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Exploring the Role of Pantohepatogen-S in Deer Antler Products: Characterization and Authenticity Verification

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ABSTRACT

This paper aims to provide insights into pantohepatogen-S, a promising product derived from deer antlers. Antler-based products, which have been used for centuries in modern and traditional medicine, are renowned for their adaptogenic, nootropic, and immunomodulatory effects. They are also known to improve stamina, and mental well-being, and support digestion and metabolism. As contemporary society faces challenges such as environmental pollution and nutrient deficiencies due to poor dietary habits, pantohepatogen-S emerges as a valuable supplement for enhancing human health. This study examines the composition, properties, and microbiological indicators of pantohepatogen-S, along with its quality, safety standards, and nutritional and energy profiles. In addition, the paper covers the procedures for obtaining blood from *Altai wapiti* females and the appropriate storage conditions for the product. The shelf life of pantohepatogen-S is determined based on comprehensive laboratory analyses conducted in the Russian Federation.

Keywords: Deer antler product, Pantohepatogen-S, Nutritional supplement, Composition, Properties

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Introduction

The exploration of new local raw materials for the production of specialized food products is a key component of the Russian Federation's health-focused nutrition policy. The concept of "healthy nutrition" has been recognized since the 1990s, and it emphasizes the need for a diet that not only provides essential nutrients and energy but also helps prevent the onset of various multifactorial non-communicable diseases, thereby ensuring overall health and productivity. The role of combining food components with medicinal treatments for common illnesses has become increasingly significant in modern healthcare [1-3].

In this study, specialized products, particularly biologically active food supplements, play a crucial role in enhancing nutrition and improving public health. These supplements are among the most reliable, effective, and accessible tools available for supporting better nutrition and wellness [4-14].

Pantohepatogen, a product derived from deer antlers, has a long history of use in both modern and traditional medicine, making it an important material derived from both plant and animal sources [15-18].

Development of this food category represents an innovation, as innovation is defined by the creation of new or improved products or the use of upgraded technological processes to bring these products to market. This study investigates the chemical composition of pantoheumatogen, sourced from the blood of Altai wapiti females, along with its production process and adherence to quality control standards.

Materials and Methods

Blood samples were obtained from healthy animals under veterinary supervision, using sterile, disposable blood collection and transfusion systems designed for human use. The animals selected for blood collection met the sanitary standards outlined in regulations 3.1.084-96 and veterinary guidelines 13.3.4.1100-96. Blood was collected into sterile containers and must be processed within two hours of collection. Alternatively, it could be refrigerated at 0 °C for up to 48 hours or at 5 °C for a maximum of 12 hours. The integrity of the containers and storage conditions were regularly monitored. Blood sampling was performed to conduct further veterinary analysis.

The chemical composition of pantoheumatogen was analyzed by the Laboratory of Phytopharmacology and Specialized Nutrition, a branch of the Tomsk Scientific Center of the Russian Academy of Sciences, under the leadership of Professor N. I. Suslov, Doctor of Medical Sciences.

The biologically active components include amino acids, lipid compounds (primarily phospholipids such as phosphatidylcholine, phosphatidylethanolamine, and cholesterol), and various micronutrients. The key nutrient content is summarized in **Table 1**, which shows the average data from 3 measurements across six consistent product batches. This table confirms that pantoheumatogen is a valuable source of both structural and biologically active substances.

Table 1. Chemical composition of pantoheumatogen

Substance	Content (mg/100 g)	Substance	Content (g/100 g)
Macro and micronutrients		Aminoacids	
Calcium	0.15	Lysine	0.9
Magnesium	74	Histidine	0.35
Aluminum	27	Arginine	1.13
Iron	360	4-hydroxyproline	0.95
Silicon	28	Tryptophan	1.26
Phosphorus	120	Threonine	0.57
Sodium	900	Serine	0.68
Potassium	120	Glutamine acid	1.6
Copper	0.1	Proline	1.27
Iodine	0.08	Glycine	2.2
Manganese	34	Alanine	1.38
Tin	3	Cystine	0.04
Barium	6.4	Valine	0.64
Cobalt	0.05	Methionine	0.1
Vanadium	0.04	Isoleucine	0.24
Lipids		Leucine	1.15
Free fatty acids	0.56	Tyrosine	0.24
Phospholipids	2.42	Sarkosine	1.16
Triglycerides	0.51	Taurine	0.03
Sphingomyelin	0.179	Lipids	
Nucleic bases acids		Free fatty acids	0.56
Guanine	39.9	Phospholipids	2.42
Hypoxanthine	44.2	Triglycerides	0.51
Uracil	39.1	Sphingomyelin	0.179

Other compounds	Other Compounds
Isolecithin	0.143
Lecithin	0.233
Colaminephalin	0.358
Cerebroside	0.483
Cardiolipin	0.555

Some components of pantoheumatogen can be classified as nutrient substrates, but the majority are highly active regulatory molecules, often referred to as signaling substances. Even in minute quantities, these molecules initiate a series of metabolic processes within the body, influencing enzyme activity and protein recognition and affinity [6, 7, 16-18]. They play a key role in regulating essential physiological functions, contributing to the functional and pharmacological properties of pantoheumatogen.

It is evident that pantoheumatogen either lacks vitamins or contains them in very low amounts. Therefore, pantoheumatogen-based specialized products should be supplemented with vitamins [3, 4].

The consumer attributes of pantoheumatogen include its appearance, flavor, dispersibility, moisture content, authenticity, and the quantities of pantoheumatogen, fats, proteins, carbohydrates, amino acids, and energy value. These factors were assessed and calculated following the completion of the pantoheumatogen production process. Key quality indicators that reflect the product's pharmacological properties and effectiveness include quantitative content and its authenticity. These criteria were selected as markers for determining the shelf life of the product and its regulated commercial characteristics.

Results and Discussion

The pantoheumatogen product was stored in a dark, cool environment (similar to household refrigerator conditions) for a period of two and half years at a temperature of 5.0 ± 1.0 °C. Hemoglobin levels were measured spectrophotometrically every six months to track changes. Organoleptic properties and microbiological purity were assessed both at the start and then during the storage period. The authenticity of pantoheumatogen was verified post-manufacturing.

Six consistent batches of the product underwent three separate tests each.

The observed changes in the quantitative composition of pantoheumatogen over the storage period are illustrated in **Figure 1**.

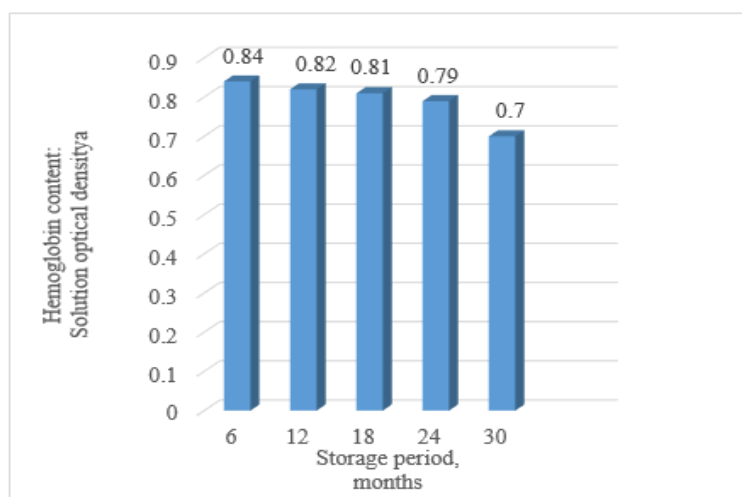


Figure 1. Pantoheumatogen-S content during the storage period

The findings indicate that the quantitative content of pantoheumatogen remained relatively stable throughout the storage period, consistently meeting the required minimum level of 0.4. A minor reduction in content was noted only after 30 months of storage.

Next, we present the findings of the microbiological testing conducted on the product both before and following the designated storage period (**Table 2**).

Table 2. Microbiological indicators of pantoheumatogen-S safety during the storage period (n = 6)

Indicator	Permissible level	Actual content before storage	Actual content 30 months later
Mesophilic aerobic and facultative anaerobic microorganisms, CFU/g, maximum	2.5×10^4	1.1×10^3	1.2×10^3
Coliform bacteria, per 0.1 g	Prohibited	None	None
Sulfite-reducing clostridia, per 1.0 g	Prohibited	None	None
Staphylococcus aureus and Proteus, per 1.0 g	Prohibited	None	None
Pathogenic microorganisms, including salmonella, per 25.0 g	Prohibited	None	None
Yeasts, CFU/g, maximum	200	below 12	below 12
Molds, CFU/g, maximum	200	below 10	below 10

It can be concluded that after 30 months of storage, the microbiological safety indicators remained unchanged from the initial measurements. This, combined with the stability of the pantoheumatogen's quantitative content, supported the determination of a shelf life of two years from the date of manufacture, with an added safety margin of 6 months.

In addition to microbiological purity, other safety parameters were evaluated to confirm the product's compliance with regulatory standards (**Table 3**).

Table 3. Pantoheumatogen-S safety criteria (n = 6)

Indicator	Permissible level	Actual content
Toxic elements, mg/kg, maximum		
Lead	1.0	0.3
Cadmium	1.0	0.07
Arsenic	1.5	Maximum 0.2
Mercury	0.2	Maximum 0.01
Pesticides, mg/kg, maximum		
HCH and its isomers	0.1	Maximum 0.006
DDT and its metabolites	0.1	Maximum 0.02
Heptachlor	Prohibited	None
Aldrin	Prohibited	None
Antibiotics, units/g, maximum		
Levomecetin	0.01	None
Tetracycline group	0.01	None
Grisin	0.5	None
Bacitracin	0.02	None
Streptomycin	Prohibited	None
Penicillin	Prohibited	None
Radionuclides, Bq/kg, maximum		
Cesium-137	200	Maximum 27.0
Strontium-90	100	Maximum 3.0

The data shown in the table confirm the product's sanitary safety. No alterations were observed in the organoleptic quality indicators.

To assess the product's authenticity, spectrophotometric measurements were conducted on the hemoglobin absorption spectrum in the 480-650 nanometer range. A distinct double-flattened peak was observed, with maximum absorption at 540 ± 10 nanometers, confirming the product's authenticity. Pantoheumatogen-S regulated quality criteria are presented in **Table 4**.

Table 4. Pantoheumatogen-S regulated quality criteria

Indicator	Description
Appearance	Amorphous powder from reddish-brown to dark brown
Smell	Specific
Taste	Specific with meat flavor
Dispersity	Particles with a diameter larger than 0.63 mm – maximum 2%. Particles with a diameter larger than 2 mm – not found
Humidity	Maximum 9%
Authenticity	Determined by the hemoglobin absorption spectrum of the product solution in 0.5% ammonium solution. Double flattened peaks with maximum absorption at 540 ± 10 nm and 570 ± 10 nm must be recorded in the range of 480-650 nm.
The quantitative content of pantoheumatogen	Measured spectrophotometrically by hemoglobin content. 0.1 g of product (accurately weighed) was dissolved in 0.5% ammonium solution and brought to 50 cm ³ at 540 nm. The solution's optical density, measured by a spectrophotometer, must be a minimum of 0.4.

The regulated physicochemical quality properties of pantoheumatogen-S, nutritional and energy content (**Table 5**), were established based on the research findings.

Table 5. Pantoheumatogen-S nutritional and energy value

Indicator	Value
Proteins and amino acids, g/100 g	96.0–97.0 (96.5)
Carbohydrates, g/100 g	0.16–0.18 (0.17)
Fats, g/100 g	0.05–0.07 (0.06)
Energy value, kcal/100 g	385–389 (387)

Note: Average values of 6 measurements are provided in round brackets.

Pantoheumatogen-S is a fine, amorphous powder derived from the blood of female antler deer. The blood undergoes partial defibrination and dehydration under controlled, mild conditions while simultaneously being disintegrated. The dehydration and disintegration processes are performed in a deep vacuum environment (-1 atm) at temperatures ranging from 36-40 °C. This method guarantees the product's bacteriological purity, excellent preservation, and the maintenance of the active substances' functional activity.

Conclusion

The product is an active compound: it has pronounced adaptogenic, nootropic, and immunomodulating effects, demonstrates anti-anemic properties, improves metabolism and digestion, and enhances physical activity and mental health.

Pantoheumatogen-S serves as a component for specialized product manufacturing, including biologically active food supplements with different functional properties.

The State Sanitary and Epidemiological Service of the Russian Federation and the Main Testing Center for Food Products at the Research Institute of Nutrition of the Russian Academy of Sciences issued their expert reports on pantoheumatogen-S. The established shelf life of pantoheumatogen is two years from the date of manufacture. The clinical trial confirms its efficiency and functional properties.

Pantoheumatogen-S is manufactured at the enterprises of “Yug” company, located in Biysk, that are certified according to the requirements of international standards of the ISO 9001, 22000, and GMP series.

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Conflict of Interest: None

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