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ISSN 6299 -0975

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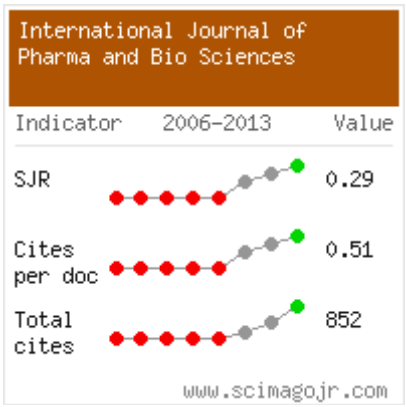


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Int J Pharm Bio Sci 2015 Oct; 6(4): (B) 577 - 582

**Research Article** **Biotechnology**

**International Journal of Pharma and Bio Sciences** **ISSN 0975-6299**

# DEVELOPMENT OF MEAT AND VEGETABLE PATE WITH FUNCTIONAL PROPERTIES

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## ABSTRACT

The article covers aspects of establishment of competitive food products meat and vegetable-based with adjustable, pre-determined characteristics of nutritional and biological value, enriched by the functional ingredients and having a positive effect on different body functions or body in general. The technique employed is similar to that conventionally used in food industry. The *composition and properties of the objects* is studied by physical-chemical methods according to standards of the Republic of Kazakhstan and International standards. Three options of pate processing are considered, and optimal sample of product for the functional nutrition are developed in the food laboratory of the University. A new functional food product has been designed and tested. It is a pate having a combination of 54 % beef meat and 30 % crushed topinambur. The data obtained provide an exhaustive interpretation of the structure of the pate. Results of research work make it possible to using inexpensive plant raw material in processing food products with functional properties.

**KEY WORDS: Meat, vegetable raw materials, dietary products, meat products, functional nutrition.**

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# INTRODUCTION

Development of available healthy foods is important and actual task of the national policy, allowing strengthen health and take prophylactic measures of diseases among population. Herewith leading role belongs to meat and fish products, the use of which contributes to the regulation of many physiological reactions and processes. Creating of functional purpose products that are designed for the systematic daily use and aims to cover lack of energy in the body, plastic or regulatory food substances will allow increasing the range and application of science-based functional foods in the daily diet. Functional foods are a foodstuff containing functional ingredients that are beneficial to human health, increase its resistance to disease, can improve many physiological processes in the human body, allowing him a long time to maintain an active lifestyle. The positive impact of functional foods on health includes: reducing the level of blood cholesterol, maintaining bones and teeth, energy supply, reducing diseases of some forms of cancer and etc. Currently, functional food products are not more than 3 % of all known foods. According to the forecasts, within the next few decades, their part will reach 30-50 % of the total food market. Functional drinks managed to gain a serious authority in the market – 48 %, bakery products – 27 %, and dairy products – 6 %. Today, the market segment of functional meat products is underdeveloped, due to the peculiarities of the technology of their production. Thus, we can say that the production of functional foods is a long-term tendency rather than a short-term fashionable phenomenon.

# MATERIALS AND METHODS

Under experiment supposed the study of the complex quality indices and safety performance, using standard methods allowing obtaining information about composition and properties of the research objects. Study of changes in biologically active substances (proteins, fats, carbohydrates) supposed during research provided, before and after heat treatment of the product.

***To evaluate the composition and properties of the objects the following indicators were defined***

Sensory evaluation was determined by their appearance, smell, texture, color and taste. Presented samples of finished product for tasting are evaluated by the tasting commission based on five-point scale.

***Humidity content was determined by drying.***

Humidity content in the product was determined by drying of the sample up to the constant weight in the drying unit at a temperature 100–105$^{o}$ C. Determination of raw materials pH was carried out using pH - meter, according to ST RK «Meat and meat products. Determination of pH. Reference method» ST RK ISO 2917 - 2009. pH of the product was determined in the water extract prepared at a ratio of 1:10 after infusion for 30 minutes at 20 $^{0}$ C. Determination of proteins content was carried out on total nitrogen using Kjeldahl method. Determination of fat content was carried out by express method. Ash content (mineral substances) was determined using an accelerated method with magnesium acetate.

# RESULTS AND DISCUSSION

As new functional ingredients for a new chosen meat and vegetable pate the following primary goods were used: beef (neck part), topinambur, butter and etc. For a new pate meat from the neck part of the beef carcass which is characterized by extreme rigidity and low nutritional value was used. Topinambur (the Jerusalem artichoke) contains quiet a big number of solids (up to 20 %), among of which up to 80 % of fructose polymer homologue inulin is contained. The inulin is a polysaccharide, hydrolysis of which leads to generation of fructose, a harmless sugar for diabetics. Topinambur contains fiber and rich complex of mineral elements, including (mg % of a dry substance): ferrum - 10.1; manganese - 44.0; calcium - 78.8; Magnesium - 31.7; Potassium - 1382.5 and Sodium - 17.2. On content of iron, silicon and zinc it outmatches potatoes, carrots and beets. Composition of topinambur tubers also includes proteins,

pectin, amino acids, organic and fatty acids. The content of pectic substances in topinambur is up to 11 % from the weight of a dry substance. Upon the content of vitamins B1, B2 and C, topinambur is richer potatoes, carrots and beets more than 3 times. The essential difference of topinambur from other vegetables is manifested in high content in its tubers protein (up to 3.2 % per dry substance) represented by eight amino acids that are synthesized only by plants and not synthesized in the human body: arginine, valine, histidine, isoleucine, leucine, lysine, methionine, tryptophan, phenylalanine. Furthermore, topinambur different unique complex carbohydrate based fructose and its polymers, fructooligosaccharides and inulin. Inulin is the only natural polysaccharide consisting of 95 % from fructose. Inulin, getting into the gastrointestinal tract, is splitted by Hydrochloric Acid and enzymes onto separate molecules of fructose and short fructose chains, which penetrate into the bloodstream. The remained unsplit part of the inulin is quickly excreted by connecting a large number of unnecessary body substances such as heavy metals, radionuclides, crystals of cholesterol, fatty acids, various toxic chemicals got into body with food or formed during the life activity of disease-causing microbes living in the intestinal tract. In addition, inulin significantly stimulates contractility of the intestinal wall, which considerably speeds up the cleansing of the body from toxins, undigested food and hazardous substances. Antitoxic effect of inulin is enhanced by the action of tissue, also contained in topinambur. Absorbed into the intestine the short fructose chains and blood continue to perform antitoxic, purifying function, binding, neutralizing and facilitating the excretion of harmful metabolic products and fallen from the external environment of chemical compounds. Inulin is a good solution for intestinal dysbiosis of different origin, since it contributes to multiply in the digestive tract of "friendly" and in the intestinal contents. At the same time it was noted enhancement of absorption of various mineral salts, especially calcium, reduction of serum cholesterol, decrease in the amount of putrefactive substances and carcinogens. One important feature of topinambur is a balanced state by its micro and macro element composition - contains a big number of ferrum (up to 12 mg %), silicon (up to 8 mg %), zinc (500 mg %), magnesium (30 mg %) potassium (200 mg %), manganese (up to 45 mg %), phosphorus (up to 500 mg %) and calcium (40 %). Topinambur actively accumulates silicon from the soil and refers to "siliciphilous" plants. A dry substance of topinambur contains about 8 % of silicon. According to modern concepts, silicon refers to a group of components necessary for normal growth and development of animals and humans. Organic polyhydroxy acids are 6-8 % of the dry weight. They include: citric, malic, malonic, succinic acid and fumaric acid. Organic acids are actively involved in metabolism, increase the secretory activity of the salivary glands, increase the secretion of bile and pancreatic fluid, improve digestion, dissolve undesired deposits (salts of uric acid), have a bactericidal effect, a beneficial effect on acid-base balance, the function of the gastrointestinal tract and other body systems, as activators of pancreatic secretion and intestinal motor function. Organic acids have an effect on the digestive processes, facilitating the absorption of food products in which the acids are very little. In the complex of vitamin C have a pronounced antioxidant effect. Pectin substances are polysaccharides being present in topinambur in an amount of 11 % by weight of dry substance. Pectins adsorb on its surface and excrete toxic substances, cholesterol, triglycerides, which are the main reasons of atherosclerosis and gallstones genesis. Scientific studies suggest that pectins may reduce the accumulation of atherosclerotic plaques on the walls of heart arteries. Complexing property (ability to form complexes with heavy metal ions) allows using pectins as a prophylactic in terms of occupational contact with heavy metal compounds, pesticides, radioactive substances. The above listed properties of topinambur allow you to use it as a vegetable supplement in meat products. Topinambur contains a number of nutrients, which are practically absent in animal products: food fiber, essential oils, tannins and aromatic substances, organic acids, volatile, vitamin C, beta-carotene, calciferol. Contained in carrots organic acids facilitate the absorption of poorly

soluble compounds of calcium, phosphorus and ferrum, contribute to the creation of a certain composition of microflora, inhibit the processes of decay in the gastrointestinal tract. Food fibers promote the accelerated excretion of various toxic and carcinogenic elements. Vitamin C increases the body resistance to infections, regulates metabolism of cholesterol in the body and the endocrine and nervous systems. In addition, vitamin C and beta-carotene are natural antioxidants that can destroy free oxidative radicals, which are formed by the action on the body of various damaging factors. Using of topinambur in production of a new meat pate is justified because when adjusting a new product they have functional properties, significantly enrich the finished product with vitamins, minerals, pectin, fiber, et al., increase food and biological value of the finished product. Along with this, there is a reduction of production costs due to the replacement of the expensive meat for processing on vegetable raw materials of high biological value. Butter and milk in the recipe improve the structural and mechanical properties of the system. As a result of experimental studies three choices of meat pate recipes were offered (Table 1).

**Table 1**
***Recipes of meat pate with topinambur***

| Description of material to be processed | Raw material in kg/100 kg | | |
|---|---|---|---|
| | I option | II option | III option |
| Beef | 74 | 64 | 54 |
| Topinambur | 10 | 20 | 30 |
| Unsalted butter | 12 | 12 | 12 |
| Milk 2,5 % milk fat | 4 | 4 | 4 |
| **Total:** | **100** | **100** | **100** |
| Spices, g/100 kg | | | |
| Salt | 1000 | 1000 | 1000 |
| Ground black pepper | 50 | 50 | 50 |

When formulated meat for processing was substituted by fresh crushed topinambur of 10 % (Option 1), 20 % (option 2), 30 % (Option 3) in the chopped meat. Production process of meat pate is based on a traditional technology of meat pates production. The difference is the introduction of additional functional ingredients in the technological scheme. The effect of crushed topinambur for functional and technological properties of minced systems as well as changes in the organoleptic characteristics of finished products were studied at the stage of development and optimization of new types of pates recipes. Test samples using vegetable raw materials kept optimum performances of water binding capacity (WBC) and water-holding capacity (WHC) of minces (Table 2). It should be noted that the mince with 30 % of topinambur (sample 3) also kept optimum performances WBC and WHC. Combined minces with the part of meat raw materials and additional materials 90 % and 80 % have a heavy coarse texture, fibrous and fairly dry. During the research of organoleptic performances of combined minced meat as the most preferred ratio of vegetable raw material a recipe containing 30 % of topinambur (option 3) is selected. Pate minces, cooked on this recipe, have a nice spreadable texture characterized this type of product, delicate flavor, pleasant smell with the scent of herbal products.

**Table 2**
***Functional and technological properties (FTC) of test samples***

| Description of the product | FTC properties | | |
|---|---|---|---|
| | WBC, % | WHC, % | FHC, % |
| Pate mince (control) | 83,7 | 82,5 | 30 |
| Pate mince with crushed topinambur 10 % (sample 1) | 82,1 | 80,2 | 25,1 |
| Pate mince with crushed topinambur 20 % (sample 2) | 80,6 | 78,1 | 24,4 |
| Pate mince with crushed topinambur 30 % (sample 3) | 77,6 | 75,2 | 23,4 |

Conducting open tasting allow to be ensured that use as vegetable raw material in meat and vegetable pates has improved the overall assessment of the finished product (Table. 3). The use of vegetable components increased tenderness of pate. Thus, the sample 3 increased juiciness. The highest estimate the tasting commission assigned the pate with the addition of raw minced topinambur prepared as per sample 3.

**Table 3**
***Organoleptic performances of pates with different content of crushed topinambur***

| Performances | Pate mince (control) | Pate mince with crushed topinambur 10 % (sample 1) | Pate mince with crushed topinambur 20 % (sample 2) | Pate mince with crushed topinambur 30 % (sample 3) |
|---|---|---|---|---|
| Appearance | 5 | 5 | 5 | 5 |
| Colour | 5 | 5 | 5 | 4 |
| Scent, flavor | 4 | 5 | 5 | 5 |
| Texture | 5 | 4 | 4 | 5 |
| Taste | 4 | 5 | 5 | 5 |
| Juiciness | 4 | 4 | 4 | 5 |
| Overall score | 4,5 | 4,6 | 4,6 | 4,8 |

Thus, data received testify about feasibility of using crushed raw topinambur as a substitute and fortifier of raw meat for processing in production of meat and vegetable pates having a directed action. It allows using economically raw meat, reducing the cost of the final product and improving its taste and preventive properties. The comparative qualitative and organoleptic performances of sample meat and vegetable pates with control are given in Table 4. Meat pate was taken for the control cooked on a traditional technology.

**Table 4**
***Chemical composition and organoleptic performances of meat pate***

| Performances, % | Meat pate (control) | Meat pate (sample) | | |
|---|---|---|---|---|
| | | I option | II option | III option |
| Weight content of protein | 17,2 | 18,72 | 19,2 | 19,7 |
| Moisture content | 67,52 | 69,63 | 68,24 | 67,47 |
| Weight content of fat | 15,1 | 9,05 | 10,16 | 11,53 |
| Weight content of mineral substances | 0,18 | 2,6 | 2,4 | 1,3 |
| Organoleptic assessment of the product on five-score scale system | | | | |
| Appearance | 5 | 5 | 5 | 5 |
| Colour | 5 | 5 | 5 | 4 |
| Smell, flavor | 4 | 5 | 5 | 5 |
| Taste | 5 | 4 | 4 | 5 |
| Texture | 4 | 5 | 5 | 5 |
| Juiciness | 4 | 4 | 4 | 5 |
| Overall score of the product | 4,5 | 4,6 | 4,6 | 4,8 |

Thus, compared with the control prescription, the proposed sample compositions allow to obtain meat and vegetable pate with a smooth texture, pleasant flavor, improved organoleptic properties, the composition balanced nutritionally.

## CONCLUSION

The analysis has been done in development of efficient, environmentally friendly products and improved existing technologies for processing of meat, fish and vegetable raw materials in order to increase outcome and quality of the finished product, the full use of raw materials, production of new product functionality using resource saving technologies. Formulation and production technology of meat pate with topinambur provide a natural meat and vegetable pate with a balanced chemical composition, rich in minerals and food fibers, with high organoleptic properties and relatively low cost.

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