Micro Trace Minerals Laboratory

environmental & clinical laboratory

Röhrenstrasse 20, 91217 Hersbruck, Germany
P.O.Box 4613; Boulder, CO 80306-4613, USA

MINERAL ANALYSIS — Hair

		Lab Number		1H222216	
Doctor/Clinic	Synlab MVZ Leinfelden GmbH			Test Date	19.07.2019
Patient Name	[redacted]	Sex	m	D.O.B.	15.09.1995
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	Acceptable Range	Test Value	
Essential Trace Elements (ppm = mg/kg = mcg/g)			
Chromium (Cr)	0,020 --- 0,210	< 0,020	↓
Cobalt (Co)	0,010 --- 0,300	< 0,005	↓
Copper (Cu)	10,000 --- 41,000	8,734	↓
Iodine (I)	0,050 --- 5,000	0,150	
Iron (Fe)	4,600 --- 17,700	3,720	↓
Manganese (Mn)	0,050 --- 0,920	< 0,050	↓
Molybdenum (Mo)	0,030 --- 1,100	0,022	↓
Selenium (Se)	0,400 --- 1,700	1,617	
Vanadium (V)	0,010 --- 0,200	0,002	↓
Zinc (Zn)	150,000 --- 272,000	316,127	↑
Essential Macroelements (ppm = mg/kg = mcg/g)			
Calcium (Ca)	220,000 --- 1.600,000	383,742	
Magnesium (Mg)	20,000 --- 130,000	19,563	↓
Nonessential Trace Elements (ppm = mg/kg = mcg/g)			
Boron (B)	< 0,840	< 0,250	
Germanium (Ge)	< 1,650	0,005	
Lithium (Li)	< 0,300	< 0,001	
Strontium (Sr)	0,650 --- 6,900	0,733	
Tungsten (W)	< 0,010	< 0,001	
Potentially Toxic Elements (ppm = mg/kg = mcg/g)			
Aluminum (Al)	< 8,000	1,510	
Antimony (Sb)	< 0,300	0,007	

n.n. = not detected, < x = below Detection Limit
Quality control: Dipl. Ing. Friedle, Accreditation: DIN EN ISO 17025; Validation: Dr. E. Blaurock-Busch PhD

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	Acceptable Range	Test Value		
Potentially Toxic Elements (ppm = mg/kg = mcg/g)				
Arsenic-total (As)	< 0,200	0,018		
Barium (Ba)	< 4,640	0,240		
Beryllium (Be)	< 0,100	< 0,010		
Bismuth (Bi)	< 0,200	< 0,010		
Cadmium (Cd)	< 0,200	0,009		
Lead (Pb)	< 3,000	0,367		
Mercury (Hg)	< 0,600	0,194		
Nickel (Ni)	< 1,000	0,076		
Palladium (Pd)	< 0,100	< 0,050		
Platinum (Pt)	< 0,010	n.n.		
Silver (Ag)	< 1,000	5,037	↑	
Thallium (Tl)	< 0,010	< 0,001		
Tin (Sn)	< 0,700	0,032		
Titanium (Ti)	< 1,500	0,040		
Uranium (U)	< 0,100	0,007		
Zirconium (Zr)	< 0,500	< 0,050		

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Your Analysis Determined The Following Mineral Deficiencies And Excesses. Since it is difficult to distinguish treated samples from untreated ones, it is assumed that the spectroanalytical analysis was performed on chemically untreated hair as requested in our laboratory brochure. Chemically treated hair does not provide reliable results and TMI does not assume responsibility for data obtained from treated hair. The information contained in this elemental analysis report is designed as an interpretive adjunct to normally conducted diagnostic procedures. The findings are best viewed in the context of a medical examination and history.

SILVER (Ag):
Silver is nonessential and considered non-toxic; however, Intraprasit et al found markedly elevated silver concentration of the liver in patients with chronic and acute renal failure. Silver is poorly absorbed and mainly excreted via bile and feces, but tissue concentration might be affected by disease or silver exposure. Silver interacts metabolically with copper and selenium. Hill et al showed that silver accentuates copper deficiency by interfering with the copper metabolism. High silver intake or exposure markedly depresses copper levels in tissues. Silver alleviates selenium toxicity, and has been shown to accentuate or induce vitamin E- and selenium deficiency signs by complexing with selenium to prevent the formation or function of the biologically active selenoenzyme, glutathione peroxidase. Silver occurs naturally in low concentrations in soil, plant, and animal tissue.
SOURCE OF EXPOSURE: Environmental contaminants, mining, water treatments and water filter, possibly amalgams and frequent use of silver-coated flatware.
SYMPTOMS: Industrial workers exposed to silver compounds or dust have become argyric, a condition in which silver is deposited in the skin and organ tissue. Argyria symptoms are breathing difficulties, lung and throat irritation, or stomach pain. Some foods in India are coated with a thin silver/aluminum covering called Waraq, an Indian source of silver. Ayurvedic medicines are another source.
THERAPEUTIC CONSIDERATION: Check blood levels to confirm or rule out immediate and acute exposure. DMSA and EDTA show promise in binding and detoxifying excessive silver. Urine metal analysis (pre and post chelation levels) reflect on body's ability to detoxify silver.

COBALT (Co):
Cobalt is part of the Vitamin B12 molecule and is necessary for Vitamin B12 activity and function. Cobalt, which is mainly stored in the liver, activates numerous enzymes, and is excreted in bile. A low dietary intake inhibits fetal development and may reflect a low intake of Vitamin B12.
SOURCES: All animal products, including all meats, fish, cheese, brewer's yeast and yeast extracts. Strict vegetarians (vegans) and those who lack intrinsic factor risk vitamin B12 and cobalt deficiency.
SYMPTOMS: Include pernicious anemia.
THERAPEUTIC CONSIDERATION: Increase vitamin B12 intake and/or consumption of cobalt-rich foods.

CHROMIUM (Cr):
Chromium is an essential trace element that is required for the sugar and fat metabolism, and is part of the glucose tolerance factor. Low chromium levels are often found in the elderly, and pregnant women whose diet is rich in sugars and refined food. Alcoholics and "sugarholics" are often chromium deficient. Deficiency conditions are atherosclerotic plaque, elevated LDL cholesterol levels, increased insulin need, impaired glucose tolerance and a reduced stress response. Deficiency causes are diets rich in highly processed foods, alcoholism, malabsorption, and insufficient intake of B-vitamins.
SOURCES: Whole grains, brewer's yeast, wheat germ, meat and cheeses.
THERAPEUTIC CONSIDERATION: Increase chromium and B-vitamin intake.

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COPPER (Cu):
Copper is an essential metalloenzyme needed for hemoglobin synthesis. It readily complexes with L-amino acids, which facilitate its absorption from the stomach and duodenum. There are three distinct syndromes of deficiency: The first is characterized by anemia and hypoprotenemia and is easily corrected with combined copper and iron supplementation. The second occurs in malnourished infants, receiving high-calorie, low copper diets. Neutropenia, anemia, diarrhea, bone changes and hypocupremia respond to copper therapy. The third is the genetic defect, Menke's syndrome, in which copper is not absorbed from the intestinal mucosa. Results are low blood, liver and hair copper levels.
DEFICIENCY SYMPTOMS: Reduced hemoglobin synthesis, impaired iron metabolism, hypochromia, microcytic anemia, Kwashiorkor, heart and liver disease, poor growth and development, infertility, pancreatic dysfunction, progressive mental deterioration and defective keratinization of hair.
RECOMMENDED DAILY ALLOWANCE (USA): Adults (18 years and older):
900mcg for adults; 1000mcg for pregnant women; 1300mcg for nursing women; 890mcg for adolescents 14-18 years old. Surveys suggest that most Americans consume less than the RDA for copper each day. Vegan diets appear to provide adequate amounts of copper.
SOURCES: Liver, shellfish, kidneys, egg yolk, legumes and nuts.
THERAPEUTIC CONSIDERATION: Deficiency may be due to a lack of metalloenzymes in the liver. Tyramine (tyrosine + amine) increases copper absorption. Citrus fruits increase the absorption in the small intestine, and glutamine increases copper transport into blood and tissues.

IRON (Fe):
Iron is essential for the oxygen transport and utilization. Iron is regulated in the body primarily by absorption rather than by excretion. Gastrointestinal function is important in controlling total body iron. Transferrin is the transport protein for iron in blood. The most common sign of deficiency is anemia. Symptoms include pallor and extreme fatigue, dizziness, decreased immune function, shortness of breath and poor appetite. Predisposing factors to iron deficiency may be excessive intake of copper, manganese, zinc, carbonates, oxalates, phosphates, phytates, antibiotics, coffee, or heavy metal exposure. Excessive blood loss or pregnancy can cause iron deficiency. Daily requirements vary depending on sex, age, and physio-logical status. The RDA is 10-18 mg/day.
SOURCES: Liver, other meats and green leafy vegetables.
THERAPEUTIC CONSIDERATION: Check lead, copper and manganese levels. Check transferrin levels. Prior to iron supplementation, increase intake of vitamin C, B-complex and amino acid to aid absorption.

MAGNESIUM (Mg):
Magnesium is an essential element with both electrolyte and enzyme-activator functions. It is a predominately intracellular cation, needed for cell function. 1% of body magnesium is found in blood, 60% is stored in bone, and the remainder is equally divided between muscle and other soft tissue. The absorption and excretion of magnesium is regulated by the renal system and parathyroid hormones.
HYPOMAGNESIA and MAGNESIUM DEFICIENCY: Rare and generally caused by decreased uptake of magnesium caused by gastrointestinal disorders (steatorrhea, malabsorption syndrome, gut resections, or protein-calorie malnutrition, or increased urinary losses due to renal disease or high rates of production of aldosterone, hyperparathyroidism and diabetes mellitus.
DEFICIENCY SYMPTOMS: Nervous disorders (tix’s, tremors, muscle spasms during mild activity), disorientation, cardiac arrhythmia, fast pulse, gastrointestinal problems, pancreatitis, nausea, vomiting, convulsions, seizures (especially in combination with vitamin B6 deficiency).
SOURCE: All plant foods, fish and seafood.
THERAPEUTIC CONSIDERATION: Hypomagnesia is often a symptom of alcoholism, liver cirrhosis, diabetic acidosis, atherosclerosis. Adequate magnesium reduces blood pressure, prevents circulatory problems, headaches, insomnia, excessive perspiration and has an age-retarding effect. Studies indicate that 500-1000 mg/day reduced overall illness in tested individuals.

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MANGANESE (Mn):
Manganese is a co-factor for many enzymes including arginase, cholinesterase, phosphoglucomutase, pyruvate carboxylase, mitochondrial superoxide dismutase, and several phosphatases, peptidases and glucosyltransferases. It functions with Vitamin K in the formation of prothrombin and is needed for the acetylcholine synthesis. Manganese is mostly stored in the liver and the kidneys. Acute deficiency has never been reported in humans, but symptoms of decreased intake include fatigue, lack of physical endurance, hearing loss, slow growth of fingernails and hair, impaired bone metabolism, impaired glucose metabolism incl. diabetes, reduced fertility, and increased allergic sensitivities. Deficiency symptoms may be caused by dietary insufficiency, intestinal malabsorption, or excess dietary intake of phosphorus, cobalt or magnesium. Manganese is absorbed in the small intestine and excreted in bile and pancreatic secretion.
SOURCES: Liver, kidney, wheat germ, legumes, black tea and nuts.
Uses/Documentation: Manganese is known to be an important nutrient, but manganese deficiency has not been documented in humans, as dietary intakes often exceed dietary requirements. The element may be added to TPN solutions in patients who receive chronic parenteral nutrition.
Contraindications/Precautions:
NOTE: Manganese supplements should be used cautiously in young children, pregnant and lactating females. Do not supplement manganese in these populations without medical supervision.

MOLYBDENUM (Mo):
Molybdenum deficiency has been linked to gout. Low levels in heavy meat eaters reflect digestive disorder, the need for digestive enzymes and dietary changes. Such patients should avoid pork, beef, whole grain and rather eat poultry, fish and other light proteins. Vegetarians should either add some meat to their diet or take molybdenum chelate with B-vitamins, which aid the absorption of molybdenum. Dietary molybdenum is readily absorbed by the intestine and is excreted in the urine and bile.
SOURCES: Whole grains, legumes, leafy vegetables and organ meats. The recommended daily intake is 0.15 - 0.5 mg/day, depending on age and status. Acute deficiency symptoms are unknown in humans. Excess intake of copper, zinc, and sulfates can depress Mo-update, causing disturbances in the uric acid cycle. Low molybdenum levels have been associated with impotency, increased cancer susceptibility, gout, dental caries, defects in the metabolism of sulfur-containing amino acids, and asthma.

VANADIUM (V):
The biological function of this trace element has not been substantiated and deficiency symptoms have not been established; however there is evidence that this trace element influences the glucose metabolism, the sodium/potassium transport and the adrenal catecholamine metabolism. Vanadium appears to catalyze the oxidation of catecholamine’s and inhibit cholesterol synthesis and lower phospholipid levels. It may have anti-diabetic, weight-reducing function and anti-caries effects.
SOURCE: Fiber-rich foods, dill seeds, parsley and black pepper. Vanadium is highly concentrated in vegetable oils.
THERAPEUTIC CONSIDERATION: High fiber diet, use of vegetable oil instead of animal fats.

ZINC (Zn):
High hair tissue levels of this important trace element may be due to long-term overexposure such as long-term supplementation of nutritional zinc or inhaling zinc oxide as in certain industries. High hair zinc levels are also found in the presence of a disturbed hair growth pattern as is seen in people suffering from hair loss. When hair loss is severe, these high hair zinc levels reflect a masked deficiency that is best treated with the supplementation of amino acids, the B-complex vitamins and some zinc. Since zinc uptake can be competitive with that of iron and copper, it is important to evaluate iron and copper tissue levels. When iron and copper levels are low in the presence of high hair zinc levels, a multimineral may be recommended instead of zinc supplementation. The daily recommended intake is 3-30 mg/day, depending on age and status.
THERAPEUTIC CONSIDERATION: Symptoms of zinc overload are similar to zinc deficiency symptoms, causing immune dysfunction and slow wound healing.

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The following nutritional program is aimed at providing optimum health. The program is suitable for patients 12 years and older. It is recommeded for 3-4 months, after which a repeat analysis is recommended. A follow-up test would evaluate and determine your body's ability to digest and absorb nutrients. If any questions or problems arise, consult your medical doctor or health care provider.

Chromium (Cr)

Increase chromium intake and reduce sugar consumption. In 1989, the National Academy of Sciences established an "estimated safe and adequate daily dietary intake" range for chromium. For adults and adolescents that range was 50 to 200 mcg [1]. In 2001, an “adequate daily intake” was established: 35mcg for males and 24-25mcg for females age 14-50y. For adults older than 50y, the recommended intake slightly decreases, depending on lifestyle and condition. The adequate chromium intake for pregnant and lactating females is around 45mcg/day. Chromium-rich foods are yeast products, pepper, oat flakes, unpolished rice and molasses.

[1] National Research Council, Food and Nutrition Board. Recommended Dietary Allowances, 10th Edition. National Academy Press, Washington, DC, 1989.

Cobalt (Co)

There is no recommended intake of cobalt, however vitamin B12 contains cobalt and increasing the Vitamin B12 intake can improve the cobalt status. Check with your physician. Vitamin B12-rich foods are meat, liver and cheese.

Copper (Cu)

The daily copper requirement for young adults, males and females, is 890mcg. For older adults it is 900mcg/day. Pregnant and lactating woman may need more. High copper foods are fish, shellfish, nuts, eggs, meat, poultry and dark green vegetables. Support liver function. Ask your physician.

Iron (Fe)

Ask your doctor to check serum iron and serum ferritin levels before supplementing iron. Wholegrain cereals, meats, fish and poultry are the major contributors to iron intake and to improve the bioavailability of iron, increase the intake of B-vitamins and vitamin C. In contrast, a high intake of calcium, zinc or phytates (found in legumes, rice and other grains), polyphenols and vegetable protein can inhibit the absorption of iron. The daily recommended intake for young adults 14-18y is 11mg for males and 15mg for females; female adults older than 18 require 18mg/day, males only 8mg/day. For older adults of both sexes, 8mg/day is sufficient. Pregnant and lactating women require between 9 and 27mg/day.

Magnesium (Mg)

The daily minimum requirement for magnesium is between 310 and 360mg for individuals 14years and older. Pregnant woman and lactating women require between 310 and 400mg/day. The needed intake depends on age and condition. B-Vitamins, especially vitamin B6 increase the magnesium absorption. Magnesium is widely distributed in plant and animal foods and in beverages. Green leafy vegetables, such as spinach, legumes, nuts, seeds, and whole grains are good sources.

Manganese (Mn)

No recommended dietary allowances (RDA) for manganese have been established, however, the daily Adequate Intake (AI) levels for manganese are for men age 19 and older: 2.3mg; women 19 and older: 1.8mg; pregnant women age 14 to 50: 2mg; breastfeeding women: 2.6mg. Taking more than 11mg per day by mouth is possibly unsafe for most adults. Good sources of manganese are herbal teas, green or black tea. Excessive calcium or copper intake can block manganese absorption.

Molybdenum (Mo)

Molybdenum deficiency is extremely rare and low hair values generally signify a chronically low dietary intake, which can be improved by increasing the intake of molybdenum-rich foods such as beans and other legumes, whole grains and leafy vegetables. The daily requirement for people 14 to 18 years: 43mcg, 19+ years: 45mcg. Women who are pregnant or breastfeeding: 50mcg. B-vitamins improve the molybdenum absorption. Check copper and iron status. High copper and/or iron intake can decrease molybdenum absorption.

Silver (Ag)

To evaluate exposure, check blood and/or urine levels. A provocation test may be recommended. Avoid silver water purification systems. Increase antioxidant intake and check zinc status.

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Vanadium (V)

A daily intake of 0.5 to 1.0mg is recommended for adults, and is achieved through a normal diet. Good vanadium sources are black pepper, dill seed, peanut butter, cod fish, scallops, egg yolk, chicken breast, mushrooms, olives and vegetable oils.

Zinc (Zn)

High hair zinc levels are found in the presence of hair loss problems or when hair growth patterns are disturbed. High hair zinc levels may also be due do prolonged zinc therapy or frequent use of zinc oxide lotion or cream on scalp. High zinc levels in the presence of hair loss problems may reflect a masked deficiency. Check blood levels to confirm zinc status. Increase vitamin B intake.