.

In the samples of research, the toxic elements (lead, arsenic, cadmium, mercury, copper, zinc, cesium 137, and strontium-90) are studied. Studies have been conducted at LEPL Laboratory Research Center of the Ministry of Agriculture of the Autonomous Republic of Adjara. Results of conducted studies are presented in Table 1 and Figure 1.

Table 1.

THE CONTENT OF TOXICOLOGICAL AND RADIOACTIVE ELEMENTS IN MEAT RAW

Sample no.	*Place of sampling*	*Lead (Mg/Kg)*	*Arsenic (Mg/Kg)*	*Cadmium (Mg/Kg)*	*Mercury (Mg/Kg)*	*Copper (Mg/Kg)*	*Zinc (Mg/Kg)*	*Cesium 137 (Bk/Kg)*	*Strontium 90 (Bk/Kg)*
1	Bagdati	0.02	0.03	<0.01	<0.001	<1.0	2.27	5.21	23.2
2	Zestafoni	0.03	0.04	<0.01	<0.001	<1.0	5.38	6.31	24.4
3	Tskaltubo	0.06	0.045	<0.01	<0.001	1.06	19.38	5.93	19.0
4	Terjola	0.03	0.06	0.02	<0.001	2.10	9.61	10.3	21.3
5	*Zestafoni*	*0.025*	0.04	0.01	—	—	—	10.7	17.8
6	*Zestafoni*	*0.28*	0.05	<0.01	—	—	—	6.95	11.2
7	Khoni	0.04	0.06	<0.01	—	—	—	6.31	23.9
8	*Kutaisi*	*0.32*	0.03	0.02	—	—	—	6.80	24.4
9	Tskhaltubi	0.05	0.04	<0.01	—	—	—	6.76	11.4
10	Chiatura	0.04	0.05	<0.01	—	—	—	5.97	11.2
11	Sachkhere	0.05	0.07	<0.01	—	—	—	6.06	11.3
12	Zestafoni	0.07	0.05	<0.01	—	—	—	1.36	4.28
13	Zestafoni	0.07	0.03	<0.01	—	—	—	6.23	11.2
14	Chiatura	0.03	0.06	<0.01	—	—	—	5.66	11.2
15	*Sachkhere*	*0.2*	0.02	<0.01	—	—	—	6.73	18.4
16	*Zestafoni*	*0.3*	0.008	<0.01	—	—	—	5.73	18.1
17	*Zestafoni*	*0.32*	0.008	<0.01	—	—	—	7.14	17.5
18	*Kutaisi*	*0.23*	0.05	<0.01	—	—	—	6.28	18.0
19	*Kutaisi*	*0.26*	0.07	<0.01	—	—	—	5.65	18.2
20	*Kutaisi*	*0.22*	0.025	<0.01	—	—	—	6.43	11.5

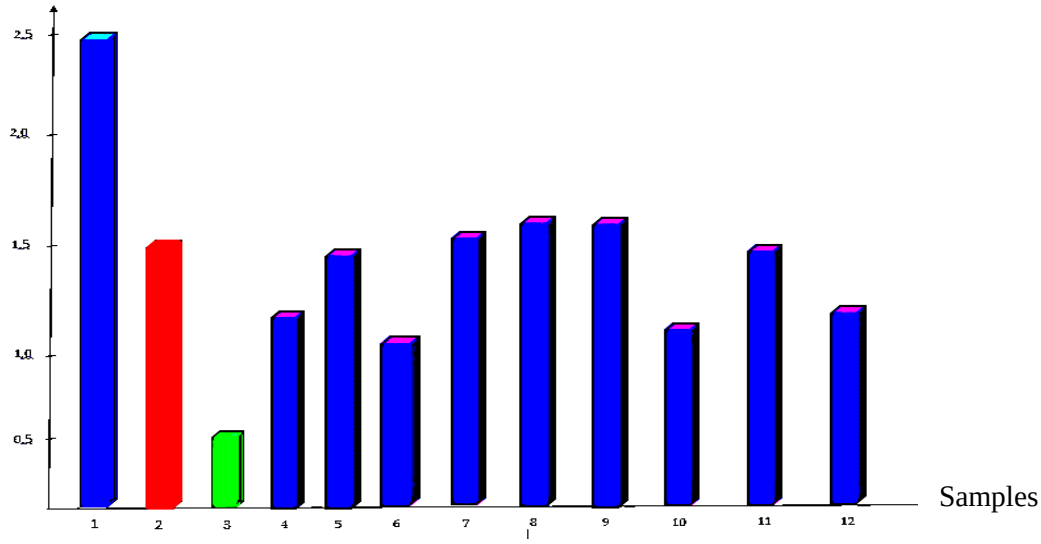

Figure 1. Lead content in researching samples: 1 — Plumbum dose for adults (sample 301/N); 2 — Plumbum dose for children (sample 301/N); 3 — Edited plumbum dose; 4–12 — Plumbum contain in the research (sample 301/N).

The results of the analysis show that the sample content of 9 samples out of 20 samples outlined in the marginal permissible norm (0.1 mg/kg) exceeds 2,5–3 times as for preschool and school-age children and adults. The samples containing the bulk of the bullets belong to Kutaisi, Zestafoni, Sachkhere and Chiatura regions.

Based on the results obtained, we believe that the primary and most important task of food producers in these ecological conditions is to provide toxicological safety of food, for which it is necessary to search for prophylactic technological techniques that provide accumulation in the body of heavy metals reduced pathological changes.

Determination of toxic and radioactive elements in raw meat was carried out by the following methods: Lead and cadmium (4.1.986-00 and GOST 26929-94, arsenic — GOST 51766-2001 and GOST 26929-94, mercury — 41.1472.03 and GOST 26927-86, copper and zinc — 4.1.991-00 and GOST 26929-94, cesium and strontium — MWN-MN 1181-2011.

For the determination of the capacity of lead sorption, peptinic substances were treated with 1% of pectin solution, with a solution of lead acetate, weeding the suspension of the lead and the filtration in the filtration to prevent the use of remaining ions. We filtered filtration with trilon–B–0,01M sodium acetate. (Using an asynchronous cylindrical orange).

The ability to connect the water–fiber–compulsory ingredient's water was estimated to have a temperature of 36±1°C for 5 times the amount of water. The quantity of water connected to the water was determined by the difference between the initial amount of water and the amount of water obtained by the depression after 1 hr.

In addition to the preparation of the fibre-polysaccharide complex of the meat peach water supply, fat syrups and fat emulsifiers we have determined with the standard method (according to Antipova, L. V. and others) [6].

The essence of prevention by technological methods of ingestion of the organism is that the effects are not environmental adverse factors, but affects the reactivity and resistance of the organism to the harmful factors of the environment, using high coronary properties, antioxidative activity additives. The basis of bio prophylactic is enterosorption. Enterosorbents combine exogenous and endogenous harmful substances through various structures through adsorption, absorption, ionization or complex formation in the digestive tract.

The most important is the creation of enterosorbates, which have the ability to lower the concentration of heavy metals into the human body in the conditions of a lightweight on the body. Such action is characterized by plant derivatives of plant origin. They are not only exposed to heavy metals from the human body but have a wide variety of prophylactic impacts on the body, including food fibers, vitamins, minerals and other biologically active ingredients. Such skills are characterized by the non-availability of vegetable cell walls of the plant cell in the remaining bran in the fruit sprays and grain crushing — cellulose, hemicellulose and peptic substances [2–5].

Based on the above mentioned, the following ingredients were selected for the formation of a phosphate–polysaccharide complex of antioxidant action:

1. Mechanical–activated wheat bran (48% of dietary fibers);
2. High-quality molecular citrus pectin of average etherification (64%);
3. Low molecular beet pectin of low etherification quality (41%).

In the Tables, the chemical composition of the ingredients used in the phosphorous polysaccharide complex and the physicochemical properties (Tables 2–3) are given.

Table 2.

THE CHEMICAL COMPOSITION OF USED WHEAT BRAN
IN FIBER-POLYSACCHARIDE COMPLEX

№	*Name of substances*	*Substance content*
1	Water, (%)	15.5±0.95
2	Carbohydrates (starch, dextrinals, mono and disaccharides) (%)	16.8±1.03
3	Food fibers, (%)	45.3±2.12
4	Fats, (%)	3.5±0.09
5	Proteins, (%)	14.25±0.51
6	Vitamin $B_{1,}$ (Mg %)	0.55±0.02
7	Vitamin B_2, (Mg %)	0.61±0.02
8	Vitamin B_6, (Mg %)	1.21±0.05
9	Vitamin B_9, (Mg %)	72.3 ±1.25
10	Vitamin PP, (Mg %)	15.1±0.65
11	Potassium, (Mg %)	1150±25
12	Magnesium, (Mg %)	665±12
13	Phosphorus, (Mg %)	1050±21
14	Iron, (Mg %)	10.8±0.3
15	Selenium, (Mg %)	79.5±1.21
16	Zinc (Mg %)	8.21±0.25

Table 3.

PHYSICAL-CHEMICAL CHARACTERISTICS OF PECTINE SUBSTANCES
USED IN THE FIBER-POLYSACCHARIDE COMPLEX

№	*Physical–chemical characteristics*	*Citrus pectin*	*Beet pectin*
1	Dry substance content (%, from Pectin damp weight)	92.2±2.3	94.1±3.2
2	Density kg/m^3	1.10±0.01	1.54±0.02
3	Composition of Galacturonic acid (%, Pectin dry weight)	82.2±2.0	87.3±0.18
4	The content of acetyl group (%, from pectin dry weight)	0.30±0.01	0.34±0.01
5	Containment of neutral sugars (%, from the dry weight of pectin)	11.7±0.21	10.1±0.19
6	Methoxylation degree	64±1.5	41±1.5
7	Molecular mass	40000±500	13000±500

The activation of the wheat bran means its active ingredient — mainly food fibers (cellulose, hemicellulose, protopactine) — to increase access to toxic elements to facilitate their solarization process, for which it is necessary to a decade or decrease measures. To achieve this goal, we have chosen mechanical destructive method, which means that the mechanical division of the particle particles up to 90–100 cm, for this purpose we used multiple molds of wheat flour and exterminated in various sizes, with the number 32 sizes — 226 nm, then the size of the n43 — measures 165 mm, With 72 sizes — 90 feet of measurements and we received the cut, which is in the number 72 in the recharge or its particle S size was reduced to 90 microns 1500–2000 mkm-up.

The role of wheat bran in the composition of this fibre-polysaccharide complex — the solvent of toxic elements in mince. Low ethical quality low-calcareous beet pectin is to go into the walls of the intestine and blood vessels, blood flow and toxicity of the toxic elements in the area. It is known that low-molecular peptins have the ability to do so. The purpose of high-molecular pectin with the level of secondary etherification is to use the toxic substance in the digestive canal because the final goal of the work is to use this additive in meat products. High molecular pectin in composition was also due to the fact that high-molecular pectin is characterized by a higher water supply capacity, which reduces water activity in the product and therefore protects it from microbial contamination.

To determine the optimal ratio of ingredients in the composition, the ability to combine individual ingredient and their (phosphoric polysaccharides complex) and the ability of water and lead juncture. (Figure 2–3).

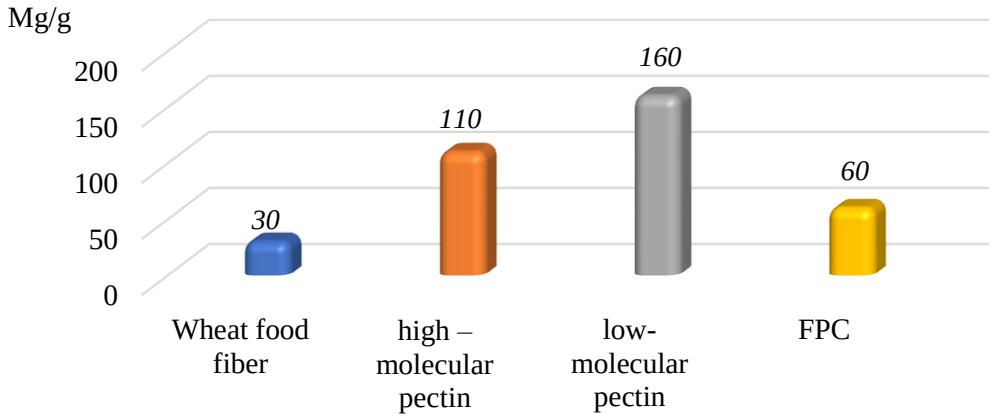

Figure 2. Lead sorption ability of fibre-polysaccharide complex.

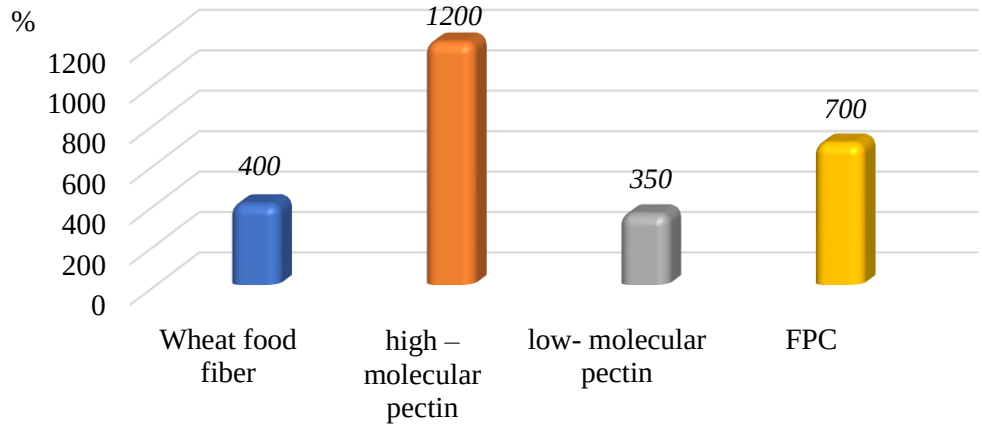

Figure 3. The ability of juncture of fibre- polysaccharide complex water.

As shown from the graphs, the ability to lead the charcoal increases in wheat bran, high molecular pectin and low-molecular pectin.

High solubility ability of low-molecular pectin is due to its low level of etherification and high-molecular pectin is characterized by the highest level of water juncture.

Table 4 presents the chemical composition of the phosphorous polysaccharide complex.

The studies for the fiber-polysaccharide complex (FPC) have been conducted in different conditions of the ingredients used. As a result of studies, the optimal ratio of ingredients in antioxidant action ingredients: wheat bran: high molecular pectin: low molecular pectin (15:3:2), characterized by high water conjugation (700%) and high sorbitation properties (capability of lead 60,8 ± 0,25 mg/c).

Table 4.

CHEMICAL COMPOSITION OF THE FIBER-POLYSACCHARIDE COMPLEX

№	*Name of substances, %*	*Substance content*
1	Water	14.25±0.72
2	Proteins	13.27±0.51
3	Fats	2.53±0.12
4	Carbohydrates (starch, dextrinals, mono and disaccharides)	12.61±0.55
5	Food fibers	34.5±1.20
6	Ashes	4.05±0.12
7	Pectin substances	25
8	Vitamin B_1	0.39±0.02
9	Vitamin B_2	0.41±0.02
10	Vitamin B_6	0.85±0.02
11	Vitamin B_9	65.30±1.15
12	Vitamin PP	11.31±0.95
13	Potassium	875±25
14	Magnesium	516±16
15	Phosphorus	480±16
16	Iron	8.5±0.22
17	Selenium	61.5±1.12
18	Zinc	6.4±0.32

At the next stage of the work, the effect of dietary supplements has been studied on the technical qualities of meat raw materials: the ability to water, the ability to fat juncture, the fat emulsion ability (Figure 4–6). In meat mince, the content of the fiber–polysaccharide complex significantly reduces the quantity of water allocated from the mince, i.e., the ability to combine mince water for both meat and poultry meat, and in the amount of 5% and more the food additive sharply worsens the mince's structural-mechanical organoleptic characteristics. Adding the fiber–polysaccharide complexes on fatty mince of pork, chicken, and beef increases the ability of fat juncture ability, especially in beef, less in case of pork meat, and does not effect on fat emulsion process at all.

The recipes and techniques of "kid's sausages", "diabetic cooked sausage" and semi–finished minced meat products are developed for the use of natural fiber–polysaccharide supplements for feeding children and diabetics. As a result of the medico–biological analysis of the derivative products, the efficacy of their prophylactic action on the organism of laboratory animals is determined. The draft Analysis and Critical Control Points (HAACP) system are drafted on all the products produced; Production test of new technologies has been conducted in the meat processing

LTD “Gurmani” (Kutaisi) and provisional technological instructions of their products are approved and approved.

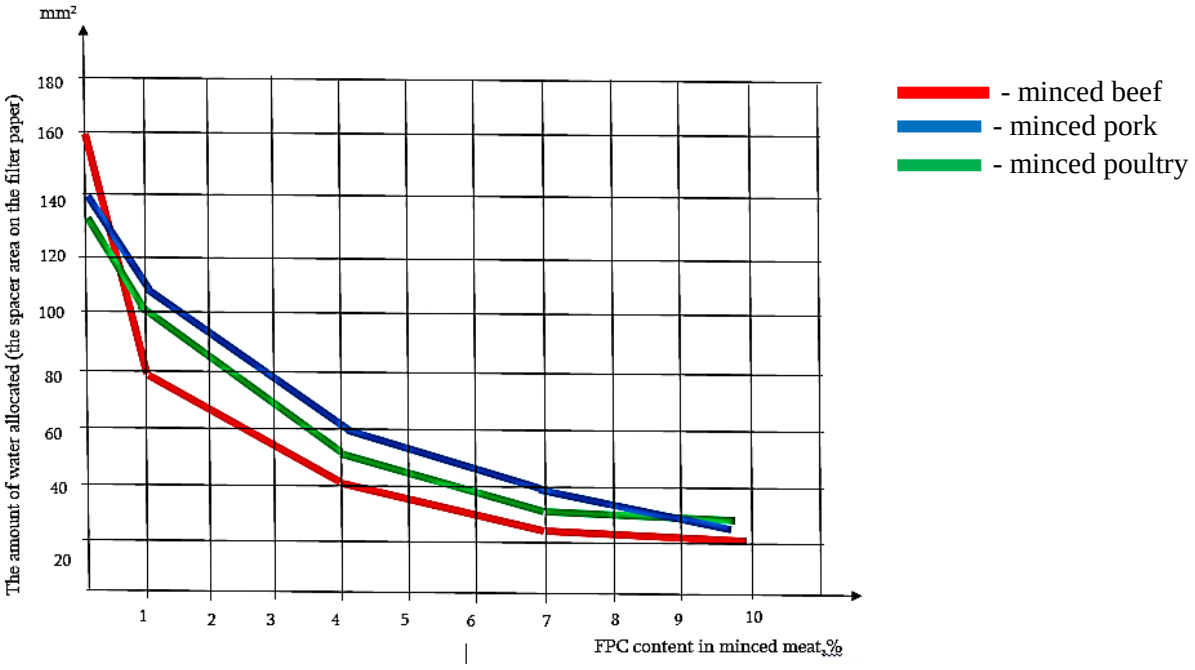

Figure 4. Influence of the fibre–polysaccharide complex of water juncture capacity of minced meat.

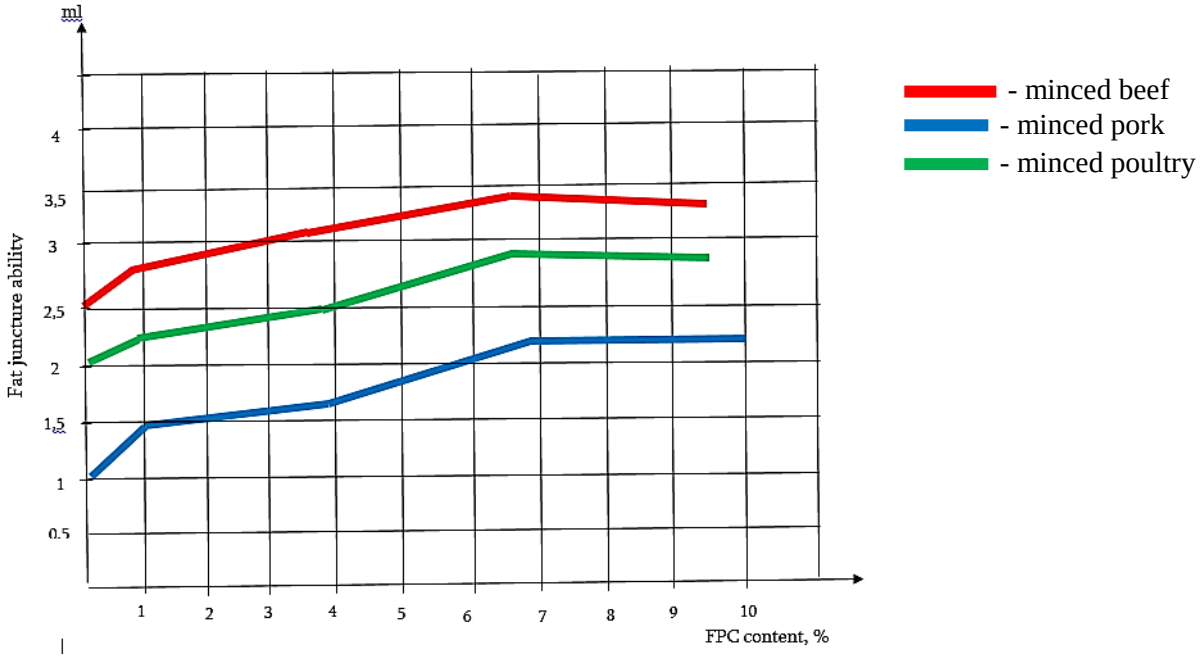

Figure 5. Influence of the fiber–polysaccharide complex of fat juncture capacity of minced meat.

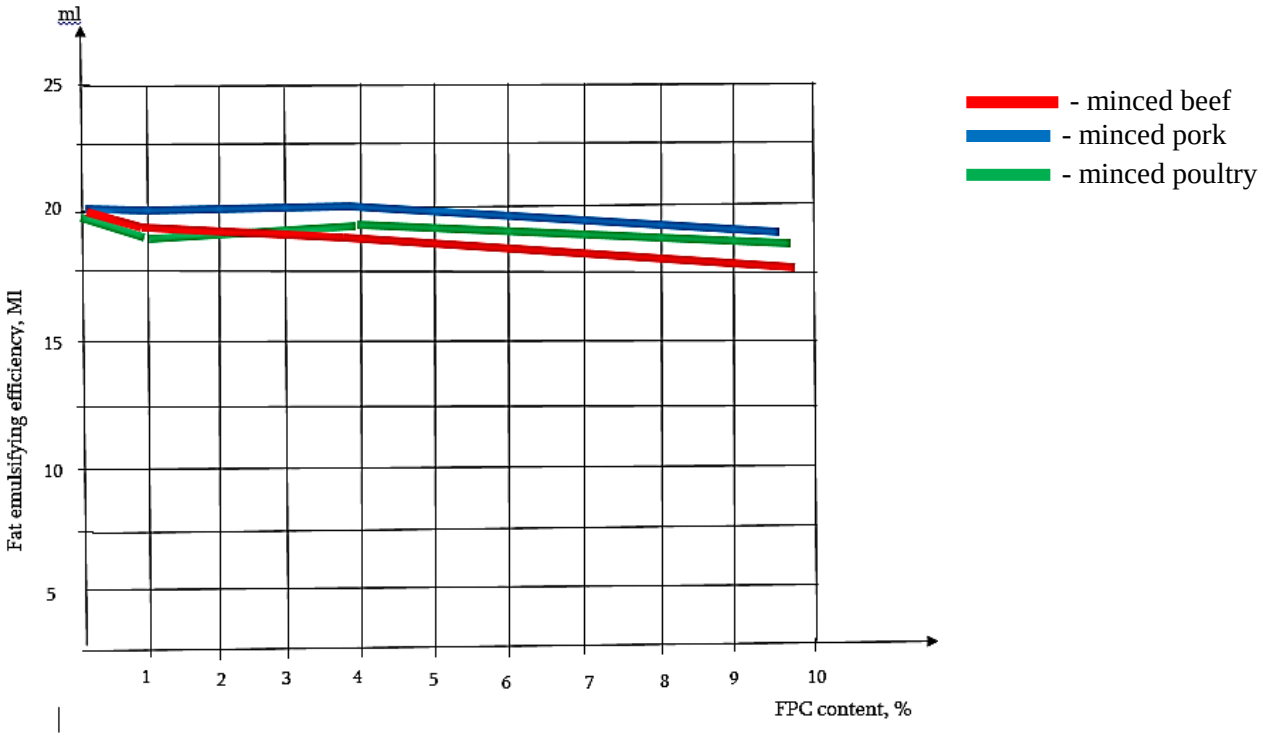

Figure 6. The effect of fiber–polysaccharide complex of fat emulsifying efficiency of Minced meat.

In the modern ecological conditions, the organic composition of the phosphoric-polysaccharide complex of antioxidant action with high coronary properties has been worked out for the following ingredients to reduce the accumulation of heavy metals in the body and to reduce the pathological changes caused by their action: mechanized activated wheat bran, high-molecular pectin medium (64%) of etherification quality and low-molecular pectin low (41%) with the level of etherification 15:3:2. By adding concentrates of pectin in this concentration, it increases its ability to increase the ratio of wheat to 35 mg/g to 60.8 mg/g and water binding ability between 400% to 700%, increasing the number of pectins in the phosphoric polysaccharide complex leads to a sharp deterioration of structural–mechanical properties of minced meat.

Receipts and Technologies for “Kids sausages”, “Diabetic Cooked Sausage” and Semi-finished minced meat products are for the children and diabetics are obtained with the usage of a natural fiber–polysaccharide supplement of antioxidant action.

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