Nordic Laboratories

PATIENT:	**Sample Report**			TEST REF:	###-##-#####
TEST NUMBER:	##########	COLLECTED:	dd/mm/yyyy		
PATIENT NUMBER:	##########	RECEIVED:	dd/mm/yyyy	PRACTITIONER:	**Nordic Laboratories**
GENDER:	Female	TESTED:	dd/mm/yyyy	ADDRESS:	
AGE:	48				
DATE OF BIRTH:	dd-mm-yyyy				

TEST NAME: Hair Elements

Toxic & Essential Elements; Hair

TOXIC METALS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 68th 95th
Aluminum	(Al)	5.0	< 7.0	
Antimony	(Sb)	0.011	< 0.050	
Arsenic	(As)	0.12	< 0.060	
Barium	(Ba)	0.44	< 2.0	
Beryllium	(Be)	< 0.01	< 0.020	
Bismuth	(Bi)	1.3	< 2.0	
Cadmium	(Cd)	0.029	< 0.050	
Lead	(Pb)	5.0	< 0.60	
Mercury	(Hg)	0.50	< 0.80	
Platinum	(Pt)	< 0.003	< 0.005	
Thallium	(Tl)	< 0.001	< 0.002	
Thorium	(Th)	0.001	< 0.002	
Uranium	(U)	0.029	< 0.060	
Nickel	(Ni)	0.08	< 0.30	
Silver	(Ag)	0.32	< 0.15	
Tin	(Sn)	0.23	< 0.30	
Titanium	(Ti)	0.37	< 0.70	
Total Toxic Representation				

ESSENTIAL AND OTHER ELEMENTS		RESULT µg/g	REFERENCE INTERVAL	PERCENTILE 2.5th 16th 50th 84th 97.5th
Calcium	(Ca)	224	300– 1200	
Magnesium	(Mg)	21	35– 120	
Sodium	(Na)	48	20– 250	
Potassium	(K)	24	8– 75	
Copper	(Cu)	74	11– 37	
Zinc	(Zn)	180	140– 220	
Manganese	(Mn)	0.31	0.08– 0.60	
Chromium	(Cr)	0.39	0.40– 0.65	
Vanadium	(V)	0.026	0.018– 0.065	
Molybdenum	(Mo)	0.026	0.020– 0.050	
Boron	(B)	0.24	0.25– 1.5	
Iodine	(I)	1.1	0.25– 1.8	
Lithium	(Li)	< 0.004	0.007– 0.020	
Phosphorus	(P)	157	150– 220	
Selenium	(Se)	1.3	0.55– 1.1	
Strontium	(Sr)	0.41	0.50– 7.6	
Sulfur	(S)	48900	44000– 50000	
Cobalt	(Co)	0.004	0.005– 0.040	
Iron	(Fe)	5.7	7.0– 16	
Germanium	(Ge)	0.037	0.030– 0.040	
Rubidium	(Rb)	0.013	0.007– 0.096	
Zirconium	(Zr)	0.039	0.020– 0.42	

SPECIMEN DATA

COMMENTS:

Date Collected: mm/dd/yyyy
Date Received: mm/dd/yyyy
Date Completed: mm/dd/yyyy
Methodology: ICP/MS

Sample Size: 0.200 g
Sample Type: Head
Hair Color:
Treatment:
Shampoo:

RATIOS

ELEMENTS	RATIOS	RANGE
Ca/Mg	10.7	4– 30
Ca/P	1.43	1– 12
Na/K	2	0.5– 10
Zn/Cu	2.43	4– 20
Zn/Cd	> 999	> 800

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TEST NAME: Hair Elements

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.

Arsenic High

In general, hair provides a rough estimate of exposure to Arsenic (As) absorbed from food and water. However, hair can be contaminated externally with As from air, water, dust, shampoos and soap. Inorganic As, and some organic As compounds, can be associated with toxicity. Inorganic As accumulates in hair, nails, skin, thyroid gland, bone and the gastrointestinal tract. Organic As, such as that derived from shellfish, is rapidly excreted in the urine.

As can cause malaise, muscle weakness, vomiting, diarrhea, dermatitis, and skin cancer. Long-term exposure may affect the peripheral nervous, cardiovascular and hematopoietic systems. As is a major biological antagonist to selenium.

Common sources of As are insecticides (calcium and lead arsenate), drinking water, smog, shellfish (arsenobetaine), and industrial exposure, particularly in the manufacture of electronic components (gallium arsenide).

As burden can be confirmed by urine elements analysis. Comparison of urine As levels pre and post provocation (DMPS, DMSA, D-penicillamine) permit differentiation between recent uptake and body stores.

TEST NAME: Hair Elements

Lead Extremely High

This individual's hair Lead (Pb) level is considered to be extremely elevated and is consistent with significant proglonged exposure to Pb. 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, transdermal absorption can contribute to body burden. Chelation therapy results in marked, transient increases in hair Pb during mobilization from tissue stores. Eventually, the hair Pb level will normalize after detoxification is complete.

Pb has neurotoxic and nephrotoxic effects and interferes with heme biosynthesis. Pb may also affect the body's ability to utilize the essential elements calcium, magnesium, and zinc. At high levels of body burden, Pb may have adverse effects on memory and cognitive abilities, nerve conduction, and metabolism of vitamin D. Impaired erythropoiesis and anemia may be present. 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 (Arch. Environ. Hlth. 51: 214-220, 1996).

Symptoms associated with excess Pb are vague, but include: loss of appetite and body weight, poor memory, fatigue, constipation, headaches, inability to concentrate, and decreased coordination.

Sources of exposure to Pb include: welding, old leaded paint (dust/chips), drinking water, some fertilizers, industrial waste, lead-glazed pottery, manufacture of stained glass, Ayrevedic 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 reflects recent or ongoing exposures and may not correlate with total body burden.

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.

Calcium Low

Hair Calcium (Ca) levels have been correlated with nutritional intake, several disease syndromes, and

metabolic disorders. Interpretation of low hair Ca levels is difficult and other variables need to be considered.

Ca is the most abundant element in the body. Although most Ca is contained in the skeletal system, Ca is actively involved in muscle contraction, the nervous system, hormone secretion, and immunological responses.

Causes of Ca deficiency include but are not limited to inadequate dietary Ca, protein or vitamin D, excess dietary phosphorus and malabsorption. Malabsorption is likely if other essential elements such as magnesium, cobalt, manganese, and chromium are also at low levels in hair. Other factors associated with poor Ca status include physical inactivity, chronic stress, hormonal imbalance, aluminum containing antacids, chronic use of diuretics or laxatives, high alcohol intake, and exposure to toxic elements (e.g. lead, cadmium).

Symptoms of Ca deficiency include: muscle cramps or tetany, myalgia, and skeletal pain. Chronic Ca deficiency (or negative balance) results in osteoporosis.

Hair is vulnerable to external contamination by Ca as a result of hair treatments (permanent solutions, dyes, bleach). Other means to assess Ca status include: dietary assessment, whole blood elements analysis, and measurement of bone density, serum vitamin D-3, and parathyroid hormone.

Magnesium Low

Low hair Magnesium (Mg) levels may be indicative of Mg deficiency, but this has not been unequivocally demonstrated. When hair Mg is low, dietary intake and malabsorption should be considered. Mg is an essential element/electrolyte that is necessary for the activity of many important enzymes. Low hair Mg may or may not be associated with physiological dysfunction.

Causes of Mg deficiency include: consumption of a ”junk food” diet or Mg-deficient foods, intestinal malabsorption, hypocalcemia with decreased Mg retention, chemical toxicity with renal wasting, alcoholism, alkalosis, prolonged diarrhea/laxative abuse, and iatrogenic causes (digoxin therapy, occasionally from oral contraceptives, hypercalcemic drugs, gentamicin, neomycin).

Symptoms of Mg deficiency include: muscle twitching, cramps, tremor or muscle spasms, paresthesia, and mental depression. Low Mg status is associated with arrythmias and increased cardiovascular risk.

Mg status can be difficult to assess; whole blood and packed red cell levels are more indicative than serum/plasma levels. Amino acid analysis can be helpful in showing rate-limited steps that are Mg-dependent such as phosphorylations. Taurine deficiency is often associated with urinary loss of Mg. The Mg challenge method may be indicative: baseline 24-hour urine Mg measurement, followed by 0.2 mEq/Kg intravenous mg, followed by 24-hour Mg measurement. A deficiency is judged to be present if less than 80% of the administrered Mg is excreted in the urine.

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.

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.

Boron Low

Boron (B) is normally found in hair, but the correlations among dietary B intake, and tissue and hair levels of B have yet to be established. Recent studies clearly indicate that B has an important role in normal bone metabolism/density and may be needed for normal membrane function. In post-menopausal women consuming a very low B diet, B supplementation significantly lowered urinary excretion of calcium and magnesium and increased serum levels of estrogen (Environ. Health Persepct.; 102 Supl.7: 59-63, 1994). Further research is in process to determine the clinical significance of hair B levels.

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.

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.