

HAIR ELEMENTS

LAB#: H080728-0147-1
 PATIENT: Sample
 SEX: Female
 AGE: 46

CLIENT#: 34726
 DOCTOR: Rhonda Lyons, ND
 27 Union Jack Street
 Marina Del Rey, CA 90292

POTENTIALLY TOXIC ELEMENTS				
TOXIC ELEMENTS	RESULT $\mu\text{g/g}$	REFERENCE RANGE	PERCENTILE	
			68 th	95 th
Aluminum	11	< 7.0		
Antimony	0.016	< 0.050		
Arsenic	< 0.01	< 0.060		
Beryllium	< 0.01	< 0.020		
Bismuth	0.16	< 2.0		
Cadmium	0.050	< 0.10		
Lead	0.29	< 1.0		
Mercury	1.9	< 1.1		
Platinum	< 0.003	< 0.005		
Thallium	< 0.001	< 0.010		
Thorium	< 0.001	< 0.005		
Uranium	0.17	< 0.060		
Nickel	0.57	< 0.40		
Silver	0.63	< 0.15		
Tin	1.8	< 0.30		
Titanium	0.50	< 1.0		
Total Toxic Representation				

ESSENTIAL AND OTHER ELEMENTS							
ELEMENTS	RESULT $\mu\text{g/g}$	REFERENCE RANGE	PERCENTILE				
			2.5 th	16 th	50 th	84 th	97.5 th
Calcium	7430	300- 1200					
Magnesium	610	35- 120					
Sodium	85	12- 90					
Potassium	16	8- 38					
Copper	22	12- 35					
Zinc	180	140- 220					
Manganese	0.82	0.15- 0.65					
Chromium	0.46	0.20- 0.40					
Vanadium	0.27	0.018- 0.065					
Molybdenum	0.014	0.028- 0.056					
Boron	0.54	0.30- 2.0					
Iodine	0.31	0.25- 1.3					
Lithium	0.012	0.007- 0.023					
Phosphorus	168	160- 250					
Selenium	0.50	0.95- 1.7					
Strontium	35	0.50- 7.6					
Sulfur	42200	44500- 52000					
Barium	10	0.26- 3.0					
Cobalt	0.058	0.013- 0.050					
Iron	< 1	5.4- 14					
Germanium	0.043	0.045- 0.065					
Rubidium	0.010	0.007- 0.096					
Zirconium	0.22	0.020- 0.42					

SPECIMEN DATA			RATIOS		
COMMENTS:			ELEMENTS	RATIOS	EXPECTED RANGE
Date Collected: 7/8/2008	Sample Size: 0.196 g		Ca/Mg	12.2	4- 30
Date Received: 7/12/2008	Sample Type: Head		Ca/P	44.2	1- 12
Date Completed: 7/30/2008	Hair Color: Blond		Na/K	5.31	0.5- 10
	Treatment:		Zn/Cu	8.18	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 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.

RECOMMENDATIONS:

1. Check shampoo and other hair products, baking powder, processed cheese, drinking water, and antiperspirant for **Aluminum, Nickel, Silver, Uranium,, Strontium** as these products may be over-loading your body with these toxic elements.
2. Decrease any supplements that contain for **Aluminum, Nickel, Silver, Tin, Chromium, Vanadium, Uranium, Strontium, and Iron,** as your levels in this elements and minerals are higher than they should be in your body.
3. You have low levels of **Selenium** (which is an essential cofactor in the deiodination of T-4 to active T-3 (thyroid hormone), your heart, and immune system). Studies have shown that **Selenium** is needed to fight against cancer and asthma.

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.**

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); **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.

Food rich in Selenium are 2 Brazil Nuts Daily (Brazil nuts are the most highly concentrated source of selenium):

World's Healthiest Foods ranked as quality sources of: selenium						
Food	Serving Size	Cals	Amount (mcg)	DV (%)	Nutrient Density	World's Healthiest Foods Rating
Crimini mushrooms, raw	5 oz-wt	31.2	36.85	52.6	30.4	excellent
Cod, baked/broiled	4 oz-wt	119.1	53.07	75.8	11.5	excellent
Shrimp, steamed/boiled	4 oz-wt	112.3	44.91	64.2	10.3	excellent
Snapper, baked/broiled	4 oz-wt	145.2	55.57	79.4	9.8	excellent
Tuna, yellowfin, baked/broiled	4 oz-wt	157.6	53.07	75.8	8.7	excellent
Halibut, baked/broiled	4 oz-wt	158.8	53.07	75.8	8.6	excellent
Mustard seeds	2 tsp	35.0	9.96	14.2	7.3	very good
Salmon, chinook, baked/broiled	4 oz-wt	261.9	53.07	75.8	5.2	excellent
Egg, whole, boiled	1 each	68.2	13.55	19.4	5.1	very good
Barley, cooked	1 cup	270.0	36.40	52.0	3.5	very good
Oats, whole grain, cooked	1 cup	145.1	18.95	27.1	3.4	very good
Tofu, raw	4 oz-wt	86.2	10.09	14.4	3.0	good
Beef tenderloin, lean, broiled	4 oz-wt	240.4	27.67	39.5	3.0	good
Rye, whole grain, uncooked	0.33 cup	188.7	19.89	28.4	2.7	good
Sunflower seeds, raw	0.25 cup	205.2	21.42	30.6	2.7	good
Garlic	1 oz-wt	42.2	4.03	5.8	2.5	good
Brown rice, cooked	1 cup	216.4	19.11	27.3	2.3	good
Blackstrap molasses	2 tsp	32.1	2.43	3.5	1.9	good
Asparagus, boiled	1 cup	43.2	3.06	4.4	1.8	good
Spinach, boiled	1 cup	41.4	2.70	3.9	1.7	good
Mozzarella cheese, part-skim, shredded	1 oz-wt	72.1	4.08	5.8	1.5	good

World's Healthiest Foods Rating	Rule				
excellent	DV>=75%	OR	Density>=7.6	AND	DV>=10%
very good	DV>=50%	OR	Density>=3.4	AND	DV>=5%
good	DV>=25%	OR	Density>=1.5	AND	DV>=2.5%

Public Health Recommendations

What are current public health recommendations for selenium?

Adequate Intake (AI) levels for selenium, set in 2000 by the Institute of Medicine at the National Academy of Sciences, are as follows:

- Males and females, 0-6 months: 15 micrograms
- Males and females, 6-12 months: 20 micrograms

Recommended Dietary Allowances for selenium, set in 2000 by the Institute of Medicine at the National Academy of Sciences, are as follows:

- Males and females, 1-3 years: 20 micrograms
- Males and females, 4-8 years: 30 micrograms
- Males and females, 9-13 years: 40 micrograms
- Males and females, 14 years and older: 55 micrograms
- Pregnant females: 60 micrograms
- Lactating females: 70 micrograms

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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..

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.

Food rich in sulfur are:

What are the benefits of the sulfur compounds found in cruciferous vegetables?

Broccoli, and the other members of the cruciferous family of vegetables, pack a powerful punch when it comes to cancer prevention. The cancer protective properties of crucifers such as broccoli, Brussels sprouts, cauliflower, cabbage, and kale are attributed to the fact that these foods contain substantial quantities of the phytonutrients called isothiocyanates, specifically two isothiocyanates called sulforaphane and indole-3-carbinol. Research indicates that sulforaphane has the ability to increase the capacity of the liver to detoxify harmful, cancer-causing compounds. Specifically, sulforaphane increases the activity of the liver's Phase 2 detoxification enzymes. These enzymes (which include glutathione transferases, NAD(P)H: quinone reductase, and glucuronosyltransferases) are well known for their ability to clear a wide variety of toxic compounds from the body including not only many carcinogens, but also many reactive oxygen species, a particularly nasty type of free radical. By jump starting these important detoxification enzymes, compounds in crucifers provide protection against cell mutations, cancer and

numerous other harmful effects that would otherwise be caused by these toxins. Research on indole-3-carbinol shows this compound helps deactivate a potent estrogen metabolite (2-hydroxyestrone) that promotes tumor growth, especially in estrogen-sensitive breast cells. Indole-3-carbinol has been shown to suppress not only breast tumor cell growth, but also cancer cell metastasis (the movement of cancerous cells to other parts of the body).

A study published in the August 2003 issue of the *International Journal of Cancer* suggests that eating lots of cruciferous vegetables may provide a significant survival advantage for women diagnosed with ovarian cancer. One of the most aggressive cancers, ovarian cancer claims the lives of 14,000 American women each year.

For about 7 years, a team of Australian researchers at Queensland Institute of Medical Research in Brisbane followed a group of 609 women newly diagnosed with ovarian cancer when the study began. Those who had eaten the most vegetables and vitamin E-containing foods during the year before they were diagnosed were most likely to survive for at least five years after diagnosis. While the overall five-year survival rate among study subjects was 45%, women who ate more than 5 servings a day of all types of vegetables had a better prognosis: 50% were alive five years after diagnosis.

Cruciferous vegetables such as cabbage, cauliflower, Brussels sprouts and broccoli, were especially beneficial: 49% of those who ate nearly a serving a day were still alive after five years compared to 42% who ate half a serving.

Researchers theorize that crucifers' protective effects are due to their high content of isothiocyanates, specifically indole-3-carbinol and sulforaphane. These compounds not only increase the excretion of the form of estrogen (2-hydroxyestrone) linked to breast cancer, but dramatically improve the body's ability to eliminate numerous carcinogens. While being slim also conferred a slight survival advantage in this study, only eating lots of vegetables, particularly cruciferous vegetables was helpful; taking supplements had no effect. (Nagle CM, Purdie DM, Webb PM, Green A, Harvey PW, Bain CJ. Dietary influences on survival after ovarian cancer *Int J Cancer*. 2003 Aug 20;106(2):264-9. September 30, 2003)

In addition to helping your body protect itself from cancer, cruciferous vegetables are also believed to help prevent cataracts and age-related macular degeneration, two debilitating diseases that can lead to vision impairment and blindness. These vegetables also contain a vast array of the vitamins and minerals that are necessary for optimal health.

Taking advantage of the health benefits that the cruciferous vegetables have to offer is easy: Simply eat at least one serving from this versatile and varied family of vegetables every day. If you need help getting started, try the following suggestions:

1. All of the crucifers are wonderful when lightly steamed. For a little extra pizzaz, sprinkle steamed broccoli, cauliflower, cabbage, or kale with lemon.
2. Steamed broccoli, cauliflower, and kale make a delicious addition to marinara (tomato) sauce. Or for a tomato-free pasta meal, toss pasta with olive oil, pine nuts and healthy sautéed broccoli florets.
3. Purée cooked broccoli and cauliflower, then combine with seasonings of your choice to make a simple, yet delicious, soup.
4. These vegetables can also be enjoyed raw. When you prepare a vegetable tray, be sure to include broccoli, cauliflower, and chopped sections of red cabbage.
5. Sauté cauliflower with garlic, minced ginger and tamari. For cauliflower with a vivid yellow color, boil it briefly with a spoonful of turmeric or generous pinch of saffron.
6. Cabbage leaves are a great way to reinspire leftovers. Spoon some leftovers such as rice salad or a vegetable mixture onto the center of a cabbage leaf and roll into a neat little package. Bake in medium heat oven until hot. Enjoy your easy and healthy version of stuffed cabbage, a traditional eastern European dish.
7. To make a unique coleslaw combine shredded red and white cabbage with soy mayonnaise.

Iron Low

Hair Iron (Fe) levels do not correlate with Fe assimilation as determined by serum ferritin, Fe binding capacity, or transferrin saturation. A very low hair Fe result should be viewed only as possible indication for further tests because hair is only a screening test for this element. Fe supplementation is not indicated nor recommended solely on the basis of the measured hair Fe level. Unwarranted Fe supplementation, particularly in combination with ascorbic acid, can result in Fe overload. A large body of scientific literature indicates significant relationships between dietary Fe overload and heart disease, cancer, diabetes, osteoporosis, and arthritis. (Biochem. Mol. Med.; 54(1):1-11, 1995)

Iron rich foods are

Iron Rich Foods containing Non-Heme Iron

	Excellent Sources		Good Sources
■	<ul style="list-style-type: none"> • Enriched breakfast cereals • Cooked beans and lentils • Pumpkin seeds • Blackstrap Molasses 	■	<ul style="list-style-type: none"> • Canned beans • Baked potato with skin • Enriched pasta • Canned asparagus

The absorption of Non-heme iron can be improved when a source of heme iron is consumed in the same meal. In addition, the iron absorption-enhancing foods can also increase the absorption of non-heme iron. While some food items can enhance iron absorption, some can inhibit or interfere iron absorption. Avoid eating them with the iron-rich foods to maximize iron absorption.

Iron Absorption Enhancers

- Meat/fish/poultry
- Fruits: Orange, Orange Juice, cantaloupe, strawberries, grapefruit etc
- Vegetables: Broccoli, brussels sprouts, tomato, tomato juice, potato, green & red peppers
- White wine

Iron Absorption Inhibitors

- Red Wine, Coffee & Tea
- Vegetables: **Spinach**, chard, beet greens, rhubarb and sweet potato
- Whole grains and bran
- Soy products

Manganese High

Hair Manganese (Mn) levels generally reflect actual body stores, 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 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: disorientation, memory loss, anxiety, 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, 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 or kidney function. Mn excess is occasionally associated with alcoholism.

Aluminum High

The Aluminum (Al) level in hair is a reliable indicator of assimilation of this element, provided that hair preparations have not added exogenous Al. Al is a nonessential element that can be toxic if excessively assimilated into cells.

Excess Al can inhibit the formation of alpha-keto glutarate and result in toxic levels of ammonia in tissues. Al can bond to phosphorylated bases on DNA and disrupt protein synthesis and catabolism. Al excess should be considered when symptoms of presenile dementia or Alzheimer's disease are observed. Individuals with renal problems or on renal dialysis may have elevated Al.

Possible sources of Al include some antacid medications, Al cookware, baking powder, processed cheese, drinking water, and antiperspirant components that may be absorbed. Analyses performed at DDI indicate extremely high levels of Al are in many colloidal mineral products. Al has neurotoxic effects at high levels, Early symptoms of Al burden may include: fatigue, headache, and symptoms of phosphate depletion.

Mercury High

Mercury (Hg) is toxic to humans and animals. The accumulation of Hg in the body is generally reflected by the hair Hg levels, but hair Hg levels can be artifactually high in association with the use of certain hair dyes.

Individuals vary greatly in sensitivity and tolerance to Hg burden. At hair levels below 3 µg/g, 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, contaminated seafood, water supplies, some hemorrhoidal preparations, skin lightening agents, 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).

Nickel High

Hair is a reasonable tissue for monitoring accumulated body stores of 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.

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. 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 and hypersensitivity reactions. Ni can hypersensitize the immune system, subsequently causing hyperallergenic responses to many different substances..

Long term or chronic Ni toxicity may lead to liver necrosis and carcinoma.

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, jewelry making (especially soldering), 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).

Tin High

Hair Tin (Sn) levels have been found to correlate with environmental exposure. Depending on chemical form, Sn is a potentially toxic element. Inorganic Sn has a low degree of toxicity, while organic Sn has appreciable toxicity.

The main source of Sn is food. Other possible sources are: dental amalgams, cosmetics, preservatives, food and beverage containers, pewter, bronze, and anticorrosive platings.

Symptoms of excess Sn include: skin, eye, and GI tract irritation, muscle weakness, anemia, and testicular degeneration.

Uranium High

The levels of Uranium (U) in hair usually reflect levels of U in other tissues. However, hair may be externally contaminated by shampoos or hair products that contain U.

U is a nonessential element that is very abundant in rock, particularly granite, lignite, monazite sands, and phosphate rocks. U is present at widely varying levels in drinking water, root vegetables, and present in high phosphate fertilizers. Other sources of U include: ceramics, some colored glass, many household products and tailings from U mines. Spent U rods have been milled into armor piercing bullets and missile heads.

Uranyl cations bind tenaciously to protein, phosphate, nucleotides, and bone, where it substitutes for Ca. Published data are sparse, but there appears to be a correlation between U exposure, nephrotoxicity and cancer. Kidney and bone are the primary sites of U accumulation.

All isotopes of U are radioactive; ²³⁸U is the most abundant and lowest energy emitter. It is important to note that the measured result, which is ²³⁸U, does NOT necessarily indicate or imply exposure to highly enriched ²³⁵U, which is used in nuclear power and weaponry.

Chronic fatigue is often reported in association with hair U levels >0.5 µg/g (DDI observations). U is rapidly cleared from blood and deposited in tissues. Currently, DTPA is the only effective chelating agent for ACUTE U poisoning. However, it must be administered immediately and is not effective once U has transferred from blood to tissues. Currently there are no available chelators or complexing agents that have been established to be effective for ameliorating U retention associated with long-term, low-level exposure to U.

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.

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 , hypoglycemia, hormonal imbalances, and metabolic disorders.

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.

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 algacides. 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 a normal range. However, under circumstances of contamination, a real Cu deficit could appear as a (false) normal.

Chromium High

A high hair Chromium (Cr) level is likely to indicate excess exposure to Cr. Hair Cr levels do not appear to be affected by permanent solutions, dyes, or bleaches, but external contamination is possible. Trivalent Cr is considered to be an essential trace element with a low order of toxicity. Cr toxicity via oral ingestion is not likely. However, it is noteworthy that self-supplementation has been reported to be associated with insomnia and increased unpleasant dream activity in some individuals (J. Nutr. Med.; 3(43), 1992).

In contrast, hexavalent Cr compounds are considerably more toxic and are primarily absorbed through exposure to be associated with allergic dermatitis, skin ulcers, bronchitis, and lung carcinoma. Elevated hair Cr levels have also been observed in patients with cerebral thrombosis and cerebral hemorrhage. Sources of exposure to hexavalent Cr include: manufacture and use of ferrochromium and stainless steel, wood finishing and leather tanning industries, and handling of cement.

Vanadium High

High levels of Vanadium (V) in hair may be indicative of excess absorption of the element. It is well established that excess V can have toxic effects in humans. Although it appears that V may have essential functions, **over zealous supplementation** is not warranted.

Excess levels of V in the body can result from chronic consumption of fish, shrimp, crabs, and oysters derived from water near offshore oil rigs (Metals in Clinical and Analytical Chemistry, 1994).

Toxicity vary with chemical form and route of absorption. Inhalation of **excess V may produce respiratory irritation and bronchitis. Excess ingestion of V can result in decreased appetite, depressed growth, diarrhea/gastrointestinal disturbances, nephrotoxic and hematotoxic effects.** Pallor, diarrhea, and green tongue are early signs of excess V and have been reported in human subjects consuming about 20 mg V/day (Modern Nutrition in Health and Disease, (Modern Nutrition in Health and Disease, 8th edition, eds. Shils, M., Olson, J., and Mosha, S., 1994).

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.

Barium High

Hair may be used for biological monitoring of Barium (Ba). Exogenous contamination has been observed from bath water containing Ba. Elevated levels of hair Ba are often observed as a result of exposure to Ba for diagnostic medical tests. Ba has not been established to be an essential element. Elevated levels of Ba **may interfere with calcium metabolism and potassium retention.**

Acutely high intakes of soluble Ba salts (nitrates, sulfides, chlorides) can be toxic. Chronic ingestion of Ba at elevated levels may be manifested by muscular and myocardial stimulation, tingling in the extremities, and loss of tendon reflexes. The main dietary sources of Ba are **milk, flour, potatoes and some types of nuts.**

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.