Creating Functional Food Products from the Domestic Reindeer Breeding Produce

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Abstract: as a result of the research, medical-biological and technological requirements for the composition, nutritional value and safety of products based on raw materials produced through domestic reindeer husbandry are formulated. The technological scheme of the production has been developed. Using the results of the research, technical documentation for production was developed, and prototypes were obtained.

1. Introduction

Due to the deterioration of the environmental situation and fierce competition in the food market, the development of such a group of products as products with specified consumer properties is important for each region [4, 5, 10]. Therefore, problems of nutrition quality and adaptation become important [14, 20]. One of the ways to solve this problem is to correct food rations and use products with specified biological properties [10, 21].

Northern domestic reindeer herding is one of the most unique sectors of domestic agriculture, and it is an ancestral and traditional occupation of indigenous peoples, which determines the conditions and way of life of these peoples. It is not just a separate economic category and also has deep social foundation able to carry out a critical role in the health of the population of Russia on the basis of constantly reproducible raw materials of natural origin, necessary for the production of a highly safe therapeutic and recreational drugs [8, 6].

Therapeutic and preventive properties of preparations and products based on reindeer products are well known [2, 8]. tinctures, pills are developed for these purposes, etc. Studies of reindeer products have shown that their mineral elements, amino acid and protein complexes, and lipid substances represent a complex, well-balanced set of biologically active substances. At the same time, it is scientifically proven that the body of reindeer, even when placed in conditions of strong anthropogenic and man-made pollution, demonstrates the properties of self-purification of the body from toxicants and radionuclides that have entered it. The advantage of domestic reindeer products is their environmental friendliness [17, 18, 19].

In this regard, there is a need to create a modern high-tech production of a new generation of products based on domestic reindeer husbandry.
2. Research methods

The collection of raw materials was carried out in the reindeer farms of the Republic, as well as antler-donor herds of the Tomtor section of the Mountain ulus.

To determine the morphobiochemical composition of reindeer blood by gender and season, groups of 5 animals were formed, using blood sera and whole blood stabilized with heparin or sodium citrate. Experienced animals are clinically healthy and kept in the same conditions with the same level of feeding.

Biochemical studies of samples were carried out on analytical equipment in a biochemistry laboratory. Laboratory blood tests were performed by counting red blood cells and white blood cells in the Goryaev chamber, the content of macro- and microelements was determined by infrared spectroscopy on the Nir Scappeg model 4250 analyzer.

The experimental and testing part and technological research were carried out in the workshop for the production of dietary supplements from reindeer products of Taba JSC.

The obtained data were processed biometrically using a personal computer (the program Microsoft Excel 2003, Statistica for Microsoft Windows XP).

3. Relevance, scientific significance

In rural and commercial areas of the Far North, the population traditionally consumes only deer meat and offal. Venison and products made from it do not offer a wide variety of products [2, 20].

But in addition to deer meat, other products of reindeer husbandry that can be used in the production of biologically active supplements, as well as in other branches of Russian industry, deserve our attention. These include antlers, horns, bones, blood, endocrine-enzyme, slaughtered raw materials, etc. [2, 12, 15].

Farm animal slaughter products, including reindeer blood, are not fully used, and sometimes many products are disposed of, although they can serve as raw materials for the production of a variety of products. In turn, the blood of reindeer is represented by an environmentally friendly complex of proteins, amino acids, minerals and trace elements, vitamins, hormones and hormone-like substances. All these components are found in the blood in balanced concentrations necessary for life.

Blood obtained from animals is an important source of protein, food and feed resources replenishment. Its biological value is determined by its significant content of proteins, mineral salts, vitamins and hormones. In terms of protein content, blood is almost equal to meat. Therefore, the products of reindeer blood processing can adequately occupy this niche and be among the best in terms of their unique properties that do not contain foreign impurities [16, 9].

With the development of pharmacology and the science of therapeutic nutrition, the use of blood products in combination with other active substances is scientifically justified [3, 9].

In accordance with global practice, a product is considered functional if the regulated content of micronutrients in it is sufficient to meet (at the usual level of consumption) 25-50% of the average daily need for these components [10, 13].

It has been proven that blood can be used in the treatment of beriberi and in many other cases. In combination with other active substances, in particular microelements (iron, cobalt), the therapeutic effect of blood increases [9, 17, 19].

The properties and composition of the blood of reindeer in terms of amino acid, fatty acid, and mineral composition are not inferior to the blood of marals, and even surpass them in some indicators. According to a number of researchers, the blood of marals and horses is a complete, from a dietary point of view, product rich in essential amino acids. As a dietary product, reindeer blood is used for anemia, general weakness, growth retardation, and lack of nutrition to restore protein reserves [16, 9, 7].

Therefore, an important task of scientists in the North is to find and use new non-traditional ways of using local Arctic raw materials [17].
4. Scientific background and implementation results

To ensure the population's demand for natural products, new types of products are developed. This is confirmed for the first time by the introduced technical conditions and technological instructions that are registered under know-how 4th intellectual property assets regime, and are already being produced and sold by Taba company. It is the only company in the far Eastern Federal district that carries out deep processing of products of reindeer husbandry by uniting the traditions of reindeer herding and innovations.

Two types of dietary supplements are encapsulated ultrafine powder and slides from reindeer antlers, which, according to the expert opinion of the Research Institute of Nutrition (Moscow) are positioned as a source of calcium containing iron. All products are certified, entered in the register of food products of the Russian Federation and introduced into licensed production.

Currently, the company's products are used by athletes during intense training by freestyle wrestlers, boxers, track and field athletes and Paralympic athletes. Certain positive effects and sporting achievements are observed, and records are set.

5. Results of experimental studies

We have carried out a comparative study of the seasonal variability of the protein composition of the blood serum of domestic reindeer in different age and gender groups by season.

The value of blood indicators varies in different seasons of the year. The amount of total protein in the spring season averaged 8.66 g%, the largest amount is produced by studs with 9.14 g%, the smallest by the two-year olds with 8.40 g% (the significant difference was \( P<0.001 \)). And she-deer and green hides do not show any specific differences.

In autumn, the average total protein was 8.73 g%. The difference in average total protein values for the seasons (spring and autumn) was not found.

According to the studies of V. Afanasiev [1], the protein content in the blood of deer differs significantly by season. The maximum number of them is observed in autumn: 7.6 g%. The average amount of the total protein of V. Afanasiev [1] differ from the blood parameters of the experimental herd. The difference in spring time was 2.9 (\( P<0.05 \)), in autumn — 1.1 g%, the difference has a statistically significant level (\( P<0.001 \)).

Albumins in all seasons of the year significantly predominate over globulins. Their content in the blood of deer does not change by season. The average albumin values according to V. Afanasiev [1] in comparison with the experimental herd in the spring are lower by 0.09 g%. A small change in the content of \( \beta \)-globulins is observed in the spring season. Studs have the largest share with 0.41 g%, while the two-year olds show the smallest with 0.26 g%, and the significant difference is \( P<0.005 \). There is no difference by season. And according to Afanasiev, the seasonal difference in the content of \( \beta \)-globulins was 0.46 g%, which is reliable (\( P<0.001 \)), and there was no difference in the experimental herd. In terms of the content of \( \alpha \) and \( \gamma \) globulins, there were no fluctuations in the age of animals and seasons of the year.

The highest content of carotene in the spring is observed in studs: by 0.07 g% higher than the average. Their content in autumn increases by 0.04 g%.

There was no significant difference in the mineral content by season and age groups of the experimental herd of deer.

According to the literature data [8, 9], the content of calcium and phosphorus is higher in the autumn season by 3.53 and 0.18, respectively. The magnesium content in autumn is less by 1.41 g%, and there is no special difference in the seasons of the year for the studied deer.

The highest indicator of phosphorus content in bull calves is 4.70, with the lowest one in studs: 4.53, which is reliable (\( P<0.001 \)).

In spring and autumn, the main morphological picture of blood is characterized by a high content of hemoglobin (in spring 11.74, in autumn 12.78 the difference is significant \( P<0.01 \)) and red blood cells (in spring 8.1 million, in autumn 8.44 million). The level of white blood cells increases in the fall by 0.58 thousand more than in the spring (\( P<0.0001 \)).
In comparison with the average research data [1], the hemoglobin content in the blood of the studied reindeer is 1.52 g% higher in spring (P<0.0001) and 0.51 g% lower in autumn (P<0.0001). The content of red blood cells is higher by 1.3 (P<0.0001) and 0.75 (P<0.03), respectively.

The minimum content of hemoglobin and red blood cells in the spring was observed in two year olds and studs (hemoglobin – 11.0, red blood cells – 7.12). In autumn she-deer had: hemoglobin – 11.91, the red blood cells – 8.12.

A high white blood cell count was observed in the two year olds (in spring – 6.81, in autumn – 7.32 statistical significance of the difference P<0.04). The number of white blood cells in the average herd in the fall increases by 0.58 thousand. And according to the literature data, the number of hemoglobin, red blood cells and white blood cells increases in the fall.

According to the results of the study, there was no significant difference in the blood pattern for the season and age of domestic reindeer in the Tomtor area. At the same time, the herd is regularly given extra nutrition. In winter and spring it is mineral salt and regular feed additives with special deer feed (according to the recipe of the far North Research Institute of agriculture) [15].

Based on the high content of full-fledged proteins and biologically active substances in the blood, blood has long been called "liquid meat", thus underscoring its importance as a raw material for food production [9, 16].

Due to the fact that plasma proteins (albumin, globulin, etc.) are full-fledged, easily digestible proteins, have a high nutritional value and are completely absorbed by the body [16].

Tests to verify compliance with the requirements of the project Technical Specifications ТУ 9219-002-00549163-2013 "reindeer blood – dry" were carried out in the testing accredited laboratory center Federal Research Center for Food Systems named after V. M. Gorbatov, according to physico-chemical, microbiological and safety indicators (test report No. 1194/2). The following conclusion was reached: the presented sample meets the requirements for physico-chemical, microbiological and safety indicators.

6. Conclusions

The relatively high content of iron in the blood makes it a promising raw material for the production of functional food products as an additional source of iron, iron-containing drugs and therapeutic and preventive products.

Resource conservation is achieved at all stages of production and use of reindeer resources: rationalization of collection and storage of raw materials, maximum use of reindeer by-products, minimizing losses during transportation and storage; the most effective use of raw materials in the production process or non-production consumption; identification, accounting and full use of secondary resources (formed during their primary processing), primarily for their intended purpose-as a full-fledged raw material, a source of biologically active substances, as well as waste processing and waste disposal. At the same time, production becomes almost waste-free. The implementation of the proposed innovation will help preserve the traditions and improve the efficiency of reindeer products, and have international significance as a promising raw material for export.

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