Journal of Chemistry of Goods and Traditional Medicine

J Chem Good Trad Med, Volume 4, Issue 2, 2025 Traditional Medicine

CHEMICAL ELEMENTS IN THE FOOD SUPPLEMENT "PROSTAFITO"

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DOI: https://doi.org/10.55475/jcgtm/vol4.iss2.2025.509

Keywords:
ICP-OES, ashing, working solution, calibration curve, elemental analysis, spectrometry

Annotation
This study outlines the procedures for sample preparation, working solution formulation, and chemical element analysis in biologically active samples using the ICP-OES method. The sample was ashed in a muffle furnace and mineralized with a mixture of HNO_3 and H_2O_2. The resulting solution was filtered through a 0.45 µm syringe filter and used for analysis. Calibration curves for 69 elements were constructed using certified standard solutions, all with R^2 values ≥ 0.995. The analysis was performed using a Thermo Fisher Scientific iCAP PRO X Duo ICP-OES spectrometer, and data processing was carried out with the QTegra ISDS software.

How to Cite
Tuychiev, G. U., Askarov, I. R., & Abdullayev, O. S. CHEMICAL ELEMENTS IN THE FOOD SUPPLEMENT "PROSTAFITO" . Journal of Chemistry of Goods and Traditional Medicine, 4(2). https://doi.org/10.55475/jcgtm/vol4.iss2.2025.509

Introduction. Chemical elements are a set of atoms with a specific number of protons. Each element has a specific place in the periodic table, and more than 118 elements have been identified today. Of these, more than 90 occur in nature. They are one of the main components necessary for the structure, function and vital activity of living organisms [1]. In the human body, metabolism, energy processes, enzyme activity, hormone synthesis and intracellular information signal transmission take place with the participation of these chemical elements. According to GOST and pharmacopoeia standards, chemical elements are divided into three main groups depending on their biological role and concentration in the body: macroelements, microelements and ultramicroelements [2,3]. Macroelements include calcium (Ca), magnesium (Mg), potassium (K), sodium (Na), phosphorus (P), chlorine (Cl) and sulfur (S). They are required in amounts of more than 100 mg per day and are mainly involved in bone and muscle function and maintaining water-electrolyte balance. Microelements include elements such as iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), selenium (Se), chromium (Cr), molybdenum (Mo), cobalt (Co), iodine (I) and fluorine (F), and their need is usually at the milligram or microgram level. These elements are important in enzymes, hormones, blood formation and antioxidant protection. Ultramicroelements are required in very small amounts

or are involved only in certain enzymatic systems. These include nickel (Ni), boron (B), silicon (Si), vanadium (V), antimony (As), tin (Sn), lead (Pb) and cadmium (Cd); the biological function of some of them has not yet been fully studied.

Chemical elements perform regulatory and structural functions in the body. They are active components of many enzymes and coenzymes, regulating metabolism. For example, calcium (Ca) is the main component of bones and teeth, and ensures the functioning of the heart muscle. Iron (Fe) is part of hemoglobin and serves to transport oxygen. Zinc (Zn) is involved in prostate health, DNA synthesis, and strengthening immunity. Selenium (Se) has strong antioxidant properties and reduces oxidative stress. Magnesium (Mg) is involved in balancing the activity of the heart, muscles, and nervous system and in the activity of many enzymes.

Today, due to the insufficient presence of certain chemical elements in food products or their low bioavailability (absorption), their delivery to the body through biologically active additives (BAAs) is becoming an urgent issue. The elements contained in such additives must be standardized and controlled in accordance with national and international pharmacopoeia standards [4]. This allows providing consumers with safe, effective, and beneficial microelements for their health.

Preparation of sample working solution. A 1 g sample, previously dried, ground, weighed on a 0.001 g balance (Navigatortm, OHAUS®), was ashed in a porcelain crucible using the dry ashing method in a muffle furnace (Nabertherm, Germany). Initially, it was heated to 95ºC for 30 minutes, to 120ºC for 60 minutes, to 300ºC for 120 minutes, and to 550ºC for 60 minutes, and held at 550ºC for 5 hours. 6 ml of ICP-MS-grade 70% HNO_3 (Sigma Aldrich, USA) and 2 ml of 60% H_2O_2 were added to the resulting ash and heated on a hot plate in a fume hood until white smoke ceased. The cooled solution was transferred to a 100 ml polypropylene volumetric flask and made up to the mark with ultrapure water. This working solution was filtered using a syringe filter (0.45 μm) and used for analysis.

Preparation of standard solutions. Standard solutions of 68 elements in 2% HNO_3 with a concentration of 10 mg/l (Highpuritystandards, USA), standard solutions of mercury element in 2 mol/l HNO3 with a concentration of 1000 mg/l (Sigma Aldrich, Germany), standard solutions of 25 elements in 2% HNO_3 with a concentration of 10 mg/l (Aristar, USA), 70% HNO_3 (Sigma Aldrich, USA) were used to prepare standard working solutions of elements in 2% HNO_3 and 3 more standard working solutions were prepared by dilution. A 2% HNO_3 solution was used as a blank. Calibration lines were generated for 69 elements using the above standard working solutions. The analysis was continued if the R_2 values of the calibration lines were higher than 0.995.

The analysis was performed on an iCAP PRO X Duo ICP-OES inductively coupled plasma optical emission spectrometer manufactured by Thermo Fisher Scientific (USA). Method development and analysis of the analysis results were performed using the QTegra ISDS software. The analysis parameters are listed in Table 1.

Table 1. Analysis method parameters.

Parameter	**Settings**	
Pump pipe	Tygon® yellow/white for sample	Tygon ® white/white for drainage
Pump speed	45 rpm	
Spray chamber	Glass cyclonic	
Nebulizer	Glass concentric	
Nebulizer gas flow	0,6 $L \cdot min^{-1}$	
Refrigerant gas flow	12,5 $L \cdot min^{-1}$	
Auxiliary gas flow	0,5 $L \cdot min^{-1}$	
Central tube	2 mm	
RF power	1150 Vt	
Repetition	3 times	

Analysis time	Axial	Radial
	15 sec	15 sec

Results obtained. The analysis results are presented in the table below.

Table 2. Results of determination of chemical elements in the sample by the IBP-OES method, mg/100 g.

Analyte	Amount (mg/100 g)	norm according to JSST	Analyte	Amount (mg/100 g)	norm according to JSST
K	2152,985	<3000	Cr	0,899	<1
Ca	892,07	<1200	Mo	0,822	<1
Mg	335,506	<400	Pb	1,418	<2
P	286,592	<300	As	0,129	<0.5
Fe	37,066	<50	Cd	0,086	<0.5
Na	55,347	<200	Te	0,109	<0.5
Al	30,936	<40	V	0,127	<1
Zn	9,438	<50	In	0,127	<1
Mn	6,365	<10	Sn	2,469	<5
Si	6,619	<30	Cs	3,234	<5
Sr	6,066	<10	U	0,425	<1
Cu	3,012	<5	Th	0,199	<1
B	1,642	<2	Ti	0,388	<2
Li	1,538	<2	Se	0,05	<0.5
Ba	2,054	<5	Co	0,05	<0.5

Conclusion. According to the results of the study, a number of macro- and microelements important for the body, such as calcium, magnesium, phosphorus, iron, zinc, manganese and copper, were detected in the sample in significant quantities. Their concentrations were found to be higher or close to the daily recommended intakes recommended by the World Health Organization (WHO). In particular, the high content of elements such as calcium (892.07 mg/100 g), magnesium (335.5 mg/100 g) and iron (37.06 mg/100 g) confirms the biological value of this product. In general, the composition of the analyzed sample indicates that it is a useful source that helps to meet the body's need for minerals.

References

1. GOST 30178–96. “Biologik faol moddalarni aniqlash. Umumiy talablar.”
2. GOST R 8.736–2011. “Optik-emissiya spektrometriyasi. Asosiy tushunchalar.”
3. GOST R ISO 11885–2020. “Suvlar va eritmalarda elementar tahlil. ICP-OES usuli.”
4. WHO Guidelines on food fortification with micronutrients. Geneva: World Health Organization, 2006.