Rationale and economic feasibility of improving the technology of long-term storage of meat products

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Abstract. The article considers modern problems of meat processing industry development, new approaches in the field of meat technology and healthy human nutrition. Based on the analysis, the factors influencing the production and sale of products in this industry were identified. The influence of improvement of technology of production of meat products of long term of storage on indicators of activity of the enterprise which introduces it is considered. The article draws attention to the problems of relevance of creating functional products based on meat and vegetable raw materials, which can make human nutrition rational and balanced, as well as increase resistance to adverse and extreme life factors, restore and maintain normal metabolic processes. The economic estimation of efficiency of introduction of new technology of manufacture is given and expediency of perfection of technology of meat products of long term of storage is proved.

One of the most important tasks of a civilized state is to preserve the health of the population and provide conditions for its strengthening. Among a number of physical, biological, chemical and social factors that affect human life and health, the most important is the problem of nutrition [1].

According to experts, the nation's health depends on the health care system only by 8 - 12%, while socio-economic conditions, including nutrition, which is one of the most important factors in human adaptation to environmental influences, determine the state of health at 52 - 55% [2].

Among the subjective reasons that lead to the deterioration of the quality of food adequacy, first of all it is necessary to note the weak literacy of the population regarding the requirements for rational and adequate nutrition. This applies to the nutritional value of certain foods, technological methods of cooking, which allow to ensure the preservation of essential nutrients, adherence to the diet, etc. [3].

Systematic studies conducted by the Institute of Nutrition of Medical Sciences in different regions show that the structure of the population's nutrition has recently not corresponded to the concept of balanced (rational and adequate) nutrition, especially in terms of consumption of essential nutrients. More than 60% of people working with a high rate of physical stress, suffer from diseases, the emergence and development of which is associated with poor nutrition [3]. Therefore, the development and production of new types of functional meat foods, including long-term storage, balanced in macro- and micronutrient composition, which have functional and preventive properties, is one of the priority areas of food technology of the XXI century.
These circumstances determine the urgency of creating functional products that, on the one hand, will fill the lack of nutrients, make nutrition rational and balanced, and on the other - help increase resistance to adverse and extreme life factors, restore and maintain normal metabolic processes [4, 5].

Currently, there is a shortage of animal proteins, vitamins, macro- and micronutrients in the diet, so it is necessary to develop products enriched with missing components. Consumption products that are available to all groups of the population and used in everyday food, such as canned food, should be enriched.

Enriched functional foods, especially meat-based, are currently virtually non-existent. The domestic market of functional products is mainly represented by drugs of pharmacological action, imported food additives and soy products. In this regard, a promising area is the creation of products with functional properties based on meat for different groups of the population, taking into account the specifics of metabolic processes, in particular, for people with high physical activity due to the peculiarities of professional activity [6].

The food industry is one of the most important sectors of Ukraine's economy. It forms the main part of food resources, which is an important condition for guaranteeing food security of the state, the development of domestic and foreign food markets, improving living standards. Both food security and the competitiveness of the economy as a whole depend to a large extent on the comprehensive development of the meat processing industry.

The meat processing industry is the basis of the food complex of Ukraine, but is currently in a rather difficult situation. The acute problem of today is underproduction, shortage of meat products, although due to low purchasing power of the population creates the appearance of its overproduction. Low demand for meat products leads to an adequate level of demand for raw meat, the supply of which, due to high losses, is constantly declining (table 1) [7].

| Table 1. Growth rates of meat procurement in Ukraine (in slaughter mass), %.
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Indicator       | 2015/2014       | 2016/2015       | 2017/2016       | 2018/2017       |
| Pork            | 2.30            | -1.59           | -1.57           | -4.53           |
| Beef and veal   | -6.95           | -2.19           | -3.22           | -1.27           |
| All kinds of meat | -1.53         | 0.04            | -0.23           | 1.58            |

Conditions in domestic livestock have led to a reduction in the number of cattle and, consequently, to a decrease in the level of beef production. There is a catastrophic reduction in meat resources, ie young animals for growing meat are not put to fattening, but sold as veal in the markets. The productivity potential of the gene pool of farm animals is not fully realized (not more than 40%). The main problem is to create a strong fodder base that can ensure the full realization of genetic potential. These and other factors cause a rapidly growing shortage of beef, the reserve of replenishment of which can serve as imports or domestic production. In recent years, the production of beef in Ukraine per capita is in the range of 11-14 kg, which indicates the critical situation [8]. This decline is due to the sharp decline of livestock in agricultural enterprises primarily due to the unfavorable price situation in the market of livestock products and the lack of an effective financial and economic mechanism for its support.

The decrease in the production of canned meat is due to the lower popularity of this type of product among the population and the reduction of production. Canned beef and veal account for the largest share of production, as Ukrainians consume little of this meat fresh due to its high cost. According to experts, beef and veal are mainly exported, and in Ukraine it is consumed more often in the form of canned food and frozen semi-finished products. The largest share of the market is occupied by canned meat of domestic production. Considering the market for canned meat, it should be noted that 45% is accounted for by liver pate, canned beef and veal - 26%, pork and poultry - 19 and 10%, respectively [9].

Given the current economic problems, new approaches in the field of meat technology and healthy human nutrition, it is extremely important to develop new technologies for high quality meat and...
vegetable products, which rationally use regional meat and vegetable raw materials, real production areas and equipment, due to which the finished product has a low cost.

Today, animal proteins are actively used by meat processing plants and displace soy protein, despite the higher cost. Factors influencing the rapid spread and use of complete animal proteins are a significant excess in biological value and better amino acid balance than vegetable. ScanGel DI - animal proteins from Scanflavor, which have semi-functional capabilities. ScanGel DI includes a range of functional, native, high-molecular-weight collagen derived from the insoluble fraction of lean pork skin, which is excellent for fresh meat products and products that have undergone cooking or any other processing. So, it is a good emulsifier, easy enough to use, which allows to process low-value fat-containing raw materials, improves the consistency and plasticity of minced meat, increases the organoleptic properties of the finished product, increases the yield of the finished product, retains its properties during long storage and significantly reduces production costs.

The Chernobyl accident led to the release of radionuclides with a total activity of approximately 90 MKu, which prompted the development of elamin. Given the unique properties of brown seaweed, including kelp, specialists of PJSC "Lactic Acid Plant" together with scientists of the Institute of Nutrition and the Scientific Center of Radiation Medicine of the Academy of Medical Sciences of Ukraine developed an original technology for dietary supplement elamin from brown seaweed and established its industrial production. Elamine is recommended to replenish the body's need for micro- and macronutrients, to remove radionuclides and heavy metals and block their accumulation in the body, in diseases of the thyroid gland caused by iodine deficiency, to normalize the work of the gastrointestinal tract.

With the development of the theory of adequate nutrition and modern science of assimilation of nutrients - trophology in recent years began to pay serious attention to stimulators of growth and development of bifidobacteria, many of which should be attributed to prebiotics. One of the currently known bifidogenic drugs to stimulate the growth of bifidobacteria, obtained artificially and widely implemented in a number of food industries, is lactulose, which is a disaccharide of milk sugar, consisting of galactose and fructose, and is used by bifidobacteria as a source of carbon and energy in the process of their life. Currently, lactulose has been used in the production of canned meat as a bifidogenic factor.

The development was based on medical and biological recommendations for the quality of functional meat products of preventive action, the basic principles of building diets for a certain group of people working with high physical activity [10, 11, 12].

The basis for the economic efficiency of any new development or improvement of existing technologies is primarily the profit that can be obtained by the company that introduced this development.

The research was carried out to substantiate the expediency of improving the technology of canned meat with the use of alginate-containing drug elamine, animal protein and lactulose concentrate. Calculations were made on cost items that had changes.

The item of the calculation "Raw materials and basic materials" includes the cost: raw materials and materials used in the technology of production of the product, the tax. The calculation of the change in costs under the article "Raw materials and basic materials" is made on 1 tube and is presented in table 2.

The costs under the article "Raw materials and basic materials" in the production of canned meat using the alginate-containing drug elamine, animal protein and lactulose concentrate are reduced by 1244.87 UAH/tube, compared to traditional production technology. Production cost is calculated as the sum of all costs incurred in the manufacture of products. As changes occur only under the item "Raw materials and basic materials", the total cost is reduced by 1244.87 UAH/tube. The price of production, first of all, depends on production costs.
Table 2. Calculation of changes in costs under the article "Raw materials and basic materials".

| Names of raw materials | Price of raw materials, UAH/kg | Spend until implementation | Spend after implementation | Difference in costs, +/- |
|------------------------|-------------------------------|---------------------------|---------------------------|-------------------------|
|                        |                               | Norm, kg/tube | Cost, UAH | Norm, kg/tube | Cost, UAH |            |
| Pork                   | 70                            | 206.2         | 14434.0  | 206.2         | 14434.0  | -          |
| Beef                   | 85                            | 76.38         | 6492.3   | 76.38         | 6492.3   | -          |
| Potato starch          | 15                            | 15.276        | 229.14   | 1.9           | 28.5     | -200.64    |
| Sodium caseinate       | 330                           | 7.643         | 2522.19  | -             | -        | -2522.19   |
| Scan Gel DI-91         | 137                           | -             | 7.6      | 1041.2        | +1041.2  |
| Elamine                | 80                            | -             | 1.9      | 152.0         | +152.0   |
| Lactulose              | 54                            | -             | 3.8      | 205.2         | +205.2   |
| Food phosphates        | 108                           | 1.52          | 164.16   | 1.52          | 164.16   | -          |
| Drinking water         | 13                            | 66.88         | 869.44   | 73.0          | 949.0    | +79.56     |
| Kitchen salt           | 3.3                           | 6.88          | 22.71    | 6.88          | 22.71    | -          |
| Sugar                  | 12                            | 0.266         | 3.2      | 0.266         | 3.2      | -          |
| Ground black pepper    | 720                           | 0.3116        | 224.36   | 0.3116        | 224.36   | -          |
| Nutmeg                 | 203                           | 0.152         | 30.86    | 0.152         | 30.86    | -          |
| Total                  | x                             | x             | 24992.36 | x             | 23747.49 | -1244.87   |

Calculations of the main technical and economic indicators (price, profitability, profit, costs per 1 UAH of manufactured products, etc.) are presented in table 3.

Table 3. Calculation of the main technical and economic indicators of the project on 1 tube of production.

| Indicators                                | Before implementation | After implementation | The difference, +/- |
|-------------------------------------------|-----------------------|----------------------|---------------------|
| Price, UAH/bank                            | 56.55                 | 55.78                | -0.77               |
| Income, UAH                                | 42978.0               | 42392.86             | -585.14             |
| Cost of production, UAH                    | 38399.0               | 37154.13             | -1244.87            |
| Profit from sales of products, UAH         | 4579.0                | 5238.73              | 659.73              |
| To spend on 1 UAH of the made production, UAH | 0.88                  | 0.87                 | -0.01               |
| Product profitability, %                   | 11.9                  | 14.1                 | +2.2                |

When calculating the economic assessment of the effectiveness of the introduction of new technology for the production of canned meat using iodine, animal protein and lactulose concentrate, it was found that the total cost of the product decreases due to auxiliary raw materials, which affects the price of the product and sales revenue. Profit increases by 659.73 UAH/tube due to lower costs at a faster rate than prices. As a result, product profitability increases by 2.2 percentage points.

The peculiarity of this technology is the additional introduction of functional ingredients such as elamin, animal protein and lactulose concentrate and replacement of sodium caseinate and some starch with elamin, lactulose and animal protein in quantities that meet the needs of the production process. The technology allows to obtain a product with high content of dietary fiber, high quality, biological and nutritional value, with antioxidant and radioprotective properties.

The advantage of the proposed technology is the enrichment of canned meat with iodine-containing drug elamin, animal protein and lactulose concentrate, which allows to increase and compensate for the lack of protein and iodine in the body. Economic evaluation of the effectiveness of the introduction of
new technology for the production of canned meat indicates the feasibility of implementing the results of the study.

The main strategy, which covers health, recommends tackling healthy eating, and that is the development of national living standards that exist in the world and energy, with a reduction in the status of the population, life and other truly national and state-specific countries. Discovering this, they obtained higher energy efficiency for people with high physical activity, and they formed the basic medical and biological recommendations for this product, and they created muscular products for long-term storage:

- ensuring a strictly specified chemical composition of products, taking into account the characteristics of the population for which the product is developed: increased protein content by 1.2 - 1.5 times and water-soluble vitamins, reduced fat content;
- guarantee of maximum digestibility of nutrients from products by optimal grinding of the product, the introduction of emulsifiers;
- enrichment of products with micronutrients (essential amino acids, polyunsaturated fatty acids, vitamins B, A and E, minerals);
- microbiological, chemical, radiation safety of the product.

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