

SAMPLE PRESENT



ELEMENTAL  
HAIR  
ANALYSIS  
FOR ANIMALS

**Wanessa**

**Name:** Wanessa

**Date of the test:** 2021-02-17

**Horse-owner:**  
Ania

**Test code:** AABCCNNW



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## WHAT YOU WILL FIND IN THE RESULT







The result contains information about the proportions and concentrations of nutritional and toxic elements in the body of the test horse. Both the levels of individual micro and macro elements as well as the degree of the body's load of toxic elements reflect the state of biochemical balance, which is crucial for maintaining health and a good body condition.

The reference values to which the elements indicated in the study refer were developed for the needs of EHAA by a research team from the University of Agriculture in Krakow and based on thorough comparative studies. The content of minerals is expressed in ppm.







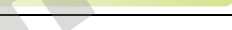
The EHAA result also includes a descriptive part, based on the reports provided by employees of the University of Agriculture. The information contained in it allows you to better understand the EHAA result and to introduce appropriate modifications to the diet of the patient in question.

## EHAA TEST RESULT

### CONCENTRATION OF NUTRITIONAL ELEMENTS – MACRO-ELEMENTS









Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Sulfur(S)	30 061,50	34 975,54 – 36 228,20			
Calcium(Ca)	1 574,35	1 393,15 – 1 594,84			
Phosphorus(P)	322,66	382,63 – 414,74			
Sodium(Na)	777,21	192,69 – 269,27			
Potassium(K)	1 174,39	531,38 – 1 212,69			
Magnesium(Mg)	211,60	489,20 – 593,63			

### CONCENTRATION OF NUTRITIONAL ELEMENTS – MICRO-ELEMENTS








Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Silicon(Si)	342,89	519,81 – 665,36			
Zinc(Zn)	110,71	137,76 – 153,01			
Iron(Fe)	78,06	196,87 – 254,60			
Copper(Cu)	4,92	4,75 – 5,30			
Manganese(Mn)	3,76	16,36 – 23,55			
Selenium(Se)	1,74	1,13 – 1,42			
Chrome(Cr)	0,66	0,57 – 0,76			



## CONCENTRATION OF TOXIC ELEMENTS

Element	Patient's result (ppm)	Maximum value	EXCESS
Aluminium(Al)	<b>143,86</b>	382,86	
Barium(Ba)	<b>1,80</b>	4,20	
Cadmium(Cd)	<b>0,01</b>	0,13	
Lithium(Li)	<b>0,12</b>	0,20	
Nickel(Ni)	<b>0,59</b>	0,80	
Lead(Pb)	<b>0,01</b>	1,67	
Strontium(Sr)	<b>3,05</b>	4,92	
Vanadium(V)	<b>0,43</b>	0,65	

## PROPORTION OF NUTRITIONAL ELEMENTS

Proportion	Patient's result (ppm)	Normal value	TOO LOW	WITHIN NORM	TOO HIGH
Calcium(Ca) Phosphorus(P)	<b>4,88</b>	3,99 – 4,87			
Magnesium(Mg) Calcium(Ca)	<b>0,13</b>	0,25 – 0,28			
Zinc(Zn) Copper(Cu)	<b>22,50</b>	30,83 – 36,59			
Iron(Fe) Copper(Cu)	<b>15,87</b>	35,34 – 47,22			
Copper(Cu) Manganese(Mn)	<b>1,31</b>	0,21 – 0,32			
Iron(Fe) Zinc(Zn)	<b>0,71</b>	1,08 – 1,51			
Sodium(Na) Potassium(K)	<b>0,66</b>	0,21 – 0,40			

Every organism is exposed to toxic elements that enter it from the external environment. The presence of such elements is therefore inevitable and, in excess, dangerous for the horse's health.

The study was performed using the ICP-OES technique - optical emission spectrometry with excitation in inductively coupled plasma. Analyzed on the Avio 200 PerkinElmer spectrometer by the analyst technician, PetsDiag laboratory:

*Janicka*  
**Janicka**  
 starszy technik analityki



# EHAA RESULT – DESCRIPTION








## I. APPEARANCE, ACTIVITY AND CONDITION

### Hair

The proper condition of the horse's hair coat depends on the correct level of numerous minerals. Depigmentation, dullness, as well as hair loss or loss of gloss, are symptoms that may result from an excess or deficiency of specific nutritional elements, as well as the presence of heavy metals.

- **Copper** - low levels cause depigmentation and matting of the coat.
- **Zinc** - even a slight deficiency contributes to hair loss.
- **Selenium** - excess contributes to the loss of hair from the mane and tail.
- **Calcium, Phosphorus, Magnesium, and Sulfur** - are the building materials of hair. Their deficiency contributes to a decrease in the overall condition and appearance of the coat.

Your horse's EHAA result showed:







Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Copper(Cu)	4,92	4,75 – 5,30			
Zinc(Zn)	110,71	137,76 – 153,01			
Selenium(Se)	1,74	1,13 – 1,42			
Calcium(Ca)	1 574,35	1 393,15 – 1 594,84			
Phosphorus(P)	322,66	382,63 – 414,74			
Magnesium(Mg)	211,60	489,20 – 593,63			
Sulfur(S)	30 061,50	34 975,54 – 36 228,20			

### Skin

Mineral balance has a huge impact on the health and condition of the horse's skin. Dryness, keratosis, difficult wound healing and many other problems are largely the result of mineral deficiencies in the diet that must be supplemented.

- **Zinc** - the deficiency leads to skin problems such as parakeratosis (pathological skin damage), hinders wound healing and disrupts the work of the sebaceous glands.
- **Copper** - low concentration reduces the production of collagen, causes depigmentation and extends the wound healing process.
- **Calcium, Phosphorus, Magnesium and Sulfur** - are the building materials of the skin. Their deficiency contributes to the decline in its overall condition and appearance.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Copper(Cu)	4,92	4,75 – 5,30			
Zinc(Zn)	110,71	137,76 – 153,01			
Calcium(Ca)	1 574,35	1 393,15 – 1 594,84			
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## Bones and joints

Both the deficiency and excess of minerals can lead to problems with the osteoarticular system and, consequently, make it difficult for the horse to move. Abnormal levels of elements in the body also cause dental problems that should be treated not only symptomatically but also causally.

- **Selenium** - excess can contribute to the separation of the hoof capsule and lameness.
- **Manganese** - low concentration causes disturbances in the ossification process and is also the cause of movement disorders.
- **Zinc** - deficiency leads to hoof deformation.
- **Calcium, Phosphorus, Magnesium, Copper** - they are the building material of bones and teeth. Their deficiency creates a risk of bone fragility and other diseases of the locomotor system.
- **Cadmium** - poisoning can lead to osteomalacia, a metabolic bone disease.
- **Lead** - poisoning may contribute to the development of osteoporosis.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Copper(Cu)	4,92	4,75 – 5,30			
Zinc(Zn)	110,71	137,76 – 153,01			
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Magnesium(Mg)	211,60	489,20 – 593,63			

Element	Patient's result (ppm)	Maximum value	EXCESS
Cadmium(Cd)	0,01	0,13	
Lead(Pb)	0,01	1,67	

## Muscles

A horse's muscular system accounts for about half of his entire body weight. The quality and condition of muscle tissue also largely depend on the appropriate amount of nutritional elements necessary for its proper structure and functioning.

- **Calcium and Phosphorus** - incorrect concentration disturbs the building function and proper course of metabolism in muscles and also leads to their general weakening. The correct level of calcium activates the muscles to work, and phosphorus ensures the efficient course of energy processes necessary for muscle cells during movement.
- **Selenium** - an antioxidant important for the development of muscle mass, especially in the nutrition of horses used intensively. Its deficiency reduces the ability of the muscles to defend against the harmful effects of free radicals, it can also cause digestive muscular dystrophy, the so-called diseases of white muscles as well as paralytic myositis.
- **Magnesium** - low concentration causes, among others muscle spasms and convulsions.
- **Potassium and Sodium** - the deficiency of electrolytes disrupts the proper functioning of the muscles, causes dehydration and weakness, thus reducing muscle strength.
- **Manganese** - too low a level may result in thickening of the hocks.
- **Zinc** - deficiency causes muscle weakness and tendon contractures.
- **Lead** - poisoning can cause seizures.



Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Selenium(Se)	1,74	1,13 – 1,42			
Manganese(Mn)	3,76	16,36 – 23,55			
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Sodium(Na)	777,21	192,69 – 269,27			
Zinc(Zn)	110,71	137,76 – 153,01			

Element	Patient's result (ppm)	Maximum value	EXCESS
Lead(Pb)	0,01	1,67	

## Immunity and condition

Keeping a horse healthy and fit requires a proper diet and supplementation. A strong immune system protects the horse from diverse harmful factors and from the illnesses they may generate. How strong such immunity is, will depend on the body's supply of nutrients.

- **Selenium** - deficiency lowers the body's resistance.
- **Zinc, Copper and Iron** - low levels increase susceptibility to infections.
- **Iron** - low concentration reduces the body's efficiency.
- **Sodium** - deficiency reduces the use of protein and energy from food, lowers appetite and causes a decline in condition.
- **Sodium and Potassium** - deficiency causes general weakness.
- **Vanadium** - poisoning can go to the extreme of exhaustion.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Zinc(Zn)	110,71	137,76 – 153,01			
Selenium(Se)	1,74	1,13 – 1,42			
Magnesium(Mg)	211,60	489,20 – 593,63			
Copper(Cu)	4,92	4,75 – 5,30			
Potassium(K)	1 174,39	531,38 – 1 212,69			
Sodium(Na)	777,21	192,69 – 269,27			
Iron(Fe)	78,06	196,87 – 254,60			

Element	Patient's result (ppm)	Maximum value	EXCESS
Vanadium(V)	0,43	0,65	



## Growth

Proper weight gain at various stages of a horse's development also depends on a properly balanced diet, i.e. satisfying his needs for nutrients. Any nutritional deficiencies inhibit the proper growth and development of the body. Hence, the following elements, in terms of growth and development, are especially important for foals.

- **Selenium, Manganese, Copper** - deficiency causes poor weight gain.
- **Chromium and Potassium** - deficiency can cause weight loss.
- **Iron and Phosphorus** - deficiency affects the poor growth of young horses.
- **Cadmium, Nickel and Vanadium** - poisoning leads to reduced growth.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Chrome(Cr)	0,66	0,57 – 0,76			
Magnesium(Mg)	211,60	489,20 – 593,63			
Copper(Cu)	4,92	4,75 – 5,30			
Selenium(Se)	1,74	1,13 – 1,42			
Potassium(K)	1 174,39	531,38 – 1 212,69			
Iron(Fe)	78,06	196,87 – 254,60			
Phosphorus(P)	322,66	382,63 – 414,74			

Element	Patient's result (ppm)	Maximum value	EXCESS
Cadmium(Cd)	0,01	0,13	
Nickel(Ni)	0,59	0,80	
Vanadium(V)	0,43	0,65	






## The functioning of the digestive system




The levels of elements in the horse's body may also reflect digestive discomfort. Problems with appetite or proper stools may be a direct or indirect consequence of elemental imbalance. However, they always require nutrition that includes an appropriate vitamin and mineral composition.

- **Phosphorus** - excess contributes to the formation of intestinal stones.
- **Sodium** - too high a level causes pollakiuria and diarrhea.
- **Sodium, Potassium, Chromium** - deficiency lowers appetite.
- **Copper** - deficiency can cause diarrhea.
- **Cadmium** - poisoning leads to digestive problems.
- **Lithium, Vanadium** - poisoning may cause diarrhea.



Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Chrome(Cr)	0,66	0,57 – 0,76			
Phosphorus(P)	322,66	382,63 – 414,74			
Potassium(K)	1 174,39	531,38 – 1 212,69			
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Element	Patient's result (ppm)	Maximum value	EXCESS
Cadmium(Cd)	0,01	0,13	
Lithium(Li)	0,12	0,20	
Vanadium(V)	0,43	0,65	



## Breeding activity

Healthy horses should be used for breeding. Also in this case, for the mating to be successful, it is necessary to provide the horse's body with the right amount of minerals necessary to maintain the reproductive capacity at the highest level possible.

- **Zinc** - deficiency reduces the quality of semen, concentration and sperm mobility decreased.
- **Selenium** - a low level reduces the ability to reproduce. In stallions it lowers sex drive and worsens sperm quality, and in mares it causes infertility.
- **Manganese** - disturbed levels have a negative impact on breeding capacity.
- **Magnesium** - deficiency lowers reproductive parameters.
- **Iron** - deficiency affects oestrus disturbances in mares.
- **Cadmium and Lead** - poisoning with these elements leads to reproductive disorders.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Zinc(Zn)	110,71	137,76 – 153,01			
Selenium(Se)	1,74	1,13 – 1,42			
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Element	Patient's result (ppm)	Maximum value	EXCESS
Cadmium(Cd)	0,01	0,13	
Lead(Pb)	0,01	1,67	














## Temperament

A horse's diet can also influence his behavior. Excessive nervousness, anxiety, or vice versa – apathy and lethargy, may indicate not only disturbances in nutrient concentrations but also the horse's body being overloaded by toxic elements.

- **Calcium, Phosphorus, Sodium and Potassium** - their abnormal concentration disrupts the functioning of the entire nervous system.
- **Magnesium** - is responsible for the central nervous system. Too low a level causes fits, overexcitement, and rapid breathing.
- **Copper** - the correct level is essential in the process of creating nervous tissue.
- **Zinc** - a deficiency may reduce concentration.
- **Lithium** - poisoning can lead to depression.
- **Lead** - poisoning can cause hyperactivity.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Phosphorus(P)	<b>322,66</b>	382,63 – 414,74			
Magnesium(Mg)	<b>211,60</b>	489,20 – 593,63			
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Calcium(Ca)	<b>1 574,35</b>	1 393,15 – 1 594,84			
Zinc(Zn)	<b>110,71</b>	137,76 – 153,01			

Element	Patient's result (ppm)	Maximum value	EXCESS
Lithium(Li)	<b>0,12</b>	0,20	
Lead(Pb)	<b>0,01</b>	1,67	





## II. ASSESSMENT OF BIOCHEMICAL NEEDS

### MACRO-ELEMENTS

#### Calcium and Phosphorus

Two of the most important macronutrients are Calcium (Ca) and Phosphorus (P). Apart from their building function, these elements are involved in blood clotting, the transmission of nerve stimuli, and energy changes in muscles. The ratio of these elements to each other is also important because too much phosphorus reduces the absorption of calcium. The proper absorption of calcium in the intestines is also reduced by the lack of an adequate amount of the active form of vitamin D.

Your horse's EHA result showed:


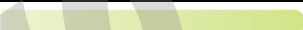
Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Calcium(Ca)	1 574,35	1 393,15 – 1 594,84			
Phosphorus(P)	322,66	382,63 – 414,74			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Calcium(Ca)	<ul style="list-style-type: none"> <li>proper functioning of the skeletal and nervous systems</li> <li>energy changes in muscles</li> <li>blood clotting</li> </ul>	<ul style="list-style-type: none"> <li>during intensive training, stress, transport</li> <li>increased risk of bone fragility</li> <li>increased risk of bone fragility</li> </ul>	<ul style="list-style-type: none"> <li>reduces phosphorus digestibility</li> <li>excreted by the kidneys</li> </ul>	<ul style="list-style-type: none"> <li>grass</li> <li>legumes</li> </ul>	25-35 g important ratio of calcium to phosphorus: from 1:1 to 3:1
Phosphorus(P)	<ul style="list-style-type: none"> <li>a bone component</li> <li>ATP and nucleic acid synthesis</li> </ul>	<ul style="list-style-type: none"> <li>rarely</li> </ul>	<ul style="list-style-type: none"> <li>limitation of calcium absorption</li> <li>formation of intestinal stones</li> </ul>	<ul style="list-style-type: none"> <li>cereals</li> <li>wheat bran</li> </ul>	15-18 g

#### Sodium and Potassium

Speaking of electrolytes, Sodium (Na) and Potassium (K) are distinguished in a horse's diet. These elements are behind a series of processes such as maintenance of acid-base balance, regulation of osmotic pressure, and membrane transport. The excess of these elements is excreted in the urine. Horses can easily compensate for the shortage with salt licks.

Your horse's EHA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Sodium(Na)	777,21	192,69 – 269,27			
Potassium(K)	1 174,39	531,38 – 1 212,69			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Sodium(Na)	<ul style="list-style-type: none"> <li>proper functioning of the nervous system</li> <li>regulation of osmotic pressure and bodily fluids</li> </ul>	<ul style="list-style-type: none"> <li>reduces the use of protein and energy from the food</li> <li>reduces appetite</li> <li>deterioration of the condition, weakness</li> </ul>	<ul style="list-style-type: none"> <li>causes increased urine output, diarrhea</li> <li>increases potassium deficiency</li> </ul>	<ul style="list-style-type: none"> <li>feed salt (licks)</li> <li>molasses, pulp</li> </ul>	41 g
Potassium(K)	<ul style="list-style-type: none"> <li>proper work of muscles and heart</li> <li>acid-base balance</li> <li>stimulation of nerve receptors</li> </ul>	<ul style="list-style-type: none"> <li>disorders of muscles and heart</li> <li>weakness</li> <li>lack of appetite</li> </ul>	<ul style="list-style-type: none"> <li>tolerated</li> <li>increase in water intake and urine excretion at extreme doses (&gt; 500 mg/kg b.w./d)</li> </ul>	<ul style="list-style-type: none"> <li>oil plants</li> <li>grass</li> <li>legumes</li> <li>molasses</li> </ul>	15-18 g

## Sulfur

Sulfur is contained in sulfur amino acids. Deficiencies practically do not occur and if they are found, they are caused by the wrong amino acid composition of the food ration.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Sulfur(S)	30 061,50	34 975,54 – 36 228,20			


	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Sulfur(S)	<ul style="list-style-type: none"> <li>amino acid synthesis</li> <li>enzyme activation</li> <li>supporting the regeneration of joints</li> <li>insulin component</li> </ul>	<ul style="list-style-type: none"> <li>weakened hooves</li> <li>hair loss</li> <li>rough hair</li> </ul>	<ul style="list-style-type: none"> <li>weaker selenium absorption</li> </ul>	<ul style="list-style-type: none"> <li>molasses</li> <li>alfalfa, hay</li> <li>MSM</li> </ul>	18,8 g



## Magnesium

Another element – Magnesium (Mg) is an enzyme activator. It participates in cell respiration and muscle contractions. About 60% of magnesium is contained in bones and 30% in muscles. It is a very important macronutrient in the nutrition of sports horses that are prone to stress, fatigue, and infections. It supports better concentration and also helps reduce excitability and irritability.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Magnesium(Mg)	211,60	489,20 – 593,63			


ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Magnesium(Mg) <ul style="list-style-type: none"> <li>• component of enzymes</li> <li>• muscle contraction</li> <li>• cellular respiration</li> </ul>	<ul style="list-style-type: none"> <li>• rapid breathing</li> <li>• excitement</li> <li>• seizures</li> <li>• muscle cramps</li> </ul>	<ul style="list-style-type: none"> <li>• small amounts excreted in sweat</li> <li>• no negative consequences</li> </ul>	<ul style="list-style-type: none"> <li>• wheat bran</li> <li>• cereals</li> <li>• legume hay</li> </ul>	15 g

## MICRO-ELEMENTS

### Iron

The most important micronutrients found in horses are Iron (Fe), Copper (Cu), Zinc (Zn) and Selenium (Se). Iron is a part of hemoglobin, myoglobin, most often in combination with proteins. The deficiency of this element in horses usually does not occur, as 90% of it is recovered from the breakdown of hemoglobin. Possible shortages are covered by feeding with feed, such as bran or plants.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Iron(Fe)	78,06	196,87 – 254,60			


ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Iron(Fe) <ul style="list-style-type: none"> <li>• oxygen transport (hemoglobin)</li> </ul>	<ul style="list-style-type: none"> <li>• loss with sweat, but 90% recovered when decomposing hemoglobin</li> <li>• anemia</li> <li>• decline in performance and resilience</li> </ul>	<ul style="list-style-type: none"> <li>• excess in the dose causes reduced use of phosphorus, copper, manganese and zinc</li> </ul>	<ul style="list-style-type: none"> <li>• beet pulp</li> <li>• legume pulp</li> <li>• grass</li> </ul>	450-500 mg



## Copper

Copper is one of many metalloproteins. It is responsible for the elasticity of connective tissue, carrying iron to the bone marrow and turning it into hemoglobin, the maturation of erythrocytes, and many other functions. The most important symptom of copper deficiency is the change in the appearance of the coat, its depigmentation, and clear dullness. Cu deficiencies are observed in horses fed with fodder collected from light, peat, and muck soils. However, the excess of Cu is perfectly tolerated by horses (even up to 500 mg/kg DM of the ration). The research by Xuezhuang Wu et al. [2015] indicates that copper may negatively affect the activity of certain enzymes in the body, resulting in reduced digestibility of protein and fiber. These authors also show that too much Cu and Zn in a food ration may interfere with the absorption of other minerals, especially Fe. Among the significant correlations shown in the experiment, the influence of an increased Cu uptake on the reduction of Mn absorption was noted.

Your horse's EHAA result showed:


Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Copper(Cu)	4,92	4,75 – 5,30			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Copper(Cu)	<ul style="list-style-type: none"> <li>the formation of nervous tissue, blood</li> <li>development of bone tissue</li> </ul>	<ul style="list-style-type: none"> <li>decrease in growth rate</li> <li>bone disorders</li> <li>damage to blood vessels</li> <li>depigmentation</li> </ul>	<ul style="list-style-type: none"> <li>reduces the absorption of zinc</li> <li>weight loss</li> </ul>	<ul style="list-style-type: none"> <li>wheat bran</li> <li>dried pulp</li> </ul>	125 mg

## Zinc

An important micronutrient in the ration of horses is also zinc - the component of over 100 enzymes. Zinc has a positive effect on the condition of the skin, hair, and hooves. Excessive supplementation does not bring any positive effects. A beneficial effect of this element on the increase in sperm concentration and motility was found. The most important symptoms of zinc deficiency include parakeratosis, i.e. damage to the skin and epidermis, hair loss, poorly healing wounds, deterioration of semen quality. Zinc supplementation is indicated after having found a deficiency. Preparations containing zinc most often also contain magnesium, as the absorption of these two elements is correlated. Proper zinc absorption is difficult in the case of vitamin E deficiency.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Zinc(Zn)	110,71	137,76 – 153,01			


	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Zinc(Zn)	<ul style="list-style-type: none"> <li>component of enzymes</li> <li>affects the condition of the skin and mucous membranes</li> </ul>	<ul style="list-style-type: none"> <li>skin changes</li> <li>susceptibility to infections</li> </ul>	<ul style="list-style-type: none"> <li>usually well tolerated</li> <li>loss of appetite may occur</li> </ul>	<ul style="list-style-type: none"> <li>most of the feeds low in zinc</li> <li>wheat bran</li> </ul>	500 mg



## Selenium

Another essential micronutrient is selenium. It plays an important role in controlling the metabolism of thyroid hormones, maintaining the integrity of cell membranes, growth, and reproduction. Selenium works together with vitamin E, which enhances its antioxidant effect. Vitamin E deficiency multiplies the effects of selenium deficiency. A large selenium deficit may cause low immunity in animals, infertility in mares, and poor growth of foals.

Your horse's EHAA result showed:


Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Selenium(Se)	1,74	1,13 – 1,42			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Selenium(Se)	<ul style="list-style-type: none"> <li>antioxidant</li> <li>influence on cellular immunity</li> <li>works together with vitamin E</li> </ul>	<ul style="list-style-type: none"> <li>when consuming excessive amounts of protein and sulphates</li> <li>weakening of the immune system</li> <li>alimentary muscular dystrophy</li> </ul>	<ul style="list-style-type: none"> <li>toxic</li> <li>poisoning</li> <li>separation of the hoof can</li> <li>hair loss</li> </ul>	<ul style="list-style-type: none"> <li>flax seeds</li> <li>wheat bran</li> <li>the level of selenium in feed depends on the soil conditions</li> </ul>	1,5 mg

## Silicon

Silicon is a very important trace element. It plays an important role in the functioning of connective tissues, especially bones and cartilage. It provides them with adequate flexibility and resistance. Additionally, silicon is part of the enzyme involved in the synthesis of collagen. Supports the work of joints, prevents fracture of hooves, and accelerates the regeneration of the epidermis.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Silicon(Si)	342,89	519,81 – 665,36			


	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Silicon(Si)	<ul style="list-style-type: none"> <li>supporting the metabolism of connective tissues</li> <li>collagen synthesis</li> </ul>	<ul style="list-style-type: none"> <li>joint problems</li> <li>brittle hoof</li> </ul>	<ul style="list-style-type: none"> <li>in some cases may cause kidney stones</li> </ul>	<ul style="list-style-type: none"> <li>grass</li> </ul>	no generalized data, may be different



## Manganese

Manganese is a micronutrient with a broad spectrum of activity. Responsible, inter alia, for the activation of enzymes involved in the transformation of fats and carbohydrates, is involved in the synthesis of proteins and nucleic acids. It also affects proper bodyweight, the skeleton, and fertility. A significant surplus causes the inhibition of iron absorption.

Your horse's EHAA result showed:


Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Manganese(Mn)	3,76	16,36 – 23,55			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Manganese(Mn)	<ul style="list-style-type: none"> <li>transformation of fats and amino acids</li> <li>in ossification processes</li> </ul>	<ul style="list-style-type: none"> <li>rarely</li> <li>thickening of the hocks</li> <li>lameness</li> </ul>	<ul style="list-style-type: none"> <li>development of anemia symptoms</li> </ul>	<ul style="list-style-type: none"> <li>green fodder</li> <li>hay</li> </ul>	400-500 mg

## Chrome

Chromium is another micronutrient necessary for the proper functioning of the body. It takes part in metabolic processes and supports the action of insulin. It increases the endurance of horses and improves stress resistance.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Normal value	DEFICIT	NORM	EXCESS
Chrome(Cr)	0,66	0,57 – 0,76			

	ROLE	DEFICIENCY	EXCESS	SOURCE	DAILY DEMAND at hard work (500 kg m.c.) (NRC 2007)
Chrome(Cr)	<ul style="list-style-type: none"> <li>metabolism of carbohydrates and fats</li> <li>supports the action of insulin</li> <li>reduces the amount of glucose in the plasma during training</li> </ul>	<ul style="list-style-type: none"> <li>unconfirmed deficiency symptoms (detectable only with the help of appropriate diagnostics)</li> </ul>	<ul style="list-style-type: none"> <li>toxic</li> <li>impaired growth</li> <li>liver and kidney damage</li> <li>nerve degeneration</li> </ul>	<ul style="list-style-type: none"> <li>chromium oxide</li> </ul>	- in the form of oxide: 300 mg/kg DM



## TOXIC ELEMENTS

The main threat posed by toxic minerals is due to their antagonistic nature with micro and macro elements. This means that if the animal is heavily loaded with heavy metals, these can block the absorption of the elements necessary for proper development and, consequently, cause serious illnesses.

### Sources of heavy metals

Most heavy metals are found naturally in trace amounts. Their presence is associated with such processes as volcanic eruptions, evaporation of oceans, forest fires, and rock weathering. Usually, they do not negatively affect the natural environment. However, the progressive urbanization and significant industrialization contributed to an increase in the concentration of heavy metals in nature. The sources that pollute the ecosystem with toxic elements include heat, power plants, steel mills, internal combustion engines, chemical industry, coal-fired furnaces in homes, waste incineration, and incorrect storage of animal excrements in farms. Thus, heavy metals that enter the atmosphere, water, and soil, are deposited on the above-ground parts of plants and are taken up by plant root systems. Therefore, it is important to prevent animals from grazing near busy roads, heat and power plants, and other industrial areas.

### Detoxification

Heavy metals are stored by the body in the liver and spleen, as well as in bones and hair. The toxic elements gradually shift from the body into the blood, which in turn is purified by the liver or kidneys. Therefore, detoxification is a very slow process.


Heavy metals are stored by the body in the liver and spleen, as well as in bones and hair. The amount of toxic elements in the blood is kept relatively constant since it is purified by the liver or by the kidneys. After the removal of heavy metals from the blood, subsequent portions of the blood are stored in the body. Therefore, detoxification is a very slow process.

The best way to reduce the risk of heavy metal poisoning is to locate and eliminate its source. You should also take care of a properly balanced diet. A malnourished organism is more exposed to the action of toxic elements. The deficiency of some micronutrients increases the absorption of heavy metals, e.g. calcium deficiency increases the absorption of cadmium and lead. Maintaining a proper level of iron in the body reduces the absorption of heavy metals and reduces the toxic effect of lead on the circulatory system. Zinc has a positive effect on the excretion of arsenic from the body and reduces the absorption of lead. In contrast, antioxidants such as selenium, vitamin C, and vitamin E minimize the oxidative damage caused by heavy metals.

### Aluminum

Aluminum (Al) is one of the most abundant elements on Earth. It is mainly found in soil and plants. In small amounts, it does not pose a risk to horses as it is excreted from the body through the kidneys. However, an excess of this element can damage the liver.


Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Aluminium(Al)	143,86	382,86	

### Cadmium

Cadmium is an element that occurs naturally in small amounts in soil, rocks and ocean waters. It is concentrated in plants that take it from the soil. Cadmium is poorly excreted from the body, so it is very important to avoid its sources. Cadmium poisoning leads to kidney damage, digestive problems, reproductive problems, osteomalacia (metabolic bone disease), and reduced growth.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Cadmium(Cd)	0,01	0,13	






## Lithium

Lithium is an element that occurs in the environment in small amounts. Animals are very rarely exposed to an excess of this metal. Symptoms of poisoning include depression, diarrhea, and ataxia (impaired body coordination).


Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Lithium(Li)	0,12	0,20	

## Nickel

Nickel is present in animal food in very small amounts. Its absorption from the gastrointestinal tract is very low, therefore it is described as a low-toxicity element. An excess of nickel can lead to kidney damage, hyperglycemia, respiratory disorders, and reduced growth.


Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Nickel(Ni)	0,59	0,80	

## Lead

Lead poisoning is one of the most commonly reported poisonings among animals. The danger is not only the lead in the soil but also the lead paints used in old buildings or the water pipes made of lead alloys. The effects of prolonged contact with lead are neurological problems, reproductive problems, kidney damage, osteoporosis, and visual disturbances. In case of acute poisoning, e.g. by swallowing a lead element, salivation, blindness, hyperactivity, and convulsions may occur.


Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Lead(Pb)	0,01	1,67	

## Vanadium

Vanadium is a highly toxic heavy metal. Poisoning with this element leads to decreased growth, diarrhea, dehydration, extreme exhaustion, and hemorrhages.

Your horse's EHAA result showed:

Element	Patient's result (ppm)	Maximum value	EXCESS
Vanadium(V)	0,43	0,65	



## PROPORTIONS OF ELEMENTS

For the assessment of the biochemical balance, the proportions between the elements are as important as the levels of the elements themselves. This is due to the antagonism and synergy between the macro and trace elements. The relationships between the elements directly affect the proper absorption of nutrients by the body, as well as blocking their absorption.

### Ca:P

One of the most important proportions for the body is the ratio of calcium to phosphorus. The excess of phosphorus reduces the absorption of calcium and thus contributes to the deficiency of this element in the body. An improper proportion of these two macronutrients leads to a disturbance of calcium-phosphorus metabolism and results in the development of skeletal diseases.

Your horse's EHA result showed:

Norm for Calcium(Ca)/Phosphorus(P)	3,99 - 4,87
<b>Patient's result</b>	<b>4,88</b>
Proportion	<b>TOO HIGH</b>
Limit consumption	calcium
Increase consumption	phosphorus
<b>Check what are the trends for your Ca:P ratio</b>	
TOO LOW	Limited calcium absorption. Increased risk of bone fragility.
TOO HIGH	Excess calcium – excessive bone mineralization.

### Mg:Ca

Another important proportion is the ratio of magnesium to calcium. These elements act antagonistically. Calcium is involved in the process of muscle contraction, while magnesium is involved in the diastolic and relaxing effect. Disturbance of the proportions between these macronutrients leads to problems with the relaxation of tense muscles and, as a result, the occurrence of soreness, tremors, and cramps.

Your horse's EHA result showed:

Norm for Magnesium(Mg)/Calcium(Ca)	0,25 - 0,28
<b>Patient's result</b>	<b>0,13</b>
Proportion	<b>TOO LOW</b>
Limit consumption	calcium
Increase consumption	magnesium
<b>Check what are the trends for your Mg:Ca ratio</b>	
TOO LOW	Impaired calcium absorption, diarrhea.
TOO HIGH	Malabsorption of magnesium, cramps, muscle tremors.



## Zn:Cu

Copper and zinc are components or activators of many enzymes. They affect the development of bone tissue, maturation of articular cartilage, and also strengthen the body's immunity. Thanks to an appropriate supply of these two micronutrients, it is possible to prevent OCD, i.e. disorders of the growth of articular cartilage in horses. Long-term excess of one of these elements reduces the absorption of the other.

Your horse's EHAA result showed:

Norm for Zinc(Zn)/Copper(Cu)	30,83 - 36,59
<b>Patient's result</b>	<b>22,50</b>
Proportion	<b>TOO LOW</b>
Limit consumption	copper
Increase consumption	zinc
<b>Check what are the trends for your Zn:Cu ratio</b>	
TOO LOW	Limited zinc absorption, liver damage.
TOO HIGH	Limited absorption of copper, weakening of the skeletal system.

## Fe:Cu and Fe:Zn

Both copper and zinc are very important elements. Their excess, however, may negatively affect iron absorption, thus leading to iron deficiency. Too low iron levels in the body can result in anemia, decreased efficiency, and immunity.

Your horse's EHAA result showed:

Norm for Iron(Fe)/Copper(Cu)	35,34 - 47,22
<b>Patient's result</b>	<b>15,87</b>
Proportion	<b>TOO LOW</b>
Limit consumption	copper
Increase consumption	iron
<b>Check what are the trends for your Fe:Cu ratio</b>	
TOO LOW	The excess of copper reduces the absorption of iron – anemia, weakened immunity.
TOO HIGH	The excess of iron limits the use of copper – depigmentation, slower growth rate.

Norm for Iron(Fe)/Zinc(Zn)	1,08 - 1,51
<b>Patient's result</b>	<b>0,71</b>
Proportion	<b>TOO LOW</b>
Limit consumption	zinc
Increase consumption	iron
<b>Check what are the trends for your Fe:Zn ratio</b>	
TOO LOW	Excess zinc reduces the absorption of iron – anemia, weakened immunity.
TOO HIGH	Excess iron limits the use of zinc – skin changes, susceptibility to infections.



## Cu:Mn

Research has shown that an increased copper uptake by horses reduces the absorption of manganese. This can result in the thickening of the hocks as well as lameness.

Your horse's EHAA result showed:

Norm for Copper(Cu)/Manganese(Mn)	0,21 - 0,32
<b>Patient's result</b>	<b>1,31</b>
Proportion	<b>TOO HIGH</b>
Limit consumption	copper
Increase consumption	manganese
<b>Check what are the trends for your Cu:Mn ratio</b>	
TOO LOW	Limited manganese absorption – thickening of hocks, lameness.
TOO HIGH	Possible excess manganese in the body – check the EHAA result for this element. If there is too much of it, symptoms of anemia may appear.

## Na:K

The concentration of electrolytes has a significant influence on the regulation of body fluid homeostasis. Disruption of this balance can lead to many diseases. That is why it is so important to replenish the deficiencies of electrolytes so that their concentration is adequate. Excess K and Na are excreted with urine, therefore deficiency is a much bigger problem. However, too much Na in a food ration may negatively affect the K content in urine. This means that excess sodium limits the absorption of potassium.

Your horse's EHAA result showed:

Norm for Sodium(Na)/Potassium(K)	0,21 - 0,40
<b>Patient's result</b>	<b>0,66</b>
Proportion	<b>TOO HIGH</b>
Limit consumption	sodium
Increase consumption	potassium
<b>Check what are the trends for your Na:K ratio</b>	
TOO LOW	Sodium deficiency – decreased appetite, deterioration of condition.
TOO HIGH	Excess sodium reduces potassium absorption, muscle and heart disorders, decreased appetite.

The demand for individual macro and micronutrients (daily demand for hard work / 500 kg b.w.) was determined on the basis of Nutrient Requirements of Horses: Sixth Revised Edition, 2007.



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