



LAB #: H151009-2210-1

PATIENT:

): DOB: xxx

SEX: Male

AGE: 37

CLIENT #:

DOCTOR: , MD

Neurological Research Institute LLC

279 Walkers Mills Rd

Bethel, ME 04217 U.S.A.

Refer to  
your  
doctor  
as alwaysSaw Palmetto  
+  
Prostate nucleotide blend

## Toxic &amp; Essential Elements; Hair

TOXIC METALS				PERCENTILE	
		RESULT µg/g	REFERENCE INTERVAL	68 <sup>th</sup>	95 <sup>th</sup>
Aluminum (Al)		1.2	< 7.0		
Antimony (Sb)		0.015	< 0.066		
Arsenic (As)		0.076	< 0.080		
Barium (Ba)		0.10	< 1.0		
Beryllium (Be)		< 0.01	< 0.020		
Bismuth (Bi)		< 0.002	< 2.0		
Cadmium (Cd)		< 0.009	< 0.065		
Lead (Pb)		0.10	< 0.80		
Mercury (Hg)		3.9	< 0.80		
Platinum (Pt)		< 0.003	< 0.005		
Thallium (Tl)		0.002	< 0.002		
Thorium (Th)		< 0.001	< 0.002		
Uranium (U)		0.020	< 0.060		
Nickel (Ni)		0.03	< 0.20		
Silver (Ag)		1.8	< 0.08		
Tin (Sn)		0.15	< 0.30		
Titanium (Ti)		0.25	< 0.60		
Total Toxic Representation					

ESSENTIAL AND OTHER ELEMENTS				PERCENTILE				
		RESULT µg/g	REFERENCE INTERVAL	2.5 <sup>th</sup>	16 <sup>th</sup>	50 <sup>th</sup>	84 <sup>th</sup>	97.5 <sup>th</sup>
Calcium (Ca)		316	200 - 750					
Magnesium (Mg)		30	25 - 75					
Sodium (Na)		150	20 - 180					
Potassium (K)		120	9 - 80					
Copper (Cu)		10	11 - 30					
Zinc (Zn)		170	130 - 200					
Manganese (Mn)		0.05	0.08 - 0.50					
Chromium (Cr)		0.36	0.40 - 0.70					
Vanadium (V)		0.029	0.018 - 0.065					
Molybdenum (Mo)		0.035	0.025 - 0.060					
Boron (B)		3.8	0.40 - 3.0					
Iodine (I)		0.32	0.25 - 1.8					
Lithium (Li)		0.16	0.007 - 0.020					
Phosphorus (P)		182	150 - 220					
Selenium (Se)		1.2	0.70 - 1.2					
Strontium (Sr)		0.25	0.30 - 3.5					
Sulfur (S)		49500	44000 - 50000					
Cobalt (Co)		0.002	0.004 - 0.020					
Iron (Fe)		4.5	7.0 - 16					
Germanium (Ge)		0.030	0.030 - 0.040					
Rubidium (Rb)		0.14	0.011 - 0.12					
Zirconium (Zr)		0.11	0.020 - 0.44					

SPECIMEN DATA		RATIOS		
COMMENTS:		ELEMENTS	RATIOS	RANGE
Date Collected: 10/07/2015		Ca/Mg	10.5	4 - 30
Date Received: 10/09/2015		Ca/P	1.74	0.8 - 8
Date Completed: 10/12/2015		Na/K	1.25	0.5 - 10
Methodology: ICP/MS		Zn/Cu	17	4 - 20
		Zn/Cd	> 999	> 800

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HE-29813

Please refer to your doctor for consideration.

As always, work with your Doctor.

With love &amp; hope, Dr. Amy

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## HAIR ELEMENTS REPORT INTRODUCTION

Hair is an excretory tissue for essential, nonessential and potentially toxic elements. In general, the amount of an element that is irreversibly incorporated into growing hair is proportional to the level of the element in other body tissues. Therefore, hair elements analysis provides an indirect screening test for physiological excess, deficiency or maldistribution of elements in the body. Clinical research indicates that hair levels of specific elements, particularly potentially toxic elements such as cadmium, mercury, lead and arsenic, are highly correlated with pathological disorders. For such elements, levels in hair may be more indicative of body stores than the levels in blood and urine.

All screening tests have limitations that must be taken into consideration. The correlation between hair element levels and physiological disorders is determined by numerous factors. Individual variability and compensatory mechanisms are major factors that affect the relationship between the distribution of elements in hair and symptoms and pathological conditions. It is also very important to keep in mind that scalp hair is vulnerable to external contamination of elements by exposure to hair treatments and products. Likewise, some hair treatments (e.g. permanent solutions, dyes, and bleach) can strip hair of endogenously acquired elements and result in false low values. Careful consideration of the limitations must be made in the interpretation of results of hair analysis. The data provided should be considered in conjunction with symptomology, diet analysis, occupation and lifestyle, physical examination and the results of other analytical laboratory tests.

**Caution:** The contents of this report are not intended to be diagnostic and the physician using this information is cautioned against treatment based solely on the results of this screening test. For example, copper supplementation based upon a result of low hair copper is contraindicated in patients afflicted with Wilson's Disease.

### Mercury High

Hair mercury (Hg) is an excellent indicator of exposure to methylmercury from fish. Mercury is toxic to humans and animals. Individuals vary greatly in sensitivity and tolerance to Hg burden.

Hg can suppress biological selenium function and may cause or contribute to immune dysregulation in sensitive individuals. Hallmark symptoms of excess Hg include: loss of appetite, decreased senses of touch, hearing, and vision, fatigue, depression, emotional instability, peripheral numbness and tremors, poor memory and cognitive dysfunction, and neuromuscular disorders. Hair Hg has been reported to correlate with acute myocardial infarction and on average each 1 µg/g of hair Hg was found to correlate with a 9% increase in AMI risk (Circulation 1995; 91:645-655).

Sources of Hg include dental amalgams, fish, water supplies, some hemorrhoidal preparations, skin lightening agents, instruments (thermometers, electrodes, batteries), and combustion of fossil fuels, Ayurvedic herbs, some fertilizers, and the paper/pulp and gold industries. After dental amalgams are installed or removed a transient (several months) increase in hair Hg is observed. Also, "baseline" hair Hg levels for individuals with dental amalgams are higher (about 1 to 2 µg/g) than are baseline levels for those without (below 1 µg/g).

Confirmatory tests for elevated Hg are measurement of whole blood as an indication of recent/ongoing



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exposure (does not correlate with whole body accumulation) and measurement of urine Hg before and after administration of a dithiol metal binding agent such as DMSA or DMPS (an indication of total body burden).

#### Silver High

Hair Silver (Ag) levels have been found to reflect environmental exposure to the element. However, hair is commonly contaminated with Ag from hair treatments such as permanents, dyes, and bleaches.

Ag is not an essential element and is of relatively low toxicity. However, some Ag salts are very toxic.

Sources of Ag include seafood, metal and chemical processing industries, photographic processes, jewelry making (especially soldering), effluents from coal fired power plants and colloidal silver products.

The bacteriostatic properties of Ag have been long recognized and Ag has been used extensively for medicinal purposes; particularly in the treatment of burns. There is much controversy over the long term safety of consumption of colloidal silver. Very high intake of colloidal silver has been reported to give rise to tumors in the liver and spleen of animals (Metals in Clinical and Analytical Chemistry, eds. Seiler, Segel and Segel, 1994). However, these data may not have relevance to the effects of chronic, low level consumption by humans.

#### Potassium High

High hair Potassium (K) is not necessarily reflective of dietary intake or nutrient status. However, elevated K may be reflective of metabolic disorders associated with exposure to potentially toxic elements.

K is an electrolyte and a potentiator of enzyme functions, but neither of these functions take place in hair. Elevated K in hair may reflect overall retention of K by the body or maldistribution of this element. In adrenocortical insufficiency, K is increased in blood, while it is decreased in urine; cellular K may or may not be increased. Also, hair is occasionally contaminated with K from some shampoos. Observations at DDI indicate that K and sodium levels in hair are commonly high in association with toxic element burden. The elevated K and sodium levels are often concomitant with low levels of calcium and magnesium in hair. This apparent phenomena requires further investigation.

Elevated hair potassium should be viewed as a screening test. Appropriate tests for excess body K include measurements of packed red blood cell K; serum or whole blood K and sodium/K ratio, measurement of urine K and sodium/K ratio; and an assessment of adrenocortical function.

#### Copper Low

Hair Copper (Cu) levels are usually indicative of body status with two exceptions: (1) addition of exogenous Cu (occasionally found in hair preparations or algacides in swimming pools/hot tubs), and (2) low hair Cu in Wilson's or Menkes' diseases. In Wilson's disease, Cu transport is defective and Cu accumulates, sometimes to toxic levels, in intestinal mucosa, liver and kidneys. At the same time, it is low in hair and deficient in other peripheral tissues. In Menkes' disease, the activity of Cu dependent enzymes

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is very low. Cu supplementation is contraindicated in these diseases.

Cu is an essential element that is required for the activity of certain enzymes. Erythrocyte superoxide dismutase (SOD) is a Cu (and zinc) dependent enzyme; lysyl oxidase which catalyzes crosslinking of collagen is another Cu dependent enzyme. Adrenal catecholamine synthesis is Cu dependent, because the enzyme dopamine beta-hydroxylase, which catalyzes formation of norepinephrine from dopamine, requires Cu.

Symptoms of Cu deficiency include: elevated cholesterol, increased inflammatory responses, anemia, bone and collagen disorders, reproductive failure, and impaired immunity. Possible reasons for a Cu deficiency include: intestinal malabsorption, insufficient dietary intake, molybdenum excess, zinc excess, and chelation therapy. Cu status is adversely affected by excess of antagonistic metals such as mercury, lead, cadmium, and manganese.

Confirmatory tests for Cu deficiency are serum ceruloplasmin to rule out Wilson's disease (ceruloplasmin is deficient in Wilson's disease), a whole blood or packed red blood cell elements analysis, and a functional test for Cu (barring zinc deficiency) is measurement of erythrocytes SOD activity. Erythrocyte SOD activity is subnormal with Cu deficiency.

#### Manganese Low

Hair Manganese (Mn) levels correlate well with Mn levels in other body tissues. Hair Mn levels are commonly low, in part due to low dietary Mn intake and the interaction of Mn with phosphates in the gut. Intestinal malabsorption also limits Mn uptake.

Mn is an essential element that is involved in energy metabolism, and bone and cartilage formation. Mn is an activator of many important enzymes including: mitochondrial superoxide dismutase, arginase, and pyruvate carboxylase.

Symptoms associated with Mn deficiency include: fatigue, lack of physical endurance, slow growth of fingernails and hair, impaired metabolism of bone and cartilage, dermatitis, weight loss, and reduced fertility. Increased allergic sensitivities and inflammation are often associated with low Mn. Seizures are occasionally reported to be associated with severe Mn deficiency.

An appropriate laboratory test to confirm Mn deficiency is whole blood elements analysis.

#### Chromium Low

Hair Chromium (Cr) is a good indicator of tissue levels and may provide a better indication of status than do urine or blood plasma/serum (Nielsen, F.H. In Modern Nutrition on Health and Disease; 8th Edition, 1994. Ed. Shils, Olson and Shike. Lea and Febiger, Philadelphia). Hair Cr is seldom affected by permanent solutions, dyes and bleaches.

Cr (trivalent) is generally accepted as an essential trace element that is required for maintenance of normal glucose and cholesterol levels; it potentiates insulin function, i.e., as a part of "glucose tolerance factor". Deficiency conditions may include hyperglycemia, transient hyper/hypoglycemia, fatigue, accelerated atherosclerosis, elevated LDL cholesterol, increased need for insulin and diabetes-like symptoms, and impaired stress responses. Marginal or insufficient Cr is common in the U.S., where average tissue levels are low compared to those found in many other countries. Low hair Cr appears to be associated with increased risk of cardiovascular disease and an atherogenic lipoprotein profile (low

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HDL, high LDL). Common causes of deficiency are ingestion of highly processed foods, inadequate soil levels of Cr, gastrointestinal dysfunction, and insufficient vitamin B-6. Cr status is also compromised in patients with iron overload/high transferrin saturation because transferrin is a major transport protein for Cr.

Confirmatory tests for Cr adequacy include glucose tolerance and packed red blood cell elements analysis.

#### Cobalt Low

One can not determine vitamin B-12 status by use of hair analysis, and the clinical significance of low hair Cobalt (Co) levels is not known. Hair is analyzed for Co primarily for detection of excessive intake of the potentially toxic element.

There is little evidence that Co has an essential function in humans other than as an obligatory constituent of the vitamin B-12 molecule. Humans absorb Co as inorganic Co and as vitamin B-12; the body pools of each fluctuate independently. Humans cannot convert inorganic Co to vitamin B-12.

The dietary content of Co is highly variable, depending upon types of foods eaten, geographical location and type of soil. Vegetarians often have lower Co levels than meat eaters.

Appropriate tests for determination of vitamin B-12 status are the measurement of urine levels of methylmalonic acid (elevated with vitamin B-12 coenzyme deficiency/dysfunction), a quantitative blood assay for vitamin B-12, a urine amino acids analysis (several metabolic steps require vitamin B-12), and diet analysis.

#### Boron High

Boron (B) is normally found in hair but the correlations among B absorption, and tissue and hair levels of B have yet to be determined. B has a low order of toxicity, but excessive intake induces riboflavinuria. Exogenous contamination of hair with B is possible since B is present in some soaps. B is also present in some cleaners, cements, ceramics, and glass.

#### Lithium High

Lithium (Li) is normally found in the hair at very low levels. Hair Li levels correlate with high dosage of Li carbonate in patients treated for Affective Disorders. Li occurs almost universally at low concentrations in water and in plant and animal food products. Li is used in the manufacture of lightweight metal alloys, glass, lubrication greases, and batteries.

Li at low levels may have essential functions in humans. Intracellularly, it slows the conversion of phosphorylated inositol to free inositol. In the nervous system, this moderates neuronal excitability. Li also influences monamine neurotransmitter concentrations at the synapse (this function is increased when Li is used therapeutically for mania or bipolar illness).

Li, when ingested in excessive quantities, may cause dermatitis, nausea, confusion, edema, or hypotension. Li toxicity may be more pronounced with low sodium intake. Li may compete for calcium and magnesium binding sites on biological ligands. Li at levels above two standard deviations does not necessarily constitute Li toxicity. Confirmation of excess Li levels may be

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obtained from blood plasma/serum levels if the uptake /exposure is recent or chronic. Point-in-time Li doses are rapidly excreted in urine, and blood analysis may not be indicative after 5 to 7 days.

#### Total Toxic Element Indication

The potentially toxic elements vary considerably with respect to their relative toxicities. The accumulation of more than one of the most toxic elements may have synergistic adverse effects, even if the level of each individual element is not strikingly high. Therefore, we present a total toxic element "score" which is estimated using a weighted average based upon relative toxicity. For example, the combined presence of lead and mercury will give a higher total score than that of the combination of silver and beryllium.

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