Meridian Valley LAB

6839 Fort Dent Way., Suite 206
Tukwila, WA 98188

Tel: (206) 209-4200
Fax: (425) 209-4211

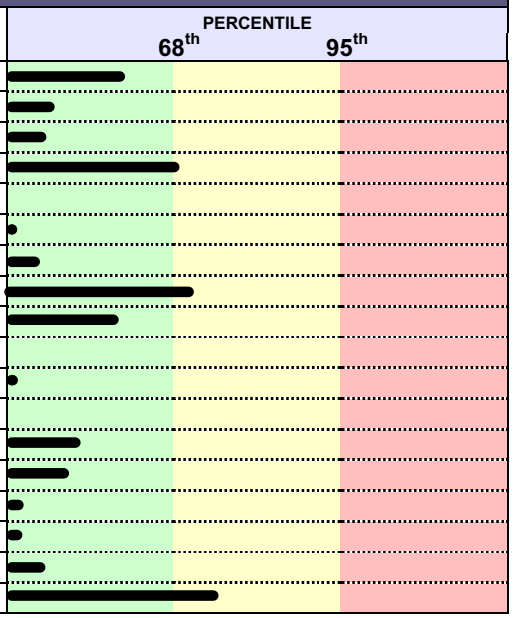
LAB#: H250221-2422-1
PATIENT: Krystie Babalos 1429895
ID: BABALOS-K-00001
SEX: Female
DOB: 07/18/1984 AGE: 40

Toxic & Essential Elements; Hair

15853 Dr. Kela Smith Ph.D, DNM /The Hormone Puzzle Society

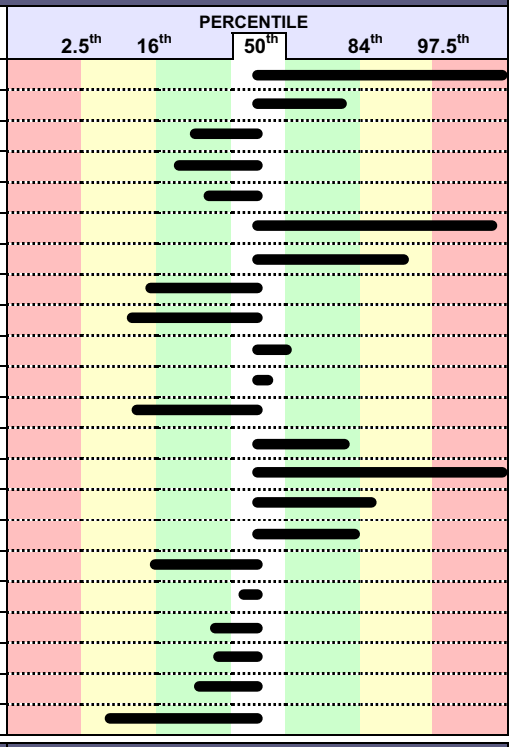
TOXIC METALS

		RESULT µg/g	REFERENCE INTERVAL
Aluminum	(Al)	8.3	< 12
Antimony	(Sb)	0.022	< 0.060
Arsenic	(As)	0.025	< 0.090
Barium	(Ba)	2.2	< 2.0
Beryllium	(Be)	< 0.01	< 0.020
Bismuth	(Bi)	0.005	< 2.0
Cadmium	(Cd)	0.015	< 0.050
Lead	(Pb)	1.4	< 1.0
Mercury	(Hg)	0.53	< 0.80
Platinum	(Pt)	< 0.003	< 0.005
Thallium	(Tl)	0.001	< 0.002
Thorium	(Th)	< 0.001	< 0.002
Uranium	(U)	0.025	< 0.060
Nickel	(Ni)	0.14	< 0.40
Silver	(Ag)	0.01	< 0.10
Tin	(Sn)	0.03	< 0.30
Titanium	(Ti)	0.27	< 1.3
Total Toxic Representation			



ESSENTIAL AND OTHER ELEMENTS

		RESULT µg/g	REFERENCE INTERVAL
Calcium	(Ca)	6180	475- 1500
Magnesium	(Mg)	170	45- 180
Sodium	(Na)	130	80- 450
Potassium	(K)	40	28- 160
Copper	(Cu)	13	11- 30
Zinc	(Zn)	410	130- 200
Manganese	(Mn)	1.2	0.15- 0.65
Chromium	(Cr)	0.39	0.40- 0.65
Vanadium	(V)	0.015	0.018- 0.065
Molybdenum	(Mo)	0.072	0.040- 0.10
Boron	(B)	1.5	0.40- 4.0
Iodine	(I)	0.21	0.25- 1.8
Lithium	(Li)	0.028	0.008- 0.030
Phosphorus	(P)	2470	250- 500
Selenium	(Se)	1.5	0.80- 1.3
Strontium	(Sr)	8.0	1.0- 8.0
Sulfur	(S)	41800	42000- 48000
Cobalt	(Co)	0.012	0.006- 0.035
Iron	(Fe)	8.7	7.0- 16
Germanium	(Ge)	0.033	0.030- 0.040
Rubidium	(Rb)	0.054	0.030- 0.25
Zirconium	(Zr)	0.020	0.040- 1.0



SPECIMEN DATA

COMMENTS:

Date Collected: 02/14/2025
Date Received: 02/21/2025
Date Reported: 02/25/2025
Methodology: ICP/MS

Sample Size: 0.198 g
Sample Type: Pubic
Hair Color:
Treatment:
Shampoo:

RATIOS

ELEMENTS	RATIOS	RANGE
Ca/Mg	36.4	4- 30
Ca/P	2.5	1- 12
Na/K	3.25	0.5- 10
Zn/Cu	31.5	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.

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, Ayruvedic 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.

Calcium High

Hair Calcium (Ca) levels have been correlated with nutritional intake, several disease syndromes, and metabolic disorders. However, hair Ca is sensitive to contamination by permanent solutions, dyes or bleaching. If hair has been treated, the reported Ca level is likely to be artifactually high and not indicative of Ca status or metabolism.

When external contamination is ruled out, elevated Ca is most often interpreted as a maldistribution of Ca. Rarely is elevated hair Ca indicative of excess dietary Ca. However, overzealous supplementation is possible. A high result for hair Ca is more likely to be indicative of an inappropriately low ratio of dietary Ca : phosphorus. Conditions associated with elevated hair Ca include but are not limited to: hyperparathyroidism, osteoporosis, excess dietary Ca or protein, excess vitamins A and/or D, phosphorus/magnesium/calcium imbalance (assessed by whole blood element analysis), hypoglycemia, hormonal imbalances, and metabolic disorders.

Hair analysis is not the preferred way to assess body Ca stores. Ca status should be assessed through: dietary analysis, whole blood or serum Ca level, vitamin A and D levels, blood concentrations of other electrolytes (sodium, magnesium, potassium), parathyroid hormone determinations, and bone density measurement.

Copper Normal

Hair Copper (Cu) levels are usually indicative of body status, except that exogenous contamination may occur giving a false normal (or false high). Common sources of contamination include: permanent solutions, dyes, bleaches, and swimming pools/hot tubs in which Cu compounds have been used as algaecides.

Cu is an essential element that activates specific 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.

If hair Cu is in the normal range, this usually means tissue levels are in the normal range. However, under circumstances of contamination, a real Cu deficit could appear as a (false) normal. If symptoms of Cu deficiency are present, a whole blood or red blood cell elements analysis can be performed for confirmation of Cu status.

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 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.

Manganese High

Hair manganese (Mn) levels generally reflect actual body stores, but external contamination can influence hair Mn. Since particulate manganese-containing dust is the most common source of Mn toxicity, hair is considered to be an excellent tissue for the assessment of Mn exposure. However, high hair Mn can be an artifact of contamination from hair treatments/products or well water (containing high Mn). These possibilities should definitely be considered and ruled out before proceeding with therapies to alleviate an apparent 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 myelin pigmented 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: lethargy, disorientation, memory loss, anxiety, emotional instability, and bipolar-like behaviors (laughing and crying), aberrant or violent behaviors, and tremor or Parkinson-like symptoms.

Occupationally, the greatest sources of exposure to Mn dust and fumes occurs in mining of the element, and in the production and fabrication of iron and steel. In addition, various Mn compounds are widely used in fertilizers, animal feeds, pharmaceutical products, dyes, paint dryers, catalysts, wood preservatives, and ceramic production. Mn is also an air pollutant derived from the gasoline additive MMT.

Other sources of exposure include contaminated teas, contaminated drinking water, some street drugs, and smoking. Conditions predisposing to Mn excess are: iron or calcium deficiency, chronic infection, and impaired liver function. Mn excess is occasionally associated with alcoholism (hepatic dysfunction), and biliary cirrhosis/obstruction.

A confirmatory test for Mn excess is Whole Blood Elements.

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 whole blood cell elements analysis.

Vanadium Low

Vanadium (V) is typically found at low levels in hair and the clinical significance of the measured result of lower than average hair V is not known. V is measured in hair for research purposes because it has been postulated to be an essential microtrace element. Indirect data to support this postulate have been derived from experimental models. Suggested functions for V include: regulation of sodium-potassium-ATPase, intracellular glutathione metabolism, thyroid metabolism, and insulin mimetic effects at pharmacological doses.

Average dietary V intake varies considerably between 20 mcg to 2 mg. Food sources of V include: liver, fish, radishes, grains, nuts, and vegetable oils.

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).

Sulfur Low

Sulfur (S) in hair is covalently bound within the cysteinyl residues of hair protein. On average, cysteine constitutes about sixteen percent of the total amino acid content of hair. Although not well documented, hair S levels may vary with S-containing amino acid status in the body. Interpretation of hair S levels is confounded by the fact some hair conditioners and permanent treatments increase hair S while straighteners can significantly lower hair S levels.

Observations at DDI indicate that hair S and urine sulfhydryl amino acid levels are often low in Hg burdened patients.

Appropriate tests to determine sulfhydryl amino acid status are plasma or urine amino acid analyses.

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.