



LAB #: H250903-2143-1
PATIENT: Olivia Zina Parbery
ID: PARBERY-O-00003
SEX: Female
DOB: 05/13/2015 AGE: 10

CLIENT #: 31417
DOCTOR:
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Toxic & Essential Elements; Hair

TOXIC METALS					
		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE	
				68 th	95 th
Aluminum	(Al)	5.1	< 8.0		
Antimony	(Sb)	0.061	< 0.066		
Arsenic	(As)	0.011	< 0.060		
Barium	(Ba)	1.3	< 1.5		
Beryllium	(Be)	< 0.01	< 0.020		
Bismuth	(Bi)	0.26	< 2.0		
Cadmium	(Cd)	0.026	< 0.070		
Lead	(Pb)	1.3	< 0.80		
Mercury	(Hg)	0.61	< 0.40		
Platinum	(Pt)	< 0.003	< 0.005		
Thallium	(Tl)	< 0.001	< 0.002		
Thorium	(Th)	< 0.001	< 0.002		
Uranium	(U)	0.017	< 0.060		
Nickel	(Ni)	0.37	< 0.30		
Silver	(Ag)	0.67	< 0.18		
Tin	(Sn)	0.28	< 0.30		
Titanium	(Ti)	0.24	< 0.70		
Total Toxic Representation					

ESSENTIAL AND OTHER ELEMENTS								
		RESULT	REFERENCE	PERCENTILE				
		µg/g	INTERVAL	2.5 th	16 th	50 th	84 th	97.5 th
Calcium	(Ca)	697	250 - 800					
Magnesium	(Mg)	140	25 - 90					
Sodium	(Na)	6	18 - 180					
Potassium	(K)	10	10 - 90					
Copper	(Cu)	84	11 - 37					
Zinc	(Zn)	260	120 - 220					
Manganese	(Mn)	0.38	0.08 - 0.60					
Chromium	(Cr)	0.50	0.40 - 0.65					
Vanadium	(V)	0.039	0.025 - 0.10					
Molybdenum	(Mo)	0.017	0.030 - 0.090					
Boron	(B)	0.45	0.30 - 1.7					
Iodine	(I)	1.1	0.25 - 1.3					
Lithium	(Li)	0.010	0.007 - 0.020					
Phosphorus	(P)	133	150 - 220					
Selenium	(Se)	0.63	0.70 - 1.1					
Strontium	(Sr)	2.4	0.37 - 3.6					
Sulfur	(S)	47600	44000 - 51000					
Cobalt	(Co)	0.021	0.005 - 0.035					
Iron	(Fe)	7.9	7.0 - 16					
Germanium	(Ge)	0.033	0.030 - 0.040					
Rubidium	(Rb)	0.006	0.008 - 0.080					
Zirconium	(Zr)	0.020	0.030 - 0.40					

SPECIMEN DATA		RATIOS		
COMMENTS:		ELEMENTS	RATIOS	RANGE
Date Collected: 08/24/2025		Ca/Mg	4.98	4- 30
Date Received: 09/03/2025		Ca/P	5.24	1- 12
Date Reported: 09/06/2025		Na/K	0.6	0.5- 10
Methodology: ICP/MS		Zn/Cu	3.1	4- 20
Sample Size: 0.197 g		Zn/Cd	> 999	> 800
Sample Type: Head				
Hair Color:				
Treatment:				
Shampoo:				

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.

Lead High

This individual's hair Lead (Pb) level is considered to be moderately elevated. Generally, hair is a good indicator of exposure to Pb. However, elevated levels of Pb in head hair can be an artifact of hair darkening agents, or dyes, e.g. lead acetate. Although these agents can cause exogenous contamination some transdermal absorption does occur.

Pb has neurotoxic and nephrotoxic effects in humans as well as interfering with heme biosynthesis. Pb may also affect the body's ability to utilize the essential elements calcium, magnesium, and zinc. At moderate levels of body burden, Pb may have adverse effects on memory, cognitive function, nerve conduction, and metabolism of vitamin D. Children with hair Pb levels greater than 1 µg/g have been reported to have a higher incidence of hyperactivity than those with less than 1 µg/g. Children with hair Pb levels above 3 µg/g have been reported to have more learning problems than those with less than 3 µg/g. Detoxification therapy by means of chelation results in transient increases in hair lead. Eventually, the hair Pb level will normalize after detoxification is complete.

Symptoms associated with excess Pb are somewhat nonspecific, but include: anemia, headaches, fatigue, weight loss, cognitive dysfunction and decreased coordination.

Sources of exposure to Pb include: welding, old leaded paint (chips/dust), drinking water, some

fertilizers, industrial pollution, lead-glazed pottery, Ayurvedic herbs and use of firearms.

Tests for Pb body burden are: urine elements analysis following provocation with intravenous Ca-EDTA, or oral DMSA. Whole blood analysis for Pb reflects recent or ongoing exposures and does not correlate well with total body burden.

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 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).

Nickel High

Hair is a reasonable tissue for monitoring exposure to Nickel (Ni). However, hair is commonly contaminated with Ni from hair treatments and dyes. When hair Ni is measured at more than .6 ppm, the possible use of hair dyes or colorings should be investigated before concluding that excessive Ni is present. Nickel is present in a surprisingly large number of foods and food products, including: black tea, nuts and seeds, soy milk and chocolate milk, chocolate and cocoa powders, certain canned and processed foods, including meat and fish, certain grains, including: oats, buckwheat, whole wheat and wheat germ.

There is substantial evidence that Ni is an essential element which is required in extremely low amounts. However, excess Ni has been well established to be nephrotoxic, and carcinogenic. Elevated Ni is often found in individuals who work in the electronic and plating, mining, and steel manufacture industries. A cigarette typically contains from 2 to 6 mcg of Ni; Ni is absorbed more efficiently in the lungs than in the gastrointestinal tract. Symptoms of chronic Ni exposure include dermatitis, chronic rhinitis, and hypersensitivity reactions. Ni can hypersensitize the immune system, subsequently causing hyper allergenic responses to many different substances.

Symptoms of Ni toxicity are dermatitis and pulmonary inflammation (following exposure to Ni dust, smoke). Long term or chronic Ni toxicity may lead to liver necrosis and carcinoma.

A test for elevated Ni body burden is the measurement of urine Ni before and after administration of chelating agents that mobilize Ni i.e., Ca-EDTA, DMSA.

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.

Magnesium High

Magnesium (Mg) is an essential element with both electrolyte and enzyme-activator functions. However, neither of these functions takes place in hair. Body excess of Mg is rare but may occur from excessive oral or parenteral supplementation or as a result of renal damage or insufficiency.

If one rules out external contamination of hair as a result of recent hair treatment, elevated hair Mg is more likely to indicate maldistribution of the element. Physiological Mg dysfunction may or may not be present. Maldistribution of Mg can occur as a result of chronic emotional or physical stress, toxic metal or chemical exposure, physiological imbalance of calcium and phosphorus, bone mineral depletion, and renal insufficiency with poor clearance of Mg (and other metabolites). Elevated hair Mg has been correlated with hypoglycemia and an inappropriately low ratio of dietary Ca : P.

Mg status can be difficult to assess; whole blood and packed blood red cell Mg levels are more indicative than serum/plasma levels. Amino acid analysis can be helpful in showing rate-limited steps that are Mg-dependent (e.g. phosphorylations).

Sodium Low

The level of Sodium (Na) in hair has not been documented to be indicative of dietary adequacy or nutritional status. Na is an essential element with extracellular electrolyte functions, but these functions do not occur in hair. Low hair Na may have no clinical significance or it may be consistent with electrolyte imbalance associated with adrenal insufficiency. In this condition, blood Na would be low, blood potassium would be high, and urinary levels of Na would be expected to be high. Observations at DDI indicate that Na and potassium levels in hair are commonly low in association with emotional stress. The low levels of Na and potassium are

frequently concomitant with high levels of calcium and magnesium in hair. This apparent "emotional stress pattern" requires further investigation.

Appropriate tests for Na status as an electrolyte are measurements of Na in whole blood and urine, and measurements of adrenocortical function.

Copper High

An elevated level of copper (Cu) in hair may be indicative of excess Cu in the body. However, it is important first to rule out exogenous contamination sources: permanent solutions, dyes, bleaches, swimming pool/hot tub water (very common), and washing hair in acidic water carried through Cu pipes. In the case of contamination from hair treatments, other elements (aluminum, silver, nickel, titanium) may also be elevated.

Copper is used extensively in sanitation and in the production of kitchen utensils, and thermal and electric conductors. Copper solutions are used in industrial processes such as electroplating, printed circuit production, textile production, and as catalysts in chemical processes. Albeit reduced, Cu-sulfate is sometimes used in agriculture (vineyards, orchards). Other sources of Cu exposure include contaminated food or drinking water, and excessive Cu supplementation, particularly in combination with low intake of zinc or molybdenum. Insufficient intake of competitively absorbed elements such as zinc or molybdenum can lead to, or worsen Cu excess. Cu toxicity significantly compromises zinc homeostasis.

Medical conditions that may be associated with excess Cu include: biliary obstruction (reduced ability to excrete Cu), liver disease (hepatitis or cirrhosis), and renal dysfunction. Symptoms associated with excess Cu accumulation are muscle and joint pain, depression, irritability, tremor, hemolytic anemia, learning disabilities, and behavioral disorders.

Zinc High

Zinc (Zn) is an essential element that is required in many very important biological processes. However, Zn can be toxic if exposure is excessive. Although uncommon, high hair Zn might be indicative of Zn overload which could result from Zn contaminated water (galvanized pipes), welding or gross, chronic over-supplementation (100 mg/day). Other sources of Zn exposure include: manufacture of brass, bronze, white paint, pesticide production, galvanization of steel and iron products, dry cell batteries, and use in rubber, textile, and ceramic industries. Symptoms of Zn excess include: gastrointestinal disorders, decreased heme synthesis (copper deficiency), tachycardia, blurred vision, and hypothermia.

Paradoxically, a moderately elevated level of Zn in hair may be associated with Zn wasting, and a low level of Zn in cells. Zn may be displaced from proteins such as intracellular metallothionein by other metals, especially cadmium and copper. Zn may also be high in hair in association with chronic use of Zn-containing anti-dandruff shampoo. Rough or dry, flaky skin is a symptom of Zn deficiency, so it is not uncommon for Zn deficient patients to use an anti-dandruff/anti-itch shampoo. A result of high hair Zn warrants further testing to assess Zn status.

Confirmatory tests for Zn status include the Whole Blood or RBC Elements tests.

Molybdenum Low

Low Molybdenum (Mo) in hair is a possible indication of Mo deficiency. Hair is very rarely contaminated with exogenous Mo.

Mo is an essential trace element that is an activator of specific enzymes such as: xanthine oxidase (catalyzes formation of uric acid), sulfite oxidase (catalyzes oxidation of sulfite to sulfate), and aldehyde dehydrogenase (catalyzes oxidation of aldehydes). Possible effects or symptoms consistent with Mo deficiency are: subnormal uric acid in blood and urine, sensitivity or reactivity to sulfites, protein intolerance (specifically to sulfur-bearing amino acids), and sensitivity or reactivity to aldehydes.

True Mo deficiency is uncommon but may result from: a poor-quality diet, gastrointestinal dysfunctions, or tungsten exposure. Tungsten (from "TIG" welding) can be a powerful antagonist of Mo retention in the body. Copper overload can also reduce Mo retention.

Because normal blood and blood cell Mo levels are very low (a few parts per billion), blood measurement is not an appropriate tissue for confirmation of subnormal molybdenum.

Confirmatory tests for Mo deficiency include measurement of urine sulfite concentration (increased in Mo deficiency), measurement of blood/urine uric acid level (decreased in Mo deficiency), and measurement of urinary Mo content.

Selenium Low

Selenium (Se) is normally found in hair at very low levels, and several studies provide evidence that low hair Se is reflective of dietary intake and associated with cardiovascular disorders. Utilization of hair Se levels to assess nutritional status, however, is complicated by the fact that use of Se- or sulfur-containing shampoo markedly increases hair Se (externally) and can give a false high value.

Se is an extremely important essential element due to its antioxidative function as an obligatory component of the enzyme glutathione peroxidase. Se is also protective in its capacity to bind and "inactivate" mercury, and Se is an essential cofactor in the deiodination of T-4 to active T-3 (thyroid hormone). Some conditions of functional hypothyroidism therefore may be due to Se deficiency (Nature; 349:438-440, 1991); this is of particular concern with mercury exposure. Studies have also indicated significant inverse correlations between Se and heart disease, cancer, and asthma.

Selenium deficiency is common and can result from low dietary intake of Se or vitamin E, and exposure to toxic metals, pesticides/herbicides and chemical solvents.

Symptoms of Se deficiency are similar to that of vitamin E deficiency and include muscle aches, increased inflammatory response, loss of body weight, alopecia, listlessness, skeletal and muscular degeneration, growth stunting, and depressed immune function.

Confirmatory tests for Se deficiency are Se content of packed red blood cells, and activity of glutathione peroxidase in red blood cells.

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.