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Determination of levels of manganese and iron in selected dietary supplements stimulating the immune system of the human body

Określenie poziomu manganu i żelaza w wybranych suplementach diety stymulujących system immunologiczny organizmu człowieka

INTRODUCTION

Dynamically increasing assortment and an increase in demand for dietary supplements (in Poland and in the world) is a result of growing trends associated with the bigger care of people concerned with their health and appearance [15].

According to the definition – dietary supplements are preparations supplementing the diet into scarce substances essential for correct functioning of the human body – they are a concentrated source of vitamins, mineral elements or other substances demonstrating nutritious or other physiological action [16]. Some of them contain powdered raw materials or obtained from them (dry or liquid) extracts [7]. Biologically active substances appearing in the dietary supplements exerting the defined pro-health action, they support the prevention of many diseases associated with the progress of civilization. It is also possible to take these preparations as supplements in therapy of different disease entities [10]. Preparations taken in order to increase the body's resistance constitute the important group of supplements – they stimulate the immune system. Powdered herbs or extracts from medicinal plants can contain considerable quantities of the mineral matter including such microelements as manganese and iron [7].

Human organism contains 10-20 mg of the manganese. This element plays substantial role in metabolic processes of the organism. Manganese is an element of many enzymes among others: pyruvate carboxylase, DNA and RNA polymerases, polysaccharide polymerases and arginase; is activating enzymes regulating the glucose metabolism, of lipids and proteins, and essential enzymes to correct effect of the biotin, vitamin B_1 and vitamin C; is a natural antioxidant as activator superoxide dismutase; essential to keep the correct structure of bones; regulates the functioning of the nervous system; will matter greatly in creating the thyroxin; participates in the synthesis of cholesterol and

of steroids; is participating in manufacturing processes of hemoglobin (along with copper and iron) [8, 9, 13].

Iron is found in human organism in an amount from 3 to 5 g and fulfills the number of important functions in the body, among others: participates in the synthesis of erythrocytes and lymphocytes (coming into existence of leucocytes and T-lymphocytes); indirectly participates in coming into existence of high-energy ATP and ADP compounds, matters greatly in the transport of the molecular oxygen from lungs to all cells of the organism (is an element of hemoglobin and myoglobin); is participating in the transfer operation of electrons and the reduction in oxygen (as the element of cytochromes and other enzymes - oxydoreductase, monooxygenase, dioxygenase); participates in coming into existence of neurotransmitters and in the destruction of the hydrogen peroxide as the component of the catalase; is participating in the process of the iodination of tyrosine; is accomplishing the substantial role in the synthesis of steroidal hormones; affects the biosynthesis of prostacyclins, of thromboxanes and leukotriens; plays a role in the prevention of illnesses - anaemias related to the sideropenia, personality and concentration disorders [8, 9, 14].

In states of deficiency of manganese and iron in humans there may come to creation of health problems, therefore holding of the correct level of these elements in the body is significant [8, 9].

Due to the low number of the publications concerning mineral composition of dietary supplements available in Poland, their growing assortment and increasing application popularity, determining the content of manganese and iron in the selected dietary supplement was fully justified.

MATERIALS AND METHODS

Dietary supplements in forms of capsules and pills and liquid supplements (juices, their mixtures, liquid extracts from medicinal plants) stimulating the immune system of the human body constituted the study material. From 3 to 5 series of the production each of preparations were examined; in two parallel runs (names and composition of supplements were given in the Table 1 and Table 2). Supplements in the form of pills were fragmented in the mortar, capsules were weighed in one piece, and liquid supplements were measured off with the pipette directly into quartz evaporating basins and they were allowed to evaporate to dry.

Table 1. Name, producer and composition of dietary supplements (in the form of capsules and tablets) stimulating human immune system

No	Preparation name	Main components
1.	Acerola Plus (tabl.); Puritan,s Pride Inc., USA	Powdered acerola fruit, powdered grains of the buckwheat, buds of the wild rose (Rosa canina), citrus biflavonoids, extract from the green pepper, extract from the blackcurrant, rutin, hesperidine
2.	Cat's Claw (caps.); Now Foods, USA	Powdered cat's claw (Uncaria tomentosa)
3.	Maca (caps.); A-Z Medica, Sp. z o. o., Poland	Powdered maca root (Lepidium meyenii Walp.)
4.	Maca 50 Plus(caps.); A-Z Medica, Sp. z o. o., Poland	Powdered maca root (Lepidium meyenii Walp.), antioxidative prefix: beta-carotene, vitamins – E, C; shark's cartilage
5.	Spirulina (tabl.); Walmark, Sp. z o. o., Czech Rep.	Sea algae (Spirulina platensis), Vitamins: B_1, B_2, B_6
6.	Spirulina Hawajska (caps.); Organic by Nature Inc., USA	Sea algae (Spirulina platensis) 100%
7.	Spirulina Pacyfica (tabl.); Cyanotech Corp., USA	Sea algae (Spirulina platensis)
8.	Vilcacora (caps.); Andean Medicine Centre Ltd., United Kingdom	Vilcacora (Uncaria tomentosa)
9.	Żeń-szeń, (caps.); Herbapol Kraków, Poland	Powdered ginseng root (Ginseng radix), iron oxides as capsule components
10.	Żeń-szeń Ginseng, (caps.); KRKA, Slovenia	Dry extract from ginseng root (Panax ginseng radicis extractum siccum), iron oxides as capsule components
11.	Żeń-szeń Ginseng (tabl.); Naturell AB, Sweden	Standardized extract from white Korean ginseng root (Panax ginseng C.A. Meyer)
12.	Żeń-szeń koreański(caps.); Walmark, Sp. z o. o., Czech Rep.	Extract from white Korean ginseng root, vitamin E (D-alpha tocopherol)
13.	Żeń-szeń, vita-complex, (caps.); Olimp Lab., Sp. z o. o., Poland	Korean ginseng (Korean Panax ginseng extract.), American ginseng (Panax quinquefolium extract)

Table 2. Name, producer and composition of liquid dietary supplements stimulating human immune system

No	Preparation name	Main components
1.	Aloe vera – aloe juice; Laboratoria Natury, Alter Medica, Olfam, Sp.z o. o., Poland	Aloe juice (Aloe vera)
2.	Aloe vera drinking gel juice with pulp pieces – gel; Laborat. Natury, Sp. z o.o., Bio Medica, Poland	Aloe juice with pulp pieces (Aloe vera)
3.	Aloes Activ – aloe juice with extract of ginseng; Alter Medica, Poland	Aloe juice (Aloe barbadensis), ginseng extract (Acanthopanax senticosus Maxim)
4.	Aloes Young + żurawina – aloe juice and cranberry juice with acerola fruit; Alter Medica, Poland	Aloe juice (Aloe barbadensis - 70%), cranberry juice (Oxycoccus palustris Hill syn. Vaccinum oxycoccus - 25%), acerola powdered fruit (Malpighia gabra – 5%)

5.	Bodymax Tonik; Axellus A/S, Denamrk	Standardized extract from ginseng GGE (Panax ginseng C.A. Meyer), Standardized extract from Japanese gingko (Ginkgo biloba), vitamins: B_1, B_2, B_6, PP, pantothenic acid
6.	Ginsenging 400 - extract from ginseng with honey; MEHECO No18, Guangiming Zhong Jie, China	Ginseng radix extractum spissum 3:1 – 400 mg, royal jelly 300 mg in 1 ampoule -10 ml
7.	Ginsenol; Krakowskie Zakłady Zielarskie „Herbapol", Kraków, Poland	Ginseng Root tincture 1:5 (Ginseng radix)
8.	Noni - noni fruit juice; Alter Medica, Poland	Noni fruit juice (Morinda citrifolia)
9.	Noni-vita - noni fruit juice; Laboratoria Natury, Sp. z o.o., Poland	100% Noni fruit juice (Morinda citrifolia)
10.	Noni Plus – juice of noni and cranberry fruits; Alter Medica, Poland	Noni fruit juice (Morinda citrifolia), cranberry juice (Oxycoccus palustris)

Samples were mineralized "dry" in a muffle furnace at the temperature of 450˚C. Process of the mineralization was accelerated using water solution of the nitric acid (V) of the concentration of about 20% (HNO_3 Suprapur, Merck). Ashes were being dissolved in the 15% water solution of the hydrochloric acid (HCl Suprapur, Merck companies).

Contents of manganese and iron were determined with FAAS method (flame absorption atomic spectrometry) in the SOLAAR M5 spectrometer, Thermo Elemental, applying the correct parameters for a given element of analysis.

The optimum parameters for determination of manganese were: wavelength – 279.5 nm; bandpass – 0.4 nm; lamp current - 12 mA ; flame type - air/acetylene; flame chemistry – stoichiometric; fuel flow rate – 0.9 – 1.2 l . $min.^{-1}$ and for determination of iron: wavelength – 248.3 nm; bandpass – 0.4 nm; lamp current – 15 mA ; flame type - air/acetylene; flame chemistry – stoichiometric; fuel flow rate – 0.9 – 1.2 l . $min.^{-1}$ [12].

In the same conditions mineralization and determination of the investigated elements were done in the reference material – Mixed Polish Herbs (INCT-MPH-2) [6]. The results were given in µg/g of the preparation and in µg/per capsule or tablet. The declared amounts were: Mn – 191 ± 12 µg/g; Fe – 460 µg/g. The following amounts were determined: Mn – 186 ± 4 µg/g; Fe - 443 ± 13 µg/g.

RESULTS AND DISCUSSION

Obtained results were presented in tables: 3, 4 and 5 - arithmetic mean, a standard deviation and a content range were given (min. - max.).

Table 3. The manganese content in supplements of diet stimulating human immune system, $\mu g.g^{-1}$ and µg/caps. (tabl.) and intake of manganese with maximal of daily dose (µg)

No	Preparation name	Manganese (Mn) content ($\mu g.g^{-1}$)	Manganese (Mn) content (µg/caps.(tabl.)	Intake of manganese with maximal of daily dose (µg of Mn)
		Arithmetic mean, standard deviation and content - (min. - max.)		
1.	Acerola Plus, (tabl.), n *)= 5, m *) = 0.92	0.15 ± 0.03 0.12 – 0.18	0.15 ± 0.03 0.12 – 0.18	0.15
2.	Cat's Claw (caps.), n = 5, m = 0.60 g	4.36 ± 0.37 3.89 – 4.66	2.61 ± 0.22 2.33 – 2.80	15.7
3.	Maca, (caps.), n = 5, m = 0.40 g	13.14 ± 1.99 10.26 – 14.51	5.26 ± 0.79 4.10 – 5.80	15.8
4.	Maca 50 Plus, (caps.), n = 5, m = 0.60 g	4.44 ± 0.98 3.15 – 5.68	2.66 ± 0.59 1.89 – 4.41	5.3
5.	Spirulina (Walmark), (tabl.), n = 5, m = 0.65 g	53.06 ± 7.45 42.42 – 62.94	34.89 ± 4.84 27.57 – 40.91	174.5
6.	Spirulina Hawaian, (caps.), n = 5, m = 0.60 g	47.96 ± 2.34 45.83 – 51.20	28.77 ± 1.40 27.50 – 30.72	172.6
7.	Spirulina Pacyfica, (tabl.), n = 5, m = 0.50 g	57.21 ± 7.12 49.43 – 66.64	28.61 ± 3.56 24.72 – 33.32	171.7
8.	Vilcacora, (caps.), n = 5, m = 0.56 g	3.21 ± 0.19 2.98 – 3.38	1.80 ± 0.11 1.67 – 1.89	10.8
9.	Żeń-szeń (Herbapol Kraków), (caps.), n = 5, m = 0.30 g	53.34 ± 18.64 31.82 – 73.66	16.00 ± 5.59 9.55 – 22.10	64.0
10.	Żeń-szeń Ginseng (KRKA), (caps.), n = 5, m = 0.46 g	5.29 ± 0.59 4.71 – 6.11	2.43 ± 0.27 2.17 – 2.81	2.4
11.	Żeń-szeń Ginseng (Naturell), (tabl.), n = 5, m = 0 40 g	4.70 ± 0.76 3.67 – 5.31	1.88 ± 0.31 1.47 – 2.12	3.8
12.	Żeń-szeń koreański- (Walmark), (caps.), n = 5, m = 0.50 g	4.38 ± 0.28 3.96 – 4.51	2.19 ± 0.12 1.98 – 2.28	2.2
13.	Żeń-szeń vita-complex (Olimp), (caps.), n = 5, m = 0.78 g	10.55 ± 0.48 9.88 – 11.01	8.23 ± 0.37 7.71 – 8.59	8.2

n *) – number of examined series of production
m *) – mean mass of capsule or tablet

Table 4. The iron content in supplements of diet stimulating human immune system μg.g^{-1} and μg/caps. (tabl.) and intake of iron with maximal of daily dose (μg)

No	Preparation name	Iron (Fe) content (μg.g^{-1})	Iron (Fe) content (μg/caps.(tabl.)	Intake of iron with maximal of daily dose (μg of Fe)
		Arithmetic mean, standard deviation and content - (min. - max.)		
1.	Acerola Plus, (tabl.), n *)= 5, m *) = 0.92	3.43 ± 0.74 2.55 – 4.13	3.16 ± 0.68 2.35 – 3.80	3.2
2.	Cat's Claw (caps.), n = 5, m = 0.60 g	25.85 ± 2.44 22.97 – 28.62	15.51 ± 1.46 13.78 – 17.17	93.1
3.	Maca, (caps.), n = 5, m = 0.40 g	101.8 ± 66.20 38.11 – 163.93	40.73 ± 26.48 15.24 – 65.57	122.2
4.	Maca 50 Plus, (caps.), n = 5, m = 0.60 g	76.81 ± 10.71 60.49 – 88.64	46.08 ± 6.42 36.29 – 53.18	92.1
5.	Spirulina (Walmark), (tabl.), n = 5, m = 0.65 g	1416 ± 454.9 1068 – 2003	920.6 ± 295.7 694.1 – 1302	4603
6.	Spirulina Hawaian, (caps.), n = 5, m = 0.60 g	1302 ± 256,2 1119 – 1682	781.5 ± 153.7 671.5 – 1009	4689
7.	Spirulina Pacyfica, (tabl.), n = 5, m = 0.50 g	2262 ± 38.1 2092 – 2392	1131 ± 69.1 1046 – 1196	6786
8.	Vilcacora, (caps.), n = 5, m = 0.56 g	165.7 ± 28.0 143.7 – 204.8	92.80 ± 15.68 80.48 – 114.71	556.8
9.	Żeń-szeń (Herbapol Kraków), (caps.), n = 5, m = 0.30 g	645.2 ± 125.1 524.8 – 755.9	193.6 ± 37.54 157.5 – 226.8	774.2
10.	Żeń-szeń Ginseng (KRKA), (caps.), n = 5, m = 0.46 g	436.0 ± 37.60 388.0 – 479.2	200.5 ± 17.30 178.5 – 220.4	200.5
11.	Żeń-szeń Ginseng (Naturell), (tabl.), n = 5, m = 0.40 g	75.11 ± 14.24 54.92 – 87.99	30.04 ± 5.70 21.97 – 35.20	60.1
12.	Żeń-szeń koreański- (Walmark), (caps.), n = 5, m = 0.50 g	68.99 ± 7.28 60.64 – 79.32	34.50 ± 3.64 30.32 – 39.66	34.5
13.	Żeń-szeń vita-complex (Olimp), (caps.), n = 5, m = 0.78 g	26.19 ± 2.66 22.32 – 27.98	20.43 ± 2.08 17.41 – 21.82	20.4

n *) – number of examined series of production
m *) – mean mass of capsule or tablet

Table 5. The manganese and iron content in supplements of diet stimulating human immune system, μg.ml^{-1}; intake of manganese and iron with maximal of daily dose (μg)

No	Preparation name	Manganese (Mn) content (μg.ml^{-1})	Intake of Mn with maximal of daily dose (μg of Mn)	Iron (Fe) content (μg.ml^{-1})	Intake of Fe with maximal of daily dose (μg of Fe)
		Arithmetic mean (M), standard deviation (SD) and content - (min. - max.)			
1.	Aloe vera – aloe juice, n*) = 5, v*) = 50 ml	0.54 ± 0.27 0.30 – 0.77	27.00	0.50 ± 0.13 0.35 – 0.62	25.00
2.	Aloes - aloe juice with pulp pieces –gel, n = 5, v= 50 ml	1.58 ± 0.29 1.14 – 1.77	79.00	1.04 ± 0.15 0.85 – 1.17	52.00
3.	Aloes Activ – aloe juice with extract of ginseng, n = 5, v = 50 ml	0.04 ± 0.01 0.03 – 0.04	2.00	0.30 ± 0.04 0.24 – 0.32	15.00
4.	Aloes Young – aloe juice with cranberry n = 5, v = 60 ml	0.53 ± 0.06 0.46 – 0.60	31.80	0.35 ± 0.08 0.28 – 0.45	21.00
5.	Bodymax Tonik, n = 5, v = 50 ml	0.04 ± 0.01 0.03 – 0.04	2.00	0.19 ± 0.04 0.16 – 0.25	9.50
6.	Ginsenging 400 - extract of ginseng with honey, n = 3, v = 10 ml	0.11 ± 0.03 0.09 – 0.15	1.10	1.40 ± 0.38 1.05 – 1.80	14.00
7.	Ginsenol, n = 3, v = 5 ml	0.32 ± 0.03 0.30 – 0.34	1.60	0.18 ± 0.01 0.17 – 0.19	0.90
8.	Noni - juice of noni fruits, n = 5, v = 40 ml	0.69 ± 0.07 0.60 – 0.75	27.60	11.74 ± 3.03 8.72 – 14.66	470
9.	Noni-vita - juice of noni fruits, n=5, v = 40 ml	0.80 ± 0.07 0.72 – 0.87	32.00	30.59 ± 2.86 26.47 – 32.89	1224
10.	Noni Plus - juice of noni and cranberry fruits, n = 3, v = 40 ml	0.54 ± 0.03 0.51 – 0.57	21.60	1.85 ± 0.16 1.69 – 2.00	74.00

n *) – number of examined series of production;
v*) – maximal of daily dose of supplement, ml;

M a n g a n e s e. In the examined dietary supplements in the form of capsules and pills, the smallest content of the manganese was stated in Acerola Plus, on average 0.16 μg/g. Supplements with the marine alga (Spirulina platensis) contained maximum amounts of this element, on average 57.21 μg/g (Spirulina Pacifica preparation). Preparation with the powdered root of ginseng produced in Cracow Herbalist's Plant of "Herbapol" contained amounts close to the manganese, on average 53.34 μg/g. Supplements with the marine alga (Spirulina platensis) applied in the maximum daily

dose, can provide to the organism, on average from 174.45 µg up to 171.66 µg of the manganese.

Supplements in the liquid form contained, on average from 0.04 µg/ml (Aloes Activ and Bodymax Tonik) to 1.58 µg of the manganese in 1 ml of the juice of bitter aloe with the pulp (Aloe vera - gel). This preparation, applied in the maximum recommended daily dose, may provide the organism on average with 79.00 µg of the manganese.

The content of the manganese in preparations examined by Leśniewicz et al. ranged on average from 16.9 µg/g to 136 µg/g [11]. Diversified amounts of this element were stated in other publications: in slimming preparations - from 0.6 µg/g (Bio C.L.A.) to 30.5 µg/g (Slim Trio), and in other supplements assisting dieting to 1033.4 µg/g (Nivelazione - capsules for the night) [1, 4]; in preparations from phytoestrogens from 0.08 µg/g (Climea capsules) to 13.86 µg/g (Menofem) [2]. In supplements containing antioxidants they stated on average 1091 µg of the manganese in 1 g of preparation [3].

Preparations of the plant origin applied in "Chinese Medicine" contained from 24.8 µg/g to 665.6 µg/g of this element [5].

I r o n. Contents of iron in the dietary supplements in the form of capsules and pills were also diversified – and ranged, on average from 3.43 µg/g (Acerola Plus) to 2262 µg/g in Spirulina Pacifica preparation (1131 µg in one pill). Remaining examined supplements with the Spirulina platensis, also contained considerable quantities of this element: 1302 µg/g (Spirulina Hawajska) and 1068 µg/g (Spirulina „Walmark"). Supplements with spirulina which were studied, can provide the organism with the maximum twenty-four hour dose, on average from 4603 µg to 6786 µg of iron.

In the liquid dietary supplements, on average from 0.18 µg/ml (Ginsenol) and 0.19 µg/ml (Bodymax Tonic water) to 30.59 µg of iron in 1 ml of the juice of noni fruits (Noni-vita) were stated. The maximum daily portion recommended for the consumption of this juice in the form of Noni-vita preparation, may provide the organism on average with 1224 µg of iron.

Recommended consumption of iron for adults according to new norms was set on level 10 mg for men and women (above 50 years of age) [9]. For younger women it is 18 mg. It was stated that dietary supplement containing the marine alga (Spirulina platensis) can constitute the important source of iron for a man. Spirulina Pacifica preparation applied in the maximum twenty-four hour dose can deliver 68% of the recommended norm to this element, and for women up to 50 years of age - RDA 38% to iron.

In the scientific literature it is possible to find scarce publications on the level of iron in supplements without the addition of minerals. Leśniewicz et al. in medicinal preparations of the plant origin stated, on average from 91.8 µg/g (Alliofil) to 1032 µg of this element in 1 g of „Tabletki uspokajające"["comforting tablets"], and in preparations with phytoestrogens- from 22.0 µg/g to 1446 µg/g [2, 11]. Preparations aiding the dieting contained to 1229 µg/g (Fat Burner), and other dietary supplements assisting dieting – up to 10272 µg of iron in 1 g of capsules for the night - Nivelazione [1, 4]. In the dietary supplements containing antioxidants, amounts of iron were stated, on average from 1.26 µg/g to 2742 µg/g of preparation [3].

CONCLUSIONS

1. Levels of manganese and iron in the examined dietary supplements presented a wide range of content; depending on form and composition of preparation.

2. Special predispositions of some plant raw materials were observed (of marine alga – spirulina and of root of ginseng) for the accumulation of determined microelements.

3. Studied dietary supplements (in forms of capsules and pills and fluid essences and juices), while applying them, can supplement the daily demand of the organism for manganese and iron, to a maximum of about RDA 4% of the manganese (spirulina preparations) and about 40-50 % RDA for iron (spirulina preparations).

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SUMMARY

In the recent years a growth of an interest in preparations (dietary supplements) which supplement the everyday diet with necessary nutritious and mineral ingredients has been observed. Supplements allow to improve irrational dietary practices, to lower the risk of appearing of illnesses (preventive action), and they also may support therapy. Raw materials of the plant origin being the source of all sorts of biologically active compounds are the components of some of these preparations. Plants contain also a considerable quantity of mineral elements. The purpose of this study was the evaluation of the level of manganese and iron (microelements important for the organism) in selected dietary supplements stimulating the immune system of the human body. The study material was the supplements in the form of capsules and pills - (Acerola Plus, Cat's Claw, Maca, Maca 50 Plus, Spirulina, Spirulina Hawajska, Spirulina Pacifica, Vilcacora, Żeń-szeń from „Herbapol" Herbal Plant in Kraków, Żeń-szeń – Ginseng (KRKA), Żeń-szeń (Naturell), Żeń-szeń koreański (Walmark), Żeń-szeń (Vita-Complex) and liquid preparations - (Aloes - juice, Aloe Vera drinking gel, Aloes Activ, Aloes Young, Bodymax Tonik, Ginsengin 400, Ginsenol, Noni - juice, Noni-vita, Noni Plus). Samples (3-5 samples of different sort of series of the production of each of supplement) were mineralized "dry" at the temperature of 450˚C. Levels of manganese and iron were determined directly from the mineralisate applying adequate parameters of analysis in SOLAAR M5 flame atomic absorption spectrometer. In the dietary supplements in the form of capsules and pills the content of manganese fluctuated on average from 0.16 μg/g (Acerola Plus) to 57.21 μg/g (Spirulina Pacifica) and of iron from 3.43 μg/g (Acerola Plus) to 2262 μg/g (Spirulina Pacifica). In the liquid dietary supplements the values were: of manganese up to 1.58 μg/ml in preparation Aloes – drinking gel and of iron up to 30.60 μg/ml in the juice from noni fruit - Noni-vita. Contents of the studied elements in selected supplements depended on form and composition of preparation. Special predispositions of some plant raw materials were observed, in particular of marine alga - spirulina, as for the accumulation of manganese and iron. Applying dietary supplements containig spirulina, in the maximum twenty-four hour dose - according to indications of the producer, we can provide the amounts of manganese into the organism constituting the recommended 4% of its daily talking and the amount of iron of about 40 - 50% of the recommended daily consumption of this element.

Keywords: manganese, iron, dietary supplements, flame atomic absorption spectrometry

STRESZCZENIE

W ostatnich latach obserwuje się wzrost zainteresowania preparatami (suplementy diety), które uzupełniają codzienną dietę w niezbędne składniki odżywcze i mineralne. Suplementy pozwalają poprawiać nieracjonalny sposób żywienia, zmniejszać ryzyko występowania chorób (działanie profilaktyczne), a także wspomagać terapię. W skład niektórych preparatów wchodzą surowce pochodzenia roślinnego będące źródłem różnych związków biologicznie aktywnych. Rośliny zawierają także znaczną ilość składników mineralnych. Celem pracy była ocena poziomu manganu i żelaza (ważnych dla organizmu mikroelementów) w wybranych suplementach diety stymulujących system odpornościowy organizmu człowieka. Materiał do badań stanowiły suplementy w postaci kapsułek i tabletek - (Acerola Plus, Cat's Claw, Maca, Maca 50 Plus, Spirulina, Spirulina Hawajska, Spirulina Pacifica, Vilcacora, Żeń-szeń z Zakładu Zielarskiego „Herbapol" w Krakowie, Żeń-szeń – Ginseng (KRKA), Żeń-szeń (Naturell), Żeń-szeń koreański (Walmark), Żeń-szeń (Vita-Complex) oraz preparaty płynne - (Aloes - sok, Aloe Vera drinking gel, Aloes Activ, Aloes Young, Bodymax Tonik, Ginsengin 400, Ginsenol, Noni - sok, Noni-vita, Noni Plus). Próbki (po 3-5 różnych serii produkcji każdego z suplementów) mineralizowano „na sucho" w temp. 450˚C. Zawartość manganu i żelaza oznaczono bezpośrednio z mineralizatu w spektrometrze absorpcji atomowej SOLAAR M5 stosując odpowiednie dla danego pierwiastka parametry analizy. W suplementach diety w postaci kapsułek i tabletek zawartość manganu wahała się średnio od 0,16 µg/g (Acerola Plus) do 57,21 µg/g (Spirulina Pacifica) i żelaza od 3,43 µg/g (Acerola Plus) do 2262 µg/g (Spirulina Pacifica). W płynnych suplementach diety stwierdzono: ilości manganu do 1,58 µg/ml w preparacie Aloes – żel do picia i żelaza do 30,60 µg/ml w soku z owoców noni - Noni-vita. Zawartości badanych pierwiastków w wybranych suplementach zależały od postaci i składu preparatu. Zaobserwowano szczególne predyspozycje niektórych surowców roślinnych, w szczególności algi morskiej – spiruliny, do kumulacji manganu i żelaza. Stosując suplementy diety zawierające spirulinę, w maksymalnej dobowej dawce - według wskazań producenta, możemy wprowadzić do organizmu ilości manganu stanowiące około 4% zalecanego jego dziennego pobrania i ilości żelaza stanowiące około 40 – 50% zalecanego dziennego spożycia tego pierwiastka.

Słowa kluczowe: mangan, żelazo, suplementy diety, płomieniowa absorpcyjna spektrometria atomowa