DOCTOR'S DATA INC

LAB #: H140204-2229-1
PATIENT: Anna M. Salanti
ID: SALANTI-A-00001
SEX: Female
AGE: 62

CLIENT #: 26339
DOCTOR:
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Toxic & Essential Elements; Hair

TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	2.4	< 12	
Antimony	(Sb)	0.066	< 0.060	
Arsenic	(As)	0.081	< 0.090	
Barium	(Ba)	1.3	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	< 0.002	< 2.0	
Cadmium	(Cd)	0.055	< 0.050	
Lead	(Pb)	0.66	< 1.0	
Mercury	(Hg)	0.27	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	< 0.001	< 0.002	
Uranium	(U)	< 0.001	< 0.060	
Nickel	(Ni)	0.12	< 0.40	
Silver	(Ag)	0.21	< 0.10	
Tin	(Sn)	0.04	< 0.30	
Titanium	(Ti)	1.6	< 1.3	
Total Toxic Representation				

ESSENTIAL AND OTHER ELEMENTS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 2.5th 16th 50th 84th 97.5th
Calcium	(Ca)	1570	475- 1500	
Magnesium	(Mg)	210	45- 180	
Sodium	(Na)	130	80- 450	
Potassium	(K)	46	28- 160	
Copper	(Cu)	34	11- 30	
Zinc	(Zn)	190	130- 200	
Manganese	(Mn)	1.8	0.15- 0.65	
Chromium	(Cr)	0.38	0.40- 0.65	
Vanadium	(V)	0.023	0.018- 0.065	
Molybdenum	(Mo)	0.090	0.040- 0.10	
Boron	(B)	3.0	0.40- 4.0	
Iodine	(I)	1.5	0.25- 1.8	
Lithium	(Li)	< 0.004	0.008- 0.030	
Phosphorus	(P)	869	250- 500	
Selenium	(Se)	1.4	0.80- 1.3	
Strontium	(Sr)	8.2	1.0- 8.0	
Sulfur	(S)	45800	42000- 48000	
Cobalt	(Co)	0.019	0.006- 0.035	
Iron	(Fe)	9.7	7.0- 16	
Germanium	(Ge)	0.025	0.030- 0.040	
Rubidium	(Rb)	0.053	0.030- 0.25	
Zirconium	(Zr)	0.008	0.040- 1.0	

SPECIMEN DATA

COMMENTS:

Date Collected: **01/20/2014**
Date Received: **02/04/2014**
Date Completed: **02/06/2014**
Methodology: **ICP/MS**

Sample Size: **0.196 g**
Sample Type: **Pubic**
Hair Color: **Brown**
Treatment:
Shampoo: **Sappo Hill Bar Soap**

RATIOS

ELEMENTS	RATIOS	RANGE
Ca/Mg	7.48	4- 30
Ca/P	1.81	1- 12
Na/K	2.83	0.5- 10
Zn/Cu	5.59	4- 20
Zn/Cd	> 999	> 800

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.

Pubic Hair Specimens

Pubic hair and scalp hair are very different tissues with respect to protein and chemical composition, and rate of growth. The levels of most nutrients elements in pubic and scalp hair for a given individual are typically quite different. Although we do have reference ranges for nutrient elements in pubic hair specimens, there is a lack of clinical data to support sound interpretation at this time. For the potentially toxic elements, however, there appears to be good correlation between scalp and pubic hair. Some clinicians utilize pubic hair for toxic element analyze, (a) to confirm results from scalp hair, and/or (b) when scalp hair has been recently treated with dye or permanent and bleaching reagents.

Antimony High

Hair is a preferred tissue for analysis of Antimony (Sb) exposure and body burden. Elevated hair Sb levels have been noted as long as a year after exposure.

Sb is a nonessential element that is chemically similar to but less toxic than arsenic. Food and smoking are the usual sources of Sb. Thus cigarette smoke can externally contaminate hair, as well as contribute to uptake via inhalation. Gunpowder (ammunition) often contains Sb. Firearm enthusiasts often have elevated levels of Sb in hair. Other possible sources are textile industry,

metal alloys, and some antihelminthic and antiprotozoic drugs. Sb is also used in the manufacture of paints, glass, ceramics, solder, batteries, bearing metals, semiconductors and fire retardant fabrics.

Like arsenic, Sb has a high affinity for sulfhydryl groups on many enzymes. Sb is conjugated with glutathione and excreted in urine and feces. Therefore, excessive exposure to Sb has the potential to deplete intracellular glutathione pools.

Early signs of Sb excess include: fatigue, muscle weakness, myopathy, nausea, low back pain, headache, and metallic taste. Later symptoms include hemolytic anemia, myoglobinuria, hematuria and renal failure. Transdermal absorption can lead to ”antimony spots” which resemble chicken pox. Respiratory tissue irritation may result from inhalation of Sb particles or dust.

A confirmatory test for recent or current exposure is the measurement of Sb in the urine or whole blood. Comparison of pre and post provocation (DMPS, DMSA, Ca-EDTA) urine Sb levels provides an estimate of net retention (body burden) of Sb.

Cadmium high

Hair Cadmium (Cd) levels provide an indication of exposure to Cd. Cd is a toxic heavy metal that has no metabolic function in the body. Moderately high Cd levels, about4-8 µg/g, may be associated with hypertension, while very severe Cd toxicity may cause hypotension. Cd adversely affects the kidneys, lungs, testes, arterial walls, and bones and interferes with many enzymatic reactions. Chronic Cd excess can lead to microcytic, hypochromic anemia and proteinuria with loss of beta-2-microglobin, and functional zinc deficiency. Cd excess is also commonly associated with fatigue,weight loss, osteomalacia, and lumbar pain.

Cd absorption is reduced by zinc, calcium, and selenium. Cd is found in varying amounts in foods, from .04 µg/g for some fruits to 3-5 µg/g in some oysters and anchovies. The use of tobacco products significantly increases Cd intake. Refined carbohydrates have very little zinc in relation to the Cd. West coast oysters are notoriously high in Cd.

If hair zinc is not abnormal, external contamination may have caused the elevated hair Cd level. Exogenous contamination may come from permanent solutions, dyes, bleach, and some hair sprays. A test for elevated body burden of Cd is urine analysis following administration EDTA.

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).

Copper High

The high 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, and washing hair in acidic water carried through Cu pipes. In the case of contamination from hair preparations, other elements (aluminum, silver, nickel, titanium) are usually also elevated.

Sources of excessive Cu include contaminated food or drinking water, excessive Cu supplementation, and occupational or environmental exposures. Insufficient intake of competitively absorbed elements such as zinc or molybdenum can lead to, or worsen Cu excess.

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.

Confirmatory tests for Cu excess are a comparison of Cu in pre vs. post provocation (D-penicillamine, DMPS) urine elements tests and a whole blood elements analysis.

Manganese High

Hair Manganese (Mn) levels generally reflect exposure to Mn, but external contamination can influence hair Mn. High hair Mn can be an artifact of contamination from: permanent solutions, dyes, bleaches, and well water (containing high Mn). These possibilities should be considered

and ruled out before proceeding with therapies to alleviate excess Mn.

Mn is an essential element which is involved in the activation of many important enzymes. However, Mn excess is postulated to result in glutathionyl radical formation, reduction of the free glutathione pool, and increased exposure of adrenal catecholamines (e.g. dopamine) to free radical damage. Excess Mn causes degeneration of melanin-pitmented dopaminergic neurons which results in abnormally low levels of serotonin and dopamine in the brain. This is hypothesized to be a reason behind the neurotoxic effects attributed to Mn overload.

The brain is particularly affected by Mn excess. Symptoms or conditions consistent with excessive Mn include: disorientation, memory loss, anxiety, hypotonia, abnormal gait, emotional instability, and bipolar-like behaviors (laughing and crying), aberrant or violent behaviors, and tremor or Parkinson-like symptoms.

Causes of Mn excess include: occupational or environmental exposures, contaminated teas, MMT (gasoline additive), coal-fired power plants,contaminated drinking water, some street drugs (cocaine products), and smoking. Conditions predisposing to Mn excess are: iron or calcium deficiency, chronic infection, and impaired liver function (e.g. biliary obstruction) or disease. Mn excess is occasionally associated with alcoholism.

Confirmatory tests for Mn excess include whole blood and a comparison of urine Mn pre- and post Ca-EDTA.

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 atherosclerogenesis, 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 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.

Lithium Low

Lithium (Li) is normally found in hair at very low levels. Hair Li correlates with high dosage of Li carbonate in patients treated for Affective Disorders. However, the clinical significance of low hair Li levels is not certain at this time. Thus, hair Li is measured primarily for research purposes.

Anecdotally, clinical feedback to DDI consultants suggests that low level Li supplementation may have some beneficial effects in patients with behavioral/emotional disorders. Li occurs almost universally in water and in the diet; excess Li is rapidly excreted in urine.

Li at low levels may have essential functions in humans. Intracellularly, Li inhibits 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).

A confirmatory test for low Li is measurement of Li in blood serum/plasma.

Phosphorus High

Hair Phosphorus (P) levels do not accurately reflect the adequacy of the biochemical functions of P. Further, hair P concentration does not correlate with dietary intake of P. However, hair P levels may be affected by abnormal calcium, P or vitamin D metabolism and possibly by abnormal magnesium levels. Hair P levels are measured primarily for research purposes.

P is a major component of mineralized tissue such as bone and teeth. Along with calcium, P assimilation is regulated by vitamin D. Phosphates also are present in every cell of the body where they are involved in chemical energy transfer and enzyme regulation. Phosphorylation chemistry is part of carbohydrate, amino acid, and lipid metabolism.

Appropriate tests for assessing P status are measurements of whole blood (total) P level; serum vitamin D-3 and/or 25-OH vitamin D-3 level; and 24-hour urinary P level (together with those of calcium and magnesium).

Strontium High

Hair usually reflects the body burden of Strontium (Sr), and Sr levels usually correlate with calcium levels in body tissue. However, hair levels of Sr can be raised by external contamination, usually from hair treatment products. Elevated Sr in hair treated with permanent solutions, dyes, or bleaches is likely to be an artifact of hair treatment and probably does not reflect the level of Sr in other tissues.

Diseases of excess Sr have not been reported, except for Sr rickets. In general, Sr excess is not of clinical concern in the U.S. It's bad reputation comes from it's radioactive isotopes which were widespread in the western U.S. as a result of nuclear testing in the 1950's. Stable Sr (not radioactive Sr) is measured and reported by DDI.

Other tests indicative of Sr status or excess are measurements of Sr in whole blood, Sr/calcium ratio in blood, and Sr in urine.

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.