DOCTOR'S DATA INC

LAB #: H210521-2354-1
PATIENT: Elanor Joyce Haynes
ID: HAYNES-E-00290
SEX: Female
DOB: 11/30/1979 AGE: 41

CLIENT #: 31417
DOCTOR:
Rn Labs
18 / 93 Rivergate Pl
Murarrie, Qld, 4172 AUSTRALIA

Toxic & Essential Elements; Hair

TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	8.2	< 7.0	
Antimony	(Sb)	0.016	< 0.050	
Arsenic	(As)	0.050	< 0.060	
Barium	(Ba)	0.23	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	0.016	< 2.0	
Cadmium	(Cd)	< 0.009	< 0.050	
Lead	(Pb)	0.71	< 0.60	
Mercury	(Hg)	0.13	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	0.002	< 0.002	
Thorium	(Th)	0.001	< 0.002	
Uranium	(U)	0.003	< 0.060	
Nickel	(Ni)	1.1	< 0.30	
Silver	(Ag)	0.03	< 0.15	
Tin	(Sn)	0.11	< 0.30	
Titanium	(Ti)	0.62	< 0.70	
Total Toxic Representation				

ESSENTIAL AND OTHER ELEMENTS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 2.5th 16th 50th 84th 97.5th
Calcium	(Ca)	426	300- 1200	
Magnesium	(Mg)	38	35- 120	
Sodium	(Na)	24	20- 250	
Potassium	(K)	37	8- 75	
Copper	(Cu)	17	11- 37	
Zinc	(Zn)	190	140- 220	
Manganese	(Mn)	0.36	0.08- 0.60	
Chromium	(Cr)	0.47	0.40- 0.65	
Vanadium	(V)	0.046	0.018- 0.065	
Molybdenum	(Mo)	0.13	0.020- 0.050	
Boron	(B)	0.39	0.25- 1.5	
Iodine	(I)	0.51	0.25- 1.8	
Lithium	(Li)	< 0.004	0.007- 0.020	
Phosphorus	(P)	154	150- 220	
Selenium	(Se)	0.81	0.55- 1.1	
Strontium	(Sr)	2.3	0.50- 7.6	
Sulfur	(S)	48800	44000- 50000	
Cobalt	(Co)	0.43	0.005- 0.040	
Iron	(Fe)	8.3	7.0- 16	
Germanium	(Ge)	0.036	0.030- 0.040	
Rubidium	(Rb)	0.055	0.007- 0.096	
Zirconium	(Zr)	0.022	0.020- 0.42	

SPECIMEN DATA

COMMENTS:

Date Collected: **05/15/2021**
Date Received: **05/21/2021**
Date Reported: **05/25/2021**
Methodology: **ICP/MS**

Sample Size: **0.201 g**
Sample Type: **Head**
Hair Color:
Treatment:
Shampoo: **Natural**

RATIOS

ELEMENTS	RATIOS	RANGE
Ca/Mg	11.2	4- 30
Ca/P	2.77	1- 12
Na/K	0.649	0.5- 10
Zn/Cu	11.2	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.

Aluminum High

The Aluminum (Al) level in hair may be an indicator of exposure and 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. Hair Al is commonly elevated in children and adults with low zinc and behavioral/learning disorders such as ADD, ADHD and autism. 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, but low levels of accumulation may not elicit immediate symptoms. Early symptoms of Al burden may include: fatigue, headache, and symptoms of phosphate depletion.

A urine elements test can be used to corroborate Al exposure. Al can be effectively complexed and excreted with silicon (J. Environ. Pathol. Toxicol. Oncol., 13(3): 205-7, 1994). A complex of malic acid and Mg has been reported to be quite effective in lowering Al levels (DDI clients).

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.

Thallium High

Thallium (Tl) is a highly toxic element which, like lead and mercury, accumulates in many body tissues. Hair levels reflect exposure to Tl.

Common sources of Tl are: foods (marine organisms concentrate Tl up to 700 times), rodenticides/ pesticides tobacco, contaminated water, electronics components, fly ash, cement dust, and some fertilizers. Tl is rapidly and completely absorbed when ingested, inhaled or brought into contact with skin.

Symptoms of Tl excess include: sleep disturbances, cardiac, optical, dermatatological, liver, GI, and kidney dysfunctions. Albuminuria and alopecia are consistent with Tl excess. Potassium, selenium and sulfhydryl compounds (e.g. glutathione) diminish Tl retention and toxicity. Tl toxicity can have a long latency period before clinical symptoms become apparent.

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.

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.

Molybdenum High

Hair is a tissue that accurately reflects exposure to excess Molybdenum (Mo), and hair is not often subject to external contamination of Mo.

Mo is an essential and relatively nontoxic element. Therefore, Mo excess may not feature symptoms. Possible manifestations of Mo excess are; loss of appetite, anemia, and arthritic symptoms. These are also signs of copper deficiency which can be a result of Mo excess.

Excess Mo is uncommon but can be the result of occupational exposures. Lubricants, catalysts, pigments, organic glazes, steel alloys are sources of Mo. Copper deficiency can predispose to Mo retention and excess.

Confirmatory tests for excess Mo include a 24 hour urine elements analysis and measurement of whole blood or packed red blood cell copper (may be depressed in Mo excess).

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.

Cobalt High

Hair may be used for monitoring exposure to cobalt (Co). However, hair is occasionally contaminated by external Co from some hair treatments. If this individual's hair has been treated with permanent solutions, dyes, or bleach, the Co levels may not be indicative of internalization of excessive amounts of Co.

Humans absorb Co both as inorganic Co and as vitamin B-12; the body pools of each fluctuate independently. Humans cannot convert inorganic Co to vitamin B-12, and vitamin B-12 provides the only documented function of Co in humans. Thus, a high hair Co level does not mean that vitamin B-12 levels are high or even adequate.

The dietary content of Co is highly variable and depends upon types of foods eaten, geographical location, and type of soil. Toxicity has been noted with ingestion of 250-400 mg/day. Recent animal studies indicate that excess Co can cause marked impairment of myocardial metabolism that results in metabolic acidosis (Clin. Chem.; 43(6): 5192, 1997). Symptoms of Co toxicity include weight loss, loss of appetite, electrolyte imbalance and decreased serum bicarbonate.

Hair analysis cannot be used to assess vitamin B-12 status. Appropriate tests for determination of B-12 status are the measurement of urine levels of methylmalonic acid (elevated with B-12 coenzyme deficiency/dysfunction), quantitative blood assay for vitamin B-12, and urine amino acids analysis (several metabolic steps require vitamin B-12).

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.