

Akaki Tsereteli State University of Kutaisi
Faculty of technical engineering

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Nino Kintsurashvili

**Developed technologies
of functional meat products and processing
system
for safety guarantees**

**Dissertation presented to obtain the academic degree of Doctor of food
technology (0104)**

A b s t r a c t

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The work has been carried out at the department of food technologies on the faculty of technical engineering of Akaki Tsereteli State University.

Academic supervisor: **Manana Qarchava**, Doctor of technic science, Professor

Reviewers: **Temur Revishvili**, doctor of technical sciences, professor
Roland Kopaliani, doctor of agricultural sciences, professor

The defense of the dissertation will be held on _____ at the meeting of the Dissertaion Board of the faculty of technical engineering. Address: 4600, Kutaisi, Tamar Mefe str. N59, I building, room N1114

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General Discription of the work

The importance of the topic:

Modern time has significantly changed human's nutrition structure expressed in surplus of saturated fat in ration and lack of essential macro – and micro nutrients important in life. In addition to above mentioned changes unhealthy ecological environment, high quality of food products contamination and other permanent negative factors endangers human's health seriously and stipulates widespread of so called "civilization diseases" in the society.

Food prescription must not be to satisfy demands only for the main food substances under these conditions. XXI century food products must activate defensive physiological mechanism of the body, prevention of expected complications, prophylactic and treatment. It is important to correct their traditional composition thoroughly and to develop new food technologies with functional prescription to secure food products with such features. Appropriate food appendage is the main pretext to develop functional food products. It is very perspective to find and use local resources for this reason.

Nowadays, such products are not produced in Georgia whereas rich base of raw materials of our country, unused vegetable and mineral resources which are not fully examined, ongoing scientific researches during decades in the whole country makes a strong pretext for the implementation and development of the functional food appendages and their production.

One of the most problematic issues is the safety of food products in the modern ecological conditions. That is why it is so important to develop appropriate, innovative approaches and provide them in technological process.

In the conclusion, to develop wide assortment of natural, biologically active food appendages and to process scientifically founded technologies and safety system of food products with different functional prescription having balanced nutritional composition and defensive functions of human's body is very **actual** and has both scientific-practical and important social-economic value.

Main purpose: To develop natural, biologically active food product appendages on the basis of local vegetable and mineral resources, to use them

in the technologies of functional meat products (fibrous, vitaminized, calcined and hypoglycemic) and to process safety system (HACCP)

The following objectives are settled to reach the above mentioned goals:

- Nutrition value research of main raw materials
- Hygienic safety research of main raw materials
- Research of the production process of natural biologically active fibrous-polysaccharide, vitaminized, mineral and hypoglycemic food appendages using local vegetable and mineral resources
- Using gained food appendages to develop meat product technologies with functional goals for child's nutrition and people with diabetes.
- Medico-biological research of new products
- To develop main principles of HACCP for new products production
- To develop normative-technical documentations about the products with functional goals.

Scientific novelty

- Innovative technological approaches and theoretical basis of producing vitamin, mineral, hypoglycemic natural food appendages with high bio access are developed
- Original composition of fibrous polysaccharide complex with a strong ability of sorption is developed which ensures high quality of toxicological safety of processed product.
- Physic-chemical, biochemical and technological features of processed products are studied, technological parameters of their produce and use in functional meat products are established
- Prophylactic effectiveness of functional meat products "sausages for children" and "sausages for the people with diabetics" with high nutrition value produced is ascertained by using fibrous, vitaminized, mineral, hypoglycemic natural product appendages.

Practical significance of the work

- The technologies of the following natural, biologically active food appendages with high bio access are processed on the bases of local vegetable and mineral resources
 - Fibrous-polysaccharide composition with the ability of strong sorption
 - lyophilized Concentrates of sweetbrier's vitamin complex

- lyophilized concentrates of mineral water "Lugela" (CaCl₂)
- lyophilized concentrates of hypoglycemic vegetable set

- Technologies of the chopped semi fabricates of sausages and meat with balanced nutrient composition is developed
- Main principles of safety system (HACCP) are developed for the production of new products

Scientific provisions to be presented

- Analyze results of the nutrition value of the meat raw materials used in the research
- Final results of the research about the microbiological and toxicological safety of the main raw materials
- Results of the research of technologies of natural, biologically active fibrous-polysaccharide, vitaminized, mineral and hypoglycemic food appendages using local vegetable and mineral resources.
- Recipes and technologies of child's nutrition functional meat products
- Recipes and technologies of functional meat products with hypoglycemic activity
- Results of the medic-biological research of new products

Work approbation: Certain results of the dissertation researches are periodically mentioned on the meeting of food technologies department of Akaki Tsereteli State University (2014-2017). Final results are discussed and published in the materials of international scientific-practical conferences; International scientific-practical conference "Science and Innovative technologies" Kutaisi, Akaki Tsereteli State University, 2014

Publications: 6 scientific articles are published about the topic of the dissertation in Georgian periodical publications with high ratings.

The structure and the size of the work. Dissertation is presented on 120 pages printed on the computer and contains 4 chapters, main conclusions and 107 literary sources, contains 21 time-tables, 7 pictures and 16 draughts.

Content

Dissertation contains introduction, 4 chapters, main conclusions and list of used literary sources.

Actuality of the topic, goals and objectives, scientific novelty and

practical values are introduced in the introduction.

First chapter – literary review – the following issues are discussed: Actuality of the functional food production, problems and perspectives; scientific-practical basis to enrich food products with micronutrients; perspectives to create natural, biologically active food appendages by using local resources; modern technologies to produce functional (Medical-prophylactical) meat products; Main principles of HACCP (Hazard analysis critical control point) to produce functional meat products.

Second chapter – is about research objects and methods

Research objects: Research objects are: Samples of beef, pork and hen's meat from the market of Imereti region, wheat bran produced in Georgia, high molecular pectin with middle quality of etherification (64%), low molecular pectin with low quality of etherification (41%), sweetbrier fruit from the ecologically clean regions of west Georgia (Zekari gorge) with its flour and water extract, mineral water "Lugela"; hypoglycemic vegetable set (bilberry leaf (*F. Myrtille*), bean husk (*C. Phaseoli*), Aralia (*R. Araliu*), equisetum arvense (*H. Equisetum*), sweetbrier (*Fr. Rose*), wasp (*H. Hiperrici*), camomile (*Fl. Chamomillae*)), fibrous-polysaccharide food appendage, lyophilized concentrates of sweetbrier complex, lyophilized concentrates of the mineral water "Lugela" (CaCl_2), lyophilized concentrates of the biologically active substances of hypoglycemic vegetable set, children's sausages and diabetic boiled sausage, experimental animals – white rats.

Research methods: to define the quality of raw materials, semi fabricates and ready-made products we use both generally accepted, standardized and special methods and tools used to estimate food value of vegetable, animal origin raw materials and ready-made raw materials, for microbiological and toxicological analyze and for the research of technological features. We conduct meat and meat products microbiological analyze according to GOST 26669-85, GOST 26670-91, GOST 10444-15-94, GOST 9948-81, GOST 30518-97, GOST 99588, GOST 30519-97, GOST 9958-81, toxic elements (Plumbum, Cadium, copper, zinc, mercury, arsenic) were defined according to GOST 299294-94, GOST R-51766-2001, GOST 29929-94, a. a. 4.1.147-03; gost 29927-86, radioactive elements – according to Cesium 137 and strontium 90 МВИ-МН 1181-2011. Ability of meat to combine the water, ability of mincemeat to combine the fat are defined according to L.V. Antipova, I.A. Glotova, I.A. Rogovi (2011). Laboratory and

technological experiments methods are in the correspond chapters of the dissertation. Experiments are conducted three times repetition and final results are processed by mathematical methods.

3. Experimental part

3.1. Evaluation of hygienic safety and nutrition value of used main raw materials

By analyze of nutrition value of meat raw material used under the research it is ascertained that both beef, pork and hen's meat are characterized with high composition of a protein of high value (13,4% + 18,6%). Hen's protein is mostly close to the ideal protein according to the correlation of the amino acid quantity. Fat contain of the meat raw material changes at wide intervals 1-50%, that is why it's so important to choose fat raw materials for the production of functional food products. Meat raw material contains until 1% glycogen and does not contain fibrous complex of polysaccharide nature.

Analyze of the vitamin contain in research raw materials revealed that it is enriched with B group vitamins (5,5 + 9,78 mg %), also with folium acid (Vitamin B₉ – 4,4 + 8,7 mg %). Contains E (0,04 + 0,05 mg %) and PP (2,75 + 8,2 mg %) and does not contain vitamin C.

Meat raw materials contain both macro and micro elements – Plumbum (1,6 + 2,7%), Cobalt (7 + 11%), copper (80 + 180 mg %), molybdenum (5,9 + 13,5 mg %), chrome (8,2 + 3,0 mg %) and zinc (2,3 + 3,5 mg %). Meat raw material contains such a low quantity of Ca that it covers only 1% physiological demand of the organism for calcium (800-1000 mg).

Hen's meat contains muscle tissue which has morphologically small fibrous structure comparing beef and pork meat which contains connecting tissue layers of minimum amount.

On the basis of analyze results the following conclusion is made:

- Hen's meat must be prior to produce boiled sausages products for children, also beef or mix of beef and hen's meat, but for the consumers with diabetes to produce boiled sausages must be used – beef, low quantity of pork (fat 33%), considering medic- biological conditions for the consumers of this category.
- Also, on the basis of conducted analyze the following conclusion is

made: it is crucial to enrich functional meat products with food fibrous, vitamins and minerals.

Time-table 1.

Contain of the main food substances in the meat raw materials

Nr	Food substances %	Beef (I category)	pork (for meat)	Hen's meat (I category)
1	Water	64,5±1,30	50,3±1,26	61,2±1,3
2	Protein	18,6±1,1	13,9±1,51	17,8±1,01
3	Fat	15,5±1,91	33,3±2,21	17,9±1,41
4	Carbohydrates	0	0	0
5	Ash	0,9±0,10	0,9±0,10	0,8±0,1
6	calorie	165±26	350±17	228±15

By the microbiological analyze of used raw materials utilized in the research it is revealed that meat products on the market of Imereti mostly satisfies their microbiological demands.

Toxicological safety analyze of meat raw materials (according to the contain of plumbum, arsenic, cadmium, mercury, copper and zinc) revealed that 45% of examined samples (9 samples from 20 samples) plumbum contain is 2.5-3 times more than maximum possible norm (0.1 mg/kg) exceeds 2.5-3 time (Fig. 1).

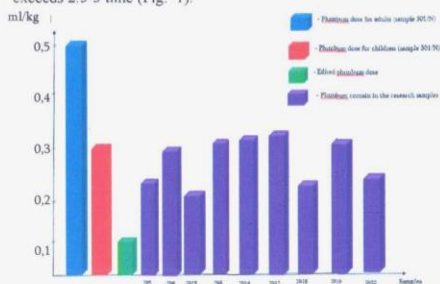


Fig. 1. Plumbum contain of the research samples

On the basis of final results it is concluded that under the following ecological conditions for the toxicological safety to produce functional meat products it is important to use prophylactic technological methods which ensures accumulation of heavy metals in the organism and reduction of pathological changes by their action.

3.2. Process of functional food appendages technologies

The most important part and main problem to process functional food appendages technologies is to choose/make and use the food appendages of the proper profile. It is very actual to use such local resources such as leavings of local food process – bran of the milled crops, fruits, berry, medical vegetables, Georgian mineral water and etc. enriched with biologically active substances.

Fibrous-polysaccharide complex with high sorption features

Non starchy polysaccharides – considering high antitoxic and anti-radiation quality of pectin substances, cellulose and hemicellulose for the toxicological and radiation safety of the functional food products under the dissertation fibrous-polysaccharide complex with high quality of sorption is developed using the following ingredients:

Mechanic activated wheat bran (with the contain of food fibbers 48%)

4. High molecular citrus pectin with middle quality of etherification (64%)

5. Low molecular beet pectin with low quality of etherification (41%)

The main function of high molecular pectin with middle quality of etherification and wheat bran in the composition of fibrous-polysaccharide complex - is sorption of toxic elements existing in products, but function of low molecular pectin with low quality of etherification is to go through the walls of gut and blood-vessels, to appear in blood stream and to join inside existing toxic elements.

The following optimal correlation of ingredients in fibrous-polysaccharide complex is ascertained – wheat bran: high molecular pectin: low molecular pectin 15:3:2. Final complex contains 75% food fibrous, 15% high molecular pectin and 10% low molecular pectin (see Fig.2)

Sorption ability of polysaccharid complex is studied on the example of plumbum sorption (time-table 3).

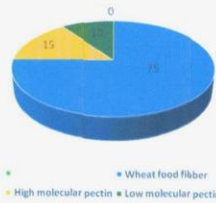


Fig. 2. Ingredients correlation in fibrous-polysaccharide complex

According to the drawing (Fig. 3) plumbum ability of sorption increases in the row - wheat bran highmolecular pectin - lowmolecular pectin. Significantly, high ability of sorption of low molecular pectin is because of the low quality of etherification. Also fibrous-polysaccharide complex ability to combine the water is examined (Fig. 4). The strongest ability to combine the water has the high molecular pectin, which is explained with its high molecular weight. According to the established correlation to add pectin substances to wheat bran increases its sorption ability from 3.5 kg/gr to 6.08 kg/g and water combine ability from 400% to 700%. Including more quantity of pectin in fibrous-polysaccharide complex provokes aggravation of mincemeat's structural-mechanical qualities.

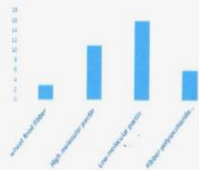


Fig. 3. Plumbum sorption quality by the Fibber-polysaccharide complex

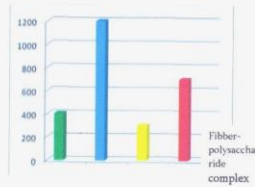


Fig. 4. Water combining quality by fibber polysaccharide complex.

Process of the vitamin food appendage technology. To enrich the functional food products with vitamin complex there is a low probability to destroy polisacharyd complex of the vegetable cell and to detach from the vitamin complex cell while using sweetbrier flour utilized in practice very frequently both during the process of grinding dry vegetable and during technological process of the raw material and digestion because of the absence of proper ferment complex. Therefore our goal was to make the dry concentrates of the sweetbrier vitamins easily bio acceptable for the organism which not only maximally detaches biologically active substances (also vitamin C) in the digestion system but also will be very convenient to dose out or use during the technological process.

To reach the above mentioned goal the extraction process of the soluble substances in sweetbrier water was conducted by us. In one case we put the water extract of the biologically active substances of sweetbrier on the wheat bran and in another case on the base of final extract we made starch paste and its lyophilized work was conducted. Lyophilized concentrate obtained after 1 mass drying process contains vitamin C but the one obtained from second mass drying process contains 850mg %. To dry the water solution of sweetbrier's biologically active substances with putting them on the wheat bran and starch paste are based on the following opinion - sweetbrier tincture was located on the starch paste because it combines 6 times more quantity of liquids then wheat bran and that is why it has a high contain of vitamin C (850mg%), but the reason why it was placed on the base of wheat bran was that in spite of the low contain of Vitamin C it is not expedient to use starch inclusive appendages for diabetic products.

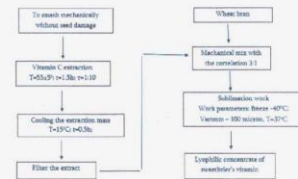


Fig. 5. Technological scheme to gain lyophilic concentrate of the sweetbrier's vitamin complex on the wheat bran

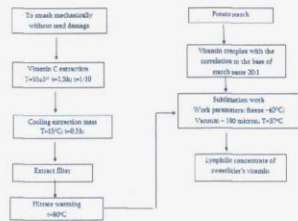


Fig. 6. Sweetbrier's vitamin complex gained on the paste of the starch

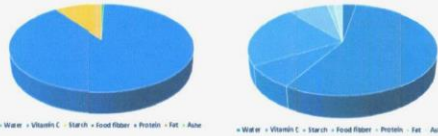


Fig. 7. Substance contain in vitamin appendages On the paste of the starch

Fig. 8. Substance contain in vitamin appendages on the wheat bran

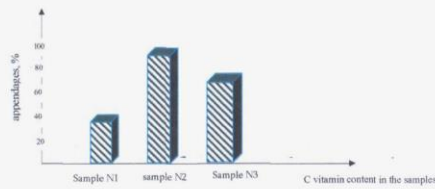


Fig. 9. Bio access of vitamin appendages

The quality of bio access of vitamin C in vitamin appendages is studied. As a result of the research it is ascertained that lyophilic concentrates of sweetbrier vitamin complex have 2,4 and 2.2 times more bio access to vitamin C comparing with sweetbrier flour which confirms the effectiveness of the used innovative technologies.

Process of the technology of mineral food appendage: Between the lack of minerals widespread in the society most problematic are the issues provoked from the lack of Ca. The lack of Ca can be solved by using mineral water "Lugela" in Georgia which presents the natural 9-10% concentrate of CaCl_2 .

"Lugela" does not have a problem of bio access to CaCl_2 because CaCl_2 is presented ionized in it (Ca^{2+} , Cl^-), but generally its physical condition hinders it to be widely used in food products - it is a liquid with the weight about 1kg/m^3 . For the flexibility of using Lugela's (CaCl_2 - o b) natural concentrates in food technologies like the lyophilic concentrates of sweetbrier vitamin complex it is not applicable to locate Lugela's lyophilic concentrates technologies on the starch paste and on the base of the wheat bran. On the figure 10 and 11 the chemical composition of Lugela (of CaCl_2) made from the presented technologies is presented.

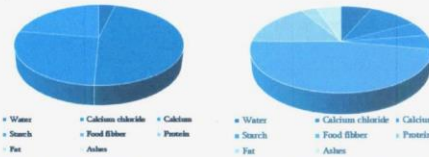


Fig. 10. Substance contain $\text{Ca}2$ %

Fig. 11. Substance contain in $\text{Ca}2$ %

Obtained concentrate from the base of starch paste contains CaCl_2 about $63,97 \pm 1,15\%$, but obtained from the base of the wheat bran contains CaCl_2 about $10,15 \pm 0,22\%$. In this appendage the low concentrate of CaCl_2 is because of the low ability of liquid sorption by the wheat bran comparing with the starch bran but this appendage unlike to Ca1 is rich with other biologically active substances of the wheat bran, such as food fibers, proteins, fats and etc and it is for the diabetic products because concentrate of

the starch paste base is not recommended for the people with diabetes.

Process of the technology of Hypoglycemic food appendage. To ensure the high prophylactic efficiency of the diabetic meat products it was necessary to rise the bio access of the biologically active substances of the hypoglycemic vegetable set. Consequently, like the lyophilic concentrates of above mentioned vitamin C and Ca technology of lyophilic concentrate of the substances soluble in the water of the hypoglycemic vegetable set (bilberry leaf, bean husk, aralia, equisetum arvense, sweetbrier, wasp, camomile) is developed only on the basis of the wheat bran.

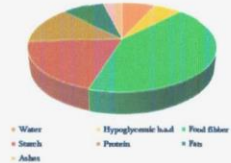


Fig. 12. Chemical composition of the lyophilic concentrates of biologically active substances of the hypoglycemic vegetable set

As it is described on the figure N12 final hypoglycemic set contains 5,6±0,2% active substances. It is rich with food fibers (44, 5±0,75%) and contains albumens (14,1±0,27%).

Study of the technological features of the food appendages: Influence of the obtained food appendages on the technological features of the meat raw material is studied: on the ability to combine the water, on the ability to combine the fat and on the ability to fat emulsion (figure: 13, 14, 15, 16, 17).

It is ascertained that composition of fibrous-polysaccharide complex in the mincemeat till 5% significantly increases ability to combine the water, both for beef, pork and hen's meat but more than 5% food appendage worsens structural-mechanical and organoleptic features of the mincemeat. To add fibrous-polysaccharide complex to beef, pork and hen mincemeat also increases fat's ability to combine and almost does not influence fat emulsion process.

Influence of vitamin, mineral and hypoglycemic appendages on the ability to combine of beef, pork and hen's meat is studied. It is ascertained that

vitamin appendage made on the paste in the conditions of 18-20°C temperature almost does not change water combining ability of beef. The same vitamin appendage on the base of wheat bran (2) decreases the quantity of the water isolated by the mincemeat during the loading process which means that it increases the ability of water combining.

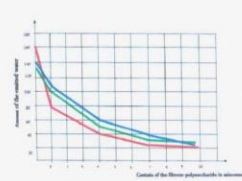


Fig. 13 Impact of the fibrous polysaccharide complex on the ability of mincemeat to combine the water

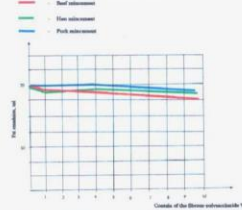


Fig. 15 Impact of the fibrous polysaccharide complex on the emulsion of mincemeat

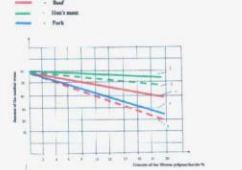


Fig. 16 Impact of vitamin, mineral and hypoglycemic appendages on water combining ability of beef mincemeat

Fig. 17 Impact of vitamin, mineral and hypoglycemic appendages on water combining ability of beef mincemeat: 80-20°C

CaCl₂ concentrate prepared on the starch paste (3) in the condition of 18-20°C increases the quantity of isolated water which means that it decreases water combining stipulated by the dehydration capacity.

The same appendage on the base of the wheat bran (4) increases water combining because of the fibrous complex of the wheat bran. Concerning the hypoglycemic appendage of the wheat bran (5) it is the same as the sample (2) (vitamin appendage gained from the wheat bran). It happens different after warming up the mincemeat 80±2°C. Food appendages gained on the base of the starch reveal stronger ability of water combining than the same appendages gained on the base of the wheat bran which is stipulated from the starch.

Final results of the research are foreseen while developing the technology of the functional food products "child's sausage" and hypoglycemic "boiled sausage" for the people with diabetes.

On the basis of the presented results the decision to use the following biologically active natural food appendages in child's sausage is made.

4. Antitoxic fibrous-polysaccharide complex with strong quality of sorption (composition: mechanic-active wheat bran, highmolecular pectin with middle quality of etherification and lowmolecular pectin with the low quality of etherification (correlation 15:3:2)
5. Lyophilic concentrate of sweetbrier's vitamin complex on the bases of starch paste;
6. Lugela's (CaCl₂) lyophilic concentrate on the basis of starch's paste.

The following biologically active food appendages should be used for the boiled sausage with diabetic prescription:

- Antitoxic fibrous-polysaccharide complex with strong quality of sorption;
- Lugela's (CaCl₂) lyophilic concentrate on the base of wheat bran;
- Lyophilic concentrate of the hypoglycemic vegetable set soluble in the water on the base of wheat bran;

On the basis of the conducted researches' recipes of sausages for children and boiled sausage for the people with diabetes are composed (time-table N2 and N3) and technological schemes (Figure 18,19). Technological parameters of the production are established.

Using the same composition of food appendages, hen's meat chops of chopped semi-finished and fricadelle recipes and technologies are developed for pre-school and school age children and people with diabetes.

Contain of the main food substances in the sausage for children and people with diabetes are presented in the time-table N4.

Time-table 2

Recipe of the sausage for children		
No	Name of ingredients	Quantity of ingredients
kg 100kg for the product		
1	Hen's tenderloin or beef	77,5
% from the weight of the meat		
3	Antitoxic fibrous-polysaccharide complex	3
4	Lyophilic concentrate of sweetbrier's vitamin complex on the basis of starch's paste	2,5
5	Lugela's (CaCl ₂) lyophilic concentrate on the base of starch's paste	0,4
g 100kg for the product		
6	Salt (contain of the natrum nitrite 0.5%)	0,05
7	illy	0,2
8	T/pepper	0,1
9	Spice "Ivena"	1,12
10	Food appendage	6,2
11	Ice	13,3

Time-table 3

Recipe of the boiled sausage for the people with diabetic		
#	Name of ingredients	Quantity of ingredients
1	Beef (kg 100kg for the product)	53,53
2	Pork	25
% from the weight of meat		
3	Lyophilic concentrate of the sweetbrier's vitamin complex on the base of wheat bran.	1,5
4	Lugela's (CaCl ₂) lyophilic concentrate on the base of the wheat bran	1,0
5	Lyophilic concentrate of the hypoglycemic vegetable set on the base of wheat bran	1,5
g 100kg for the product		
6	Salt (contain of the natrum nitrite 0.5%)	1,65
7	Spice "alba"	0,075
8	White pepper	0,15
9	Spice "saqimo"	0,6
10	Iced water	15

As it appears from the time-tables medic-biological requirements are

guaranteed in both products: correlation between albumen and fat for child's sausage 1:1 and 1:1,3 for the people with diabetics. Also, physiological norms are protected about vitamin C, Calcium, food fibers and hypoglycemic substances.

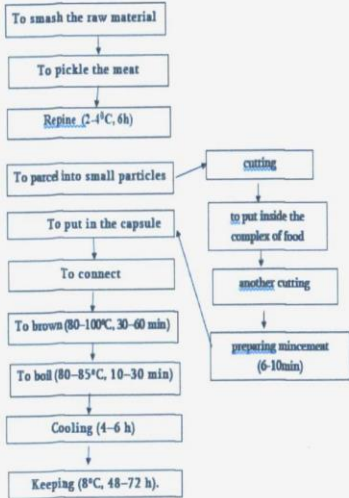


Fig.18 Technological scheme of sausage production

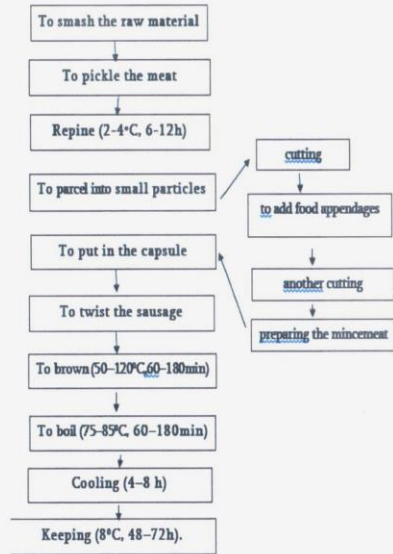


Fig.19 Production scheme of boiled sausage for the people with diabetics

Daily demand for this substances is satisfied for 20+40% which absolutely complies with the main principle of enrich products – to contain from 20 to 50% active substances' daily norm.

Time-table 4

Contain of the main food substances in the sausage for children and people with diabetic

#	Name of substance	Sausage for children		Boiled sausage for the people with diabetic	
		Contain of the substances in 1 ration (80g)	To satisfy the daily norm %	Contain of the substances in 1 ration (160g)	To satisfy the daily norm %
1	Water	41	--	81	--
2	albumen	17	--	30	--
3	fat	18	--	41	--
4	Ashe	--	--	--	---
5	Food fiber	4	20	8	--
6	Vitamin C	35	40	--	--
7	Calcium	300	35	250	25
8	Substances with hypoglycemic activities	--	--	0,98	33

Considering the ecological conditions the safety of the food is very actual in the world. Nowadays, the only preventive, effective and integrated system for food safety acknowledged by the international organizations is HAACP (Hazarel analysis and critical control points) which means scientifically grounded system for the danger analyze and critical control points including some preventive measures and using them during the whole period of food products process from the raw materials till the realization of ready made products. Within the dissertation work project of HAACP plan is studied for the process of every products – both food appendages and functional meat products – sausage for children and boiled sausage for the people with diabetic, critical control points are established and corrective activities are set.

Products of both processed sausages have production approbation in Ltd “Gurmani” and are approved to introduce. On the products of the processed sausage projects of temporary technological instructions are prepared. –

Main conclusions

- For the insurance of the technological safety for functional food products technology of “fiber-polysacharyd complex” of the natural food appendage with strong ability of sorption using the following ingredients:
 1. Mechanical active wheat – bran (food fiber contain 48%)
 2. High molecular pectin, with the middle quality of etherification (64%)
 3. Low molecular pectin, with the low quality of etherification (41%)
 Correlative appendage №1; appendage №2; appendage №3 / 15:3:2
- It is ascertained that adding pectin substances to the wheat bran according to this correlation increases the quality of sorption from 3,58 kg/g to 6,08mkg/g, and water combining quality increases from 400%-till 700%.
- Technologies of vitamin C appendages of high bio access are developed on the base of starch paste and on the base of wheat bran which contains vitamin C in the amount of 850mg% and 125mg%-quality of bio access of vitamin C is according to 88,4 and 80,7% which is almost 2,5 times more than in sweetbrier's flour.
- Lyophilic concentrate technologies of the mineral water “legula” are developed on the starch's paste and base of the wheat.
- Lyophilic concentrate technology of the hypoglycemic vegetable set substances soluble in the water is developed only on the base of the wheat bran which has 6.1% contain of biologically active substances with hypoglycemic prophylactic effect
- It is ascertained that contain of the fibrous-polysaccharide complex in mincemeat till 5% significantly increases its ability of water combining and does not influence on the fat emulsion process.
- By using processed natural fibrous-polysaccharide, vitamin, mineral and hypoglycemic biologically active food appendages “sausage for children” and “boiled sausage for the people with diabetic” are made with the recipes of chopped meat semi-fabricates and technologies for the presented contingent.
- According to the medic-biological analyzes the prophylactic efficiency of the proccsed products is ascertained.
- System project of the danger analyze and critical control points (HAACP) are developed for every processed product.

- New technologies production exams are conducted and temporary technological instruments for their production are approved.

List of used work

1. Karchava M., Berulava I., Kintsurashvili N., Ergmldize T. Technology and Prophylactic Efficiency of Natural Hypoglycemic Concentrate of High Bioavailability. **scientific journal "Bulletin of Science and Practice" №1. 2018.** Karchava M.S., Kintsurashvili N.J., Berulava I.O. Functional food and products new technologies. Agro NEWS, №4, 2017
2. Karchava M.S., Kintsurashvili N.J., Berulava I.O. Functional food supplements and new food technologies. J."Agro NEWS, №4, 2017
3. Kintsurashvili N.J., Ergemlidze T.D. Qarchava M.S., Berulava I.O. Technology of natural mineral food appendage// engineering news of Georgia, Tbilisi, 2017, No.3 (vol.84), p
4. Kintsurashvili N.J., Ergemlidze T.D. Qarchava M.S., Berulava I.O. Technology of natural vitamin food appendage // engineering news of Georgia, Tbilisi, 2017, No.3 (vol.84), p
5. Kintsurashvili N.J., Ergemlidze T.D. Jinjolia M.Sh. Qarchava M.S. Berulava I.O. Problems of pre school childrens's nutrition// engineering news of Georgia, Tbilisi, 2016, No.4 (vol.80), p.148-153
6. Kintsurashvili N.J., Ergemlidze T.D. Jinjolia M.Sh. Qarchava M.S. Berulava I.O. Natural, biologically active food appendages in child's nutrition products // engineering news of Georgia, Tbilisi, 2016, No.4 (vol.80), p.145-148
7. Karchava M., Kintsurashvili N. The role and place of food science in the food safety management system. georgian engineering news. №3. 2014. p.85-87